



**PCSIR**  
**Research & Development**  
**Programme**

**2022-2023**

**Scientific Information Centre**  
**Pakistan Council of Scientific and Industrial Research**  
**Shahrah-e-Dr. Salimuzzaman Siddiqui, Karachi-75280**

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### **Shahida Begum**

Director SIC

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## Foreword

Country's economic growth is purely influenced by the Research and Development (R&D) owing to flourishing innovation, invention, and facilitation in various aspects of life. Academia, business, and government bodies collaborate to scale-up R&D tasks luxuriantly to turn new ideas into profitable enterprises. Pakistan Council of Scientific and Industrial Research (PCSIR) is a well-reputed, and the largest R&D organization working under the umbrella of Ministry of Science & Technology, Government of Pakistan. One of the key objectives of PCSIR is to bring scientific community from academia and industry into its R&D pool to achieve significant scientific goals for the up-growth of the country. The R&D programme of PCSIR is closely linked up with Science, Technology & Innovation Policy-2022 of the Ministry of Science & Technology that confers on adopting modern STI management and governance, providing appropriate regulatory framework, invigorating human capital for driving innovation, use of emerging technologies in all sectors of economic growth and effective science diplomacy to transform the country into a technology-based economy.

In-line with the above, PCSIR represented several project proposals allied to emerging scientific and technical fields, and amongst government top priorities. In brief, one hundred (100) projects are being carried out as in-house R&D Projects in different labs / units of PCSIR. The key objectives of in-house R&D projects are to develop new processes and technologies pivoted to agro-biotech to accelerate technology controlled economic reforms. Due consideration is bestowed to excel in import substitution, as well as, export value-addition. Further, the improvement in existing infrastructure and manpower engagement for research in new fields is being carried out through PSDP schemes (11 Nos.) and R&D projects funded from RDI (06 Nos.) as well as R&D projects funded from Self-Generated Income (SGI) of PCSIR (18 Nos.). These projects are designed to upgrade the existing laboratories/ centres of PCSIR with latest techniques, and state-of-the-art equipment, as well as, to create opportunities in areas, such as, halal certification, cannabis cultivation for industrial/ medicinal uses, and gene manipulation to enhance crops yield etc. Besides, Civil Military R&D relations are tied up to assist self-sustainability in various scientific domains. The execution of the aforementioned projects will enhance the engagement of industrial sector for ultimate augmentation in PCSIR revenue generation.

In brief, core objective of the current R&D programme is to develop advance technologies through innovative scientific research and to contribute in the economic growth of the country through product commercialization. This would be achieved via promoting Technology based Innovation and Entrepreneurship, establishing Technology Transfer Centres, Techno-Business Incubators, and Science & Technology Parks to facilitate new start-ups and SMEs. Thus, the aim of PCSIR to bridge the gap between industrial community, and R&D organizations within the country fulfills here.

**(Dr. Syed Hussain Abidi)**  
Chairman



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## Public Sector Development Program (PSDP) Projects

1. PSDP No. 1046

**Title of Project: Cultivation & Processing of Medicinal & Industrial Cannabis on Experimental Fields and Establishment of Testing and Product Development Facilities (PCSIR & Arid Agriculture University)**

**Project Director:**

Dr. Quratulain Syed, DG-LLC

**Project Objectives/Scope:**

- To develop experimental fields/ land for cultivation of industrial cannabis.
- To cultivate industrial cannabis on experimental fields and it's processing.
- To develop and validate analytical methods for testing of industrial cannabis.
- To conduct research for product development from cannabis.
- To provide state-of-the-art analytical services to the exporters and industry of cannabis products.

**Location:**

- PCSIR Laboratories Complex, Karachi (Cultivation, processing, testing)
- PCSIR Laboratories Complex, Lahore (Cultivation, processing, testing)
- PCSIR Laboratories Complex, Peshawar (Cultivation, processing, testing)
- Arid Agriculture University Environment Research Facility, Rawat (cultivation)
- Arid Agriculture University Research Farm, Koont, Chakwal Road, Gujar Khan (cultivation)

**Approved Cost:**

1896.82 Million

**Date of Approval with forum:**

13-07-2021

**Likely Completion Date:**

30-06-2024

**Expenditure upto June 2022:**

299.92

**Financial progress to date (% age):**

99.9%

**Benefits on completion of project/employment generation during and after completion of Project:**

- Thousands of jobs opportunities will be created in the local industries and agriculture
- Cannabis products development.
- Foreign exchange will be saved.



2. PSDP No. 1047

**Title of Project: Data Repository of Scientific Instrumentation (DRSI)**

**Project Director:**

Dr. Naseem Rauf, Member (Science)

**Project Objectives/Scope:**

- To provide funds for instrumental access to the research institutions, universities, R & D organizations, and strategic research centers of Pakistan to carry out sample analysis.
- To facilitate faculty and research staff of newly developed, as well as existing institutions that lack scientific instrumental facility for conducting their research through the above cited grant.
- To create an online data base of scientific instruments available in research centers, institutes, and industries of Pakistan.
- To design a nationwide mechanism for enabling ease of access to instrumentations facility present in different R & D, and academic institutions of the country.
- To provide a much-needed support to the research and academic institutions of Pakistan to overcome difficulties due to unavailability of high technology instruments.
- To assist people working in different institutions of Pakistan by providing them access to much needed instruments.

**Location:**

PCSIR, Head Office, Islamabad

**Approval Cost:**

Original: Rs.300 million

**Date of Approval with Forum Original:**

27-05-2021

**Commencement Date as per First Admin. Approval:**

27-08-2021

**Likely Completion date:**

30-06-2024

**Expenditure upto June 2022:**

Rs. 25.00 Million

**Financial Progress to date (%age):**

99.90%

**Benefits on completion of Project/ employment generation during and after completion of Project:**

- Supporting research activities at national level and improving the productivity of research institutions.
- Enhancing the image of universities, and research centers as significant players in high-end research and innovation.
- Supporting a national culture of innovation and development of scientific knowledge.
- Producing skilled human resource to fulfill national requirement.
- To strengthen collaboration between the university and industry in the areas of research and development, and to create value through maximizing collaboration between academia, private, and public sector entities.
- Improving the return on investment in education and R&D.
- Effective use of available equipment and resources.
- Saving in purchasing of new equipment.



3. PSDP No. 1049

**Title of Project: Digital Transformation, Strengthening and Automation of PCSIR**

**Project Director:**

Engr. Sohail Ameer Marwat, Member (Technology)

**Project Objectives/Scope:**

- Leverage new digital and information technology and systems, such as enterprise-wide information systems, data analytics, knowledge repository, to enhance efficiency and effectiveness of PCSIR.
- To implement a modern digital organizational network through replacing existing/ obsolete IT equipment with modern I.T. equipment including servers, routers, switches, computers etc. at PCSIR.
- To make PCSIR hardware and network infrastructure ready for implementation of e-Office services to be acquired from NITB.
- To develop Key software/ applications with data driven management dashboards to make a digital automated system for PCSIR to increase transparency, productivity, efficiency and revenue generation.
- To strengthen technical manpower in managing, operating and delivering improved IT services in MoST and PCSIR.
- To train end-users on operating various systems to be developed under this project.

**Location:**

PCSIR Head Office Islamabad and its regional offices located at Lahore, Daska, Peshawar, Karachi, Quetta, Hyderabad, Skardu and MoST

**Approved Cost:**

Original: Rs. 521.060 Million

Revised: Rs. 960.71 Million

**Date of Approval with Forum:**

Original: 27-05-2021 (DDWP/CDWP)

Revised: 17-12-2021

**Commencement Date as per First Admin. Approval:**

25-08-2021

**Likely Completion date:**

30-06-2023

**Expenditure up to June 2022:**

Rs. 210 Million

**Financial Progress to date (%):**

22.37 %

**Benefits on Completion of Project/Employment Generation During and After Completion of Project:**

- **Financial:**  
The concrete figures of this facility cannot be proposed before starting but this will surely open new source of revenue generation. Having all the equipment and man-power for this domain PCSIR can take on multiple projects from public and private organization and work on them in PCSIR lab.
- **Social Benefits with Indicators:**  
This department can have immense positive affect on the society. There are many local and community problems, issues that are still left unattended and could be solved by use of technology.
- **Employment Generation (Direct & Indirect)**  
**Direct:**  
A total number of 33 jobs will be created and will be appointed through advertisement and selection committee as per Federal Government Rules. The expenditure will be met through development fund. After completion of the project all experienced employees will be absorbed in PCSIR.  
**Indirect:** This project will help PCSIR to improve its overall efficiency which will ultimately contribute in employment generation.
- **Environmental Impact:**  
This project has no expected negative impact on the environment. All the development and training activities will be done in close environment. In fact, this upgradation will help to establish paper free environment in PCSIR. It will improve the quality of life, solve many daily issues in each respective domain and add collectively in the revenue generation both for an organization and for the industry and then country on the whole.
- **Impact of Delays on Project Cost and Viability**  
**Impact of Delay in Funds:**  
Delay in release of fund can adversely affect the cost.



**4. PSDP No. 1048**

**Title of Project: Development of Computer Controlled Fermenters & Production of Biomolecules and Bioproducts**

**Project Director:**

Dr. Rubina Neelofer, PSO-LLC

**Project Objectives/Scope:**

- Establish a design and manufacturing facility for computerized automated fermenters and associated equipment and systems for a variety of volume sizes that could be used by a wide range of facilities from lab pilot scale to commercial/industrial manufacturing.
- Develop indigenous metabolic engineering capability in terms of R&D, design, development and subsequent commercial production of biochemicals, biopharmaceuticals and bioproteins etc.
- Leveraging existing commercial activities, this endeavour could create and open up new vistas of biotechnology related businesses for the country, thus moving towards knowledge-based economic growth.
- Develop and upgrade the existing essentially required facilities and infrastructure at PCSIR and ICC/ PAEC. Thus providing establishment of national level integrated bio-processing infrastructure.
- Build capacity by conducting trainings, workshops, seminars and research capability in advanced techniques in development of large sized computer controlled fermenters/ bioreactors and biochemical production. Thus, providing technical services by utilizing indigenous resources and saving precious foreign exchange in future.
- Produce local biotechnology industry needs for socio-economic growth of the country and associated spin-off technologies thereof.

**Location:**

Pakistan Council of Scientific and Industrial Research (PCSIR) Labs Complex, Lahore and Instrumentation Control & Computer Complex (ICCC), PAEC, Islamabad

**Approved Cost:**

Original Cost: 1981.607 Rs. Million

**Date of Approval with Forum**

Original Date: 26-05-2021 (DDWP)

**Commencement Date as per First Admin. Approval:**

03-09-2021

**Likely Completion date:**

30-06-2023

**Expenditure up to June 2022:**

Rs. 80.025 Million

**Financial Progress to date (%):**

4.958

**Benefits on Completion of Project/Employment Generation During and After Completion of Project:**

- Establishment of manufacturing facility for fermenters and associated equipment and systems for a variety of volume sizes that could be used by a wide range of facilities from lab pilot scale to commercial/industrial manufacturing.
- Development of indigenous capability in terms of R&D, design, development and subsequent commercial production of biochemicals, biopharmaceuticals, biofertilizers, biopesticides, etc.
- Leveraging existing commercial activities, this endeavour could create and open up new vistas of biotechnology related businesses for the country, thus creating employment in the emerging biotechnology industry.



**5. PSDP No. 1073**

**Title of Project: Up-gradation of Machinery, Equipment and Buildings of IIEE and PSTC Karachi**

**Project Director:**

Engr. Dr. Farah Haroon, Principal IIEE

**Project Objectives/Scope:**

- Addition of Lab Trainers, General Lab Equipment,

Machinery, Modernization of Labs and Library would enhance the engineering insight and technical expertise of students through updated standard of teaching and training facilities.

- Repair & renovation of the present infrastructure, buildings, workshops, labs of IIEE & PSTC and PSTC Hostel is essentially required to provide safe and conducive environment of teaching and learning environment at IIEE and PSTC, Karachi.
- Modernization of Labs and transformation of Library into Digital Library is also an important aspect.
- Procurement of Furniture and Fixtures at Class rooms, Labs and Library is required and would be utilized for Students of IIEE and PSTC.
- Purchase of Vehicles at IIEE and PSTC is required for Students in lieu of participation in Exhibitions, Seminars and Project competitions. It would broaden their vision and promote their outreach in industries and professional community.

**Location:**

IIEE and PSTC, Karachi

**Approved Cost:**

Original: Rs. 125 Million

**Date of Approval with Forum**

Original: 02-04-2020 (DDWP)

**Commencement Date as per First Admin. Approval:**

15-10-2022

**Likely completion date:**

30-06-2023

**Expenditure upto June 2022:**

Rs. 61.443 Million

**Physical Progress (% age):**

47.67 %

**Any Issues / Reasons for Slow Utilization etc.**

- Requirement of funds for meeting physical targets.





**6. PSDP No. 1074**

**Title of Project: Up-gradation of Medicinal Botanic Center as National Center for Herbal Medicine, PCSIR Labs. Complex, Peshawar (UMBC-NCHM)**

**Project Director:**

Engr. Sohail Ameer Marwat, Member (Technology)

**Project Objective/Scope:**

- The main objective of the project is to establish National Center for Herbal Medicine (NCHM) at PCSIR Laboratories Complex Peshawar.
- To upgrade research facilities according to WHO guidelines in the areas of:
  - Pharmacology & Animal House
  - Phyto-chemical Standardization
  - Process development
  - Herbal analysis
  - Microbiology
  - Biochemical assays
  - Plant tissue culture
  - Botany
- To have qualified/expert manpower in high technology fields related to health/medical sciences
- Training of Research Staff of Medicinal Botanic Centre PCSIR Peshawar, at the Chinese Institutions Specialized in Traditional System of Medicine including Institute of Chinese Materia Medica (Beijing China).

**Location:**

Medicinal Botanic Center (MBC), PCSIR Laboratories Complex, Peshawar

**Approved Cost:**

Original: Rs.110.893 Million  
Revised: Rs.286.00 Million

**Date of Approval with Forum**

Original: 15-08-2018/ CDWP  
Revised: 08-09-2021/ DDWP

**Commencement date as per First Admin. Approval:**

15-08-2018 (First Release Received on 11-11-2019)

**Likely Completion Date:**

30-06-2023

**Expenditure upto June, 2022:**

109.3531

**Physical Progress (%age):**

62%

**Benefits on completion of Project/employment generation during and after completion of Project:**

- Quality of Herbal products will be improved
- Value addition of herbal raw material will enhance their exports value
- Employment will be generated throughout the country



**7. PSDP No. 1067**

**Title of Project: Research, Development & Innovation (RD&I) in Pakistan Council of Scientific & Industrial Research (PCSIR)**

**Project Director:**

Dr. Naseem Rauf, Member (Science)

**Project Objectives/Scope:**

- Establish an RD&I Programme facility for a variety of purposes in the domain of scientific/ technological/ industrial research such as new technology initiatives, cutting-edge/ advanced R&D, commercialization, digitalization, marketing, industrial-business linkups/partnerships, etc. leading to indigenous commercial/industrial ecosystem.
- Develop linkages to facilitate cooperation between research and development facilities at PCSIR, industrial businesses, technology producers and investment platforms.
- Leveraging commercial activities, the RD&I Programme could provide new vistas of industrial technology related businesses for the country, thus moving towards knowledge-based economic growth.
- Provide support to sustain and improve the essentially required facilities and activities at PCSIR

by creating an environment of continuous services for the technological initiatives carried out in collaboration with PCSIR (Public & Private) Partners.

- Attracting diaspora to help and download business/finances/projects/opportunities back to Pakistan.
- Build capacity by conducting trainings, workshops, seminars and research capability in advanced technologies and services.

**Location:**

PCSIR, Head Office, Islamabad

**Approval Cost:**

Original: Rs. 1500 Million

**Date of Approval with Forum:**

Original: 27-05-2021(DDWP/CDWP)

**Commencement Date as per First Admin. Approval:**

09-08-2021

**Likely Completion date:**

30-06-2023

**Expenditure up to June 2022:**

Rs.43.170 Million

**Financial Progress to date (% age):**

99.9 %

**Benefits on completion of Project/ employment generation during and after completion of Project:**

- Development of new technologies, products, and services that it will be either use or sell.
- Sustainable capability in industrial research and development
- Establishment of Technology Research Partnerships/ collaborations/ linkages.
- Development of a fundamental framework for spillover of mature technologies to the civilian sector
- Introduction Technologies in the private sector through IP licensing, spin in and spin out etc.



**8. PSDP No. 1072**

**Title of Project: Up-gradation of Calibration Centre Capabilities at PCSIR Labs. Complex, Peshawar (UCCC)**

**Project Director:**

Dr. Mushtaq Ur Rehman, SSO-PLC

**Project Objectives/Scope:**

- To enhance the existing capabilities of Calibration Centre for the facilitation of Local Manufacturers and Public / Private Organizations in the fields of
  - Mass
  - Dimensional
  - Temperature
  - Electrical/Electronics
  - Mechanical
  - Chemical
- To provide a platform for interaction between manufacturers and end users by arranging technical seminars, workshops/training and exhibitions, etc.
- To provide a favorable ground for R&D and technical assistance to local industries.

**Location:**

Calibration Center, PCSIR Laboratories Complex, Peshawar

**Approved Cost:**

Rs. 35.0 Million

**Date of Approval with Forum**

11-05-2020 (DDWP)

**Commencement Date as Per First Admin Approval:**

03-08-2021

**Likely Completion date:**

03-02-2023

**Expenditure upto June 2022:**

Rs. 15.00 Million

**Financial Progress to date (%age)**

43%



**Benefits on Completion of Project / employment generation during and after completion of project:**

Enhancement in the capabilities of Calibration center will support the upgrading of the PLC metrology infrastructure of a modern metrology laboratory/facility with proper environmental conditions and it will also assist in strengthening staff skills of the center.

Consequently, the precision level of most of these equipment and machines has deteriorated. The existing setup of Calibration center needs spiraling and creation of new facilities for calibration/testing of precision type of electrical, Mass, Temperature, Mechanical & electronics products, etc. and R & D work.

By Augmenting the Calibration center capabilities, manufacturers, public and private stakeholders in Khyber Pakhtunkhwa can be benefited from the facility.



**9. PSDP No. 1050**

**Title of Project: Establishment of Materials Resource Center and Development of Additive Manufacturing & Reverse Engineering Center at PCSIR**

**Project Director:**

Engr. Sohail Ameer Marwat, Member (Technology)

**Scope in Brief/ Objectives:**

**Part A:** Establishment of “Material Resource Center” at PCSIR Labs Complex Karachi

1. The project aims at establishment/enhancement of facilities for Research and development, materials characterization, Analytical Testing and Quality assurance of materials in the following areas:
  - Advanced Engineering Materials
  - Electrical / Electronic Materials
  - Magnetic Materials
  - Optical / Spectroscopic Materials
  - Nano technology
  - Building Materials
2. Reverse Engineering and Material Identification for development of indigenous materials/ processes/ techniques for import substitution and to assist

industrial and academic sector to improve / innovate their products and R&D facilities.

3. To establish a strong nexus between researchers, manufacturers and end users.
4. To help industries in exporting valuable/ finished product by providing quality evaluation of import/export products/materials.
5. To enhance earning through facilitation of commercials and technical institutes.
6. Indirect growth of material industries will generate new employment opportunities and aiding economy by producing more standard products.

**Part B:** Development of Additive Manufacturing & Reverse Engineering Facility. PCSIR Labs Complex Peshawar.

1. Establishment of Additive Manufacturing Units in PCSIR PLC.
2. Connecting private and public sector industries, with development of prototypes and end products.
3. Establishment of value chains and end-to-end customer support network for industrial goods and parts.
4. Enhancing the PCSIR’s technical capability by developing high end prototyping labs for Advanced Thermal Design and High-Power Electronics.
5. Replacement of high-end equipment/part imports with locally produced 3D printed parts.

**Location:**

PCSIR Labs Complex Peshawar & Karachi

**Approved Cost:**

Original: Rs. 1750.00 Million  
Revised: Rs. 1951.683 Million

**Date of Approval with Forum:**

Original Date: 27-05-2021

**Commencement Date as per Admin. Approval:**

03-08-2021

**Likely Completion Date:**

30-6-2024

**Expenditure upto June 2022:**

250.0 Million

**Financial Progress to Date (% age):**

14 %

**Benefits on completion of Project/ employment generation during and after completion of Project:**

- This project mainly deals with the emerging Advance Materials, Additive Manufacturing & Reverse Engineering and the financial outcome will be both research & development products in addition to provide advance materials testing laboratory. It will pave way for the exporters to certify their consignments of locally manufactured products prior to their export and thus compete and find their place in the world market. It will become an easy source of income generation, which could be utilized for enhancement of R&D activities of PCSIR.
- Indigenously developed products will help save huge amount of foreign exchange to import such technologies through ToT or otherwise finished product form.
- The establishment of this project is directly related to general uplift of the socio economic development of the country and indirectly towards the poverty alleviation of the growers.
- Moreover, the establishment of the project infrastructure in PCSIR Laboratories Complex will create a nucleus for the creation of jobs and employment of manpower in various categories.

- Understand and synthesize the local medical device industry support requirement, skill development, ecosystem, viability of manufacturing in Pakistan.
- Increase the efficiency, quality and capacity of existing industry to become a major participant in the global supply chain of medical devices.
- Innovate and develop technologies for medical equipment, keeping in view local and global demand to assist manufacturers to move up the technology ladder.
- To augment the role of Immunology in clinical diagnostics.

**Key objectives of MEDICINE are as follows:**

- Knowledge Economy and Made in Pakistan Brand
- Expedite the Digitalization Process of Health Care Sector
- Open-Source Strategy
- Entrepreneurship culture development in IoTs
- Academia/ R&D organization -industry Linkage
- Training workshops and Seminars
- First Mover Advantage
- Boosting usage of AI
- Data sharing

**Location:**

Islamabad/Peshawar

**Approved Cost:**

Original: Rs. 1989.52 Million

**Date of Approval with Forum:**

Original: 27-05-2021 (DDWP)

**Commencement Date as per First Admin. Approval:**

09-11-2021

**Likely Completion Date:**

30-06-2025

**Expenditure up to June 2022:**

Rs. 4.480 Million

**Financial Progress to Date (% age):**

0.001359%

10. PSDP No. 1063

**Title of Project: Medical Equipment & Devices Innovation Center (Medicine)**

**Project Director:**

Engr. Ghulam Shabbir, Director (Technology)

**Project Objectives/Scope:**

- To Assist Pakistani Medical and Surgical Manufacturers in research and development of medical equipment not only to cater for local market demand but also for export.

**Benefits on completion of Project/employment generation during and after completion of Project:**

- A fully functional state-of-the-art antibody library, production and kit assembly facility will be established in PCSIR
- Develop foot prints for Indigenized capability to produce antibody libraries, kit assemblies for infectious diseases in Pakistan.
- 20-25 projects should be funded related to research, design and development of medical devices, the projects through tippel Helix should result in either:
  - i. A functional prototype of a medical device
  - ii. Development of a process aiding in manufacture of a medical device
  - iii. Improvement in design of a medical device
  - iv. Provision of software or a service for medicinal field
- To make Pakistani products (Medical Devices /Surgical) competitive in the international markets through a robust system of research, product design & development, quality control, testing and certification.
- Help Indigenous production of surgical/medical devices in Pakistan targeting local market as well as exports
- Increase adoption of local medical devices in Pakistan
- Availability of trained manpower both for local medical device industry as well as foreign industry
- Export enhancement & Balance of Payment improvement
- Increase adoption of local medical devices in Pakistan
- Improvement in Forex Reserves
- To increase IoT awareness in respective discipline
- To train contributors on the importance of quality control and assurance
- To improve product quality and bring it to international standards
- Transfer of knowledge & Technology & its spin off & spillover to industrial side.



**11. PSDP No. 1061**

**Title of Project: Gene Editing of Biological Agents for Nutritional, Bio-chemicals and Therapeutic Purposes**

**Project Director:**

Dr. Quratulain Syed, DG-LLC

**Project Objectives/Scope:**

- To establish advance Microbial Gene Editing Facility at PCSIR for nutritional and therapeutic purposes
- To develop indigenous microbial strains using genetic engineering capability for production of bio-foods, bio-chemicals, bio-pharmaceuticals, bio-fertilizers, bio-pesticides : Single Cell Proteins, Vitamin A, Omega-3, Bio-Butanol, Industrial Enzymes etc.
- To develop Quality Assurance Services of developed bio-products and their subsequent commercialization
- Capacity building by conducting trainings, workshops, seminars and research capability
- To develop CRISPR/Cas based Genome Edited Laboratories for climate resilient crops with better grain quality and yield
- To develop in vitro CRISPR/Cas based human healthcare laboratory for drug resistant pathogens
- To develop genome editing based novel diagnostic tool for human diseases
- To initiate capacity building of public and private sector in adaptation of genome editing technology

**Location:**

PCSIR Laboratories Complex Lahore and UAF Faisalabad

**Approved Cost:**

Original: Rs. 1799.60 Million

**Date of Approval with Forum:**

26-04-2021

**Commencement Date as per First Admin. Approval:**

1-07-2021

**Likely completion date:**

30-06-2023

**Expenditure up to June 2022:**

Rs. 400.00 Million

**Financial Progress to date (% age):**

99%

**Benefits on completion of Project/employment generation during and after completion of Project:**

- To establish an advanced gene editing facility at PCSIR along with associated equipment and systems that could be used for a wide range of purposes such as nutritional and therapeutic purposes, leading to indigenous commercial/ industrial manufacturing.



## Projects to be funded form Research, Development and Innovation (RD&I, PSDP Project)

**Name of Laboratory/ Centre/Unit:**  
APC & IC / KLC

**Title of Project: Establishment of Testing Facility for Electric Motors**

**Project Leader:**  
Mr. Arif Karim, PSO

**Project Associate(s):**  
Mr. Faisal Ghazanfar, SO

**Area(s) of Research:**  
Electrical /Electronic Components, Sensors, Modules, PLC, HMI & Equipment, Test-Rig& Lab development

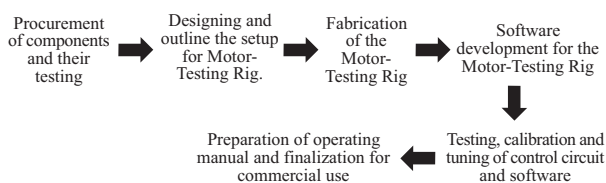
**Duration:**  
01 Year

**Research Highlights:**

- Development of indigenous facilities and expertise for Testing various parameters of Electric-Motors especially efficiency.
- The testing range may be 0.5-30KW
- Energy conservation through identifying under-efficient motors.
- Conducting awareness seminars and training workshops for energy

**Source of Funding:**  
RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Establishment of Motor Testing facility, i.e. Motor-Testing Rigs with testing range 0.5-30KW



**Name of Laboratory/ Centre/Unit:**  
CES/ KLC

**Title of Project: Extraction, Purification, Characterization of Eugenol and Synthesis of Methyl Eugenol (ME)**

**Project Leader:**  
Dr. Sohail Shaukat, SSO

**Project Associate(s):**  
Engr. Nazir Ahmed Tunio, PE

**Area(s) of Research:**  
Pest Control

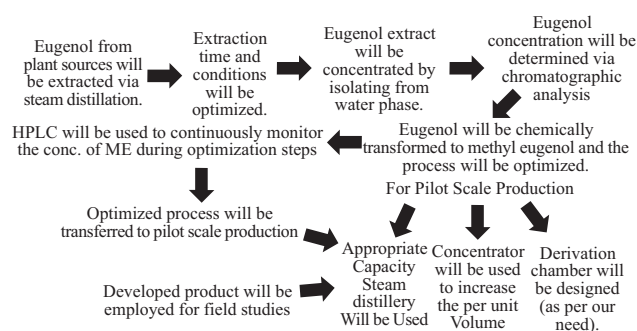
**Duration:**  
02 Years

**Research Highlights:**

- Establishment of pilot plant facility for extraction and derivatization of Eugenol.
- Process optimization to achieve economically feasible level yield in Eugenol extraction and derivatization from plant sources.
- Development of a unique research cum production facility on the subject matter at PCSIR KLC.
- Development of a feasible process and/or produce marketable ME to make the facility sustainable.

**Source of Funding:**  
RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Product Development (Methyl Eugenol)
- Pilot Scale Process Development for ME production
- Primary objective of the project is “import substitution” while the next objective is availability of the product in relatively less amount. Although same raw material will be used to that of the imported product but the local product will have edge in following manners:
  - Nominal freight cost as compared to the imported products
  - In time availability as per need
  - Conservation of foreign currency
- Technology will be available for exploring the other (cheaper) sources of raw material.



**Name of Laboratory/ Centre/Unit:**

LRC/ PCSIR

**Title of Project: Production of Biological Base Fat Liquor on Semi-Pilot Level for Pakistan Leather Industry**

**Project Leader:**

Dr. M. Kashif Perveez, CSO

**Project Associate(s):**

Ms. Tahira Ayaz, SSO

**Area(s) of Research:**

Leather Auxiliaries

**Duration:**

01 Year

**Research Highlights:**

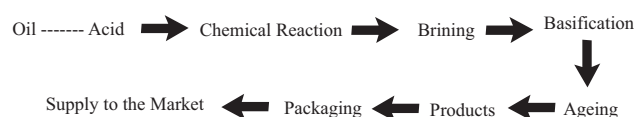
- Production of vegetable oil based fatliquor on semi pilot scale easily available raw materials (Vegetable oil) in the local market of Pakistan
- To provide the assistance to the Pakistani Chemical Manufacturing Industries in the manufacturing of leather chemicals (fatliquor) locally. It would be beneficial to leather and allied industries in Pakistan.
- To check the chemical properties of developed Fatliquor and study the physical and chemical properties after application on leather.

- To study the effluent parameter i.e. COD, BOD, TS, TDS, SS, P, N, chloride, alkalinity etc. after the application fatliquor in the processing/ making of leather and finished leather products by qualitative and quantitative analysis as the guideline of international standards

**Source of Funding:**

RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To manufacture Fatliquor locally
- Import substitution
- To save the foreign exchange of Pakistan
- Making strong relation between Tanners and LRC
- Eco-friendly towards greener approach



**Name of Laboratory/ Centre/Unit:**

FPRC/ LLC

**Title of Project: Efficient Canola Seed Processing and Value Addition Byproducts**

**Project Leader:**

Dr. Asma Saeed, CSO

**Project Associate(s):**

Dr. M. Zia-ur-Rehman, PSO

**Area(s) of Research:**

Bioresource Utilization (Food /Feed industry)

**Duration:**

01 Year

**Research Highlights:**

- To develop a continuous cyclic process for the utilization of canola seeds.

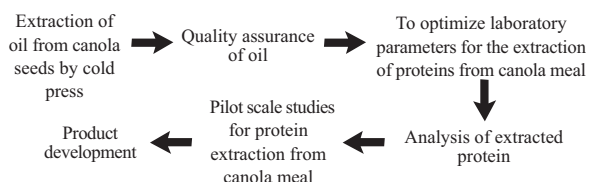


- Easy to operate process for the extraction of proteins from canola meal.
- Use of residue as animal fodder.

**Source of Funding:**

RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To develop efficient process for the extraction of storage proteins such as Cruciferin (12S globulin) and Napin (2S albumin) from canola meal.
- The protein isolates can be used for protein fortification of processed foods, emulsification of oils, body formers in baked foods and foaming agents in products with entrapped gases.
- The protein isolate can potentially be used in substitution for egg white, milk protein, etc.
- The residue can be used as animal fodder.



**Name of Laboratory/ Centre/Unit:**

MBC/ PLC

**Title of Project: Installation of Vertical Hydroponics Growing System for Fruits, Vegetables and Medicinal Herbs and Development of Various Products**

**Project Leader:**

Dr. Hina Fazal, SSO

**Project Associate(s):**

Ms. Farina Kanwal, PSO

**Area(s) of Research:**

Fruit & Beverages, Herbal & Nutraceuticals

**Duration:**

02 Years

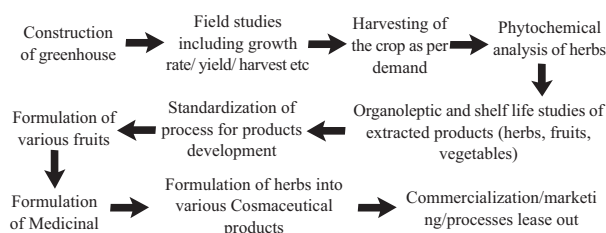
**Research Highlights:**

- To save land, and to enhance an efficient, and low cost crop production via recyclable protocol
- To organize R&D activities pertaining to better utilization of the natural resources i.e. fruits, vegetables and medicinal herbs available in the country.
- To install a system for better utilization of available water resources by saving loss of water expected in conventional farming.
- To address and resolve technical problems faced by the industrial sector related to food, herbal and cosmeceutical items.
- To minimize the environmental risk via CO<sub>2</sub> capture.
- To develop indigenous technologies for value addition to curb imports and enhance exports of the developed products.

**Source of Funding:**

RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The execution of the proposed project would possibly enhance the fresh fruits and medicinal herbs production at low cost, environmental friendly and recyclable manner.
- The successful execution of the proposed idea will open up new horizons for the researchers of PCSIR, and other organizations of Pakistan to pursue their research (of choice) in growing targeted crops, efficiently fruits and herbs.
- Moreover, the developed raw material/ product/ processes will provide opportunities to pharmaceutical, food and cosmeceutical industries/ entrepreneurs for establishment of fruit and herbal based products.



- The quantifiable outcome of the project are as follows.
- Number of hydroponic system: 01
- Number of crops produced: 02 crops/annum ,,
- Number of publications: 02
- Number of patents: 01
- Number of processes (technologies) developed/leased out: 03
- Number of product developed: 06
- Number of transfer of technologies: 03
- Expected turnover of the project: 05millions/ annum
- Expected CO<sub>2</sub> captured/acre: Based on the literature, green vertical farming can potentially emit 70% less CO<sub>2</sub> as compared to open field farming, with additional benefits of 95% less land use and 80-90.



**Name of Laboratory/ Centre/Unit:**

FTC/ PLC

**Title of Project: Production of Natural Fruits Vinegar**

**Project Leader:**

Dr. Arshad Hussain, PSO

**Project Associate(s):**

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**Area(s) of Research:**

- Value addition and product development (Food Microbiology)
- Food / Nutraceutical Industry

**Duration:**

01 Year

**Research Highlights:**

- Effective utilization of apple, dates, raisins and apricot by preparation of natural cider vinegars; it will in turn reduce the wastage of the selected fresh fruits from our Northern and Chitral areas.
- Utilization of low grade cheap fruits for production of good quality valuable product.
- Based on nutritive values of these fruits,

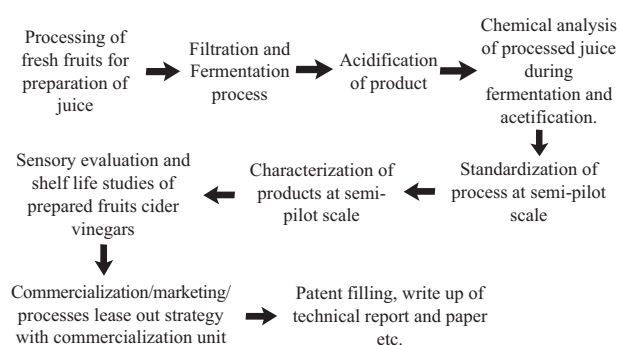
development of value added, nutritive and cost effective process for production of cider vinegars at semi pilot scale level.

- Standardization and characterization of the products for semi pilot scale in bulk quantity.
- Production of novel product by development of process for cider vinegar utilizing natural source instead of chemical additives.

**Source of Funding:**

RD&I

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- This will substantially contribute towards enhancement of the competency of potential commodities for their utilization into valuable products
- Replacement or substitute of low quality, costly and imported branded natural vinegars available in local market.
- Production in bulk quantity in less time as compared to lab/bench scale production
- Based on semi pilot scale products development, will ease the commercialization of natural fruits cider vinegar. It will fulfil the satisfaction of the customers for lease out of the product.



## Projects to be funded from Self-Generated Income (SGI) of PCSIR

**Name of laboratory / Centre/ Unit:**

FMRRC/ KLC

**Title of Project: Propagation of Healthy and High Yielding Sugarcane Seeding Material through Tissue Culture Technique**

**Project Leader:**

Dr. Beena Naqvi, PSO

**Project Associate (s):**

Mr. Muhammad Ashraf, SE

**Area (s) of Research:**

Agriculture and Plant Tissue Culture

**Duration:**

01 Year

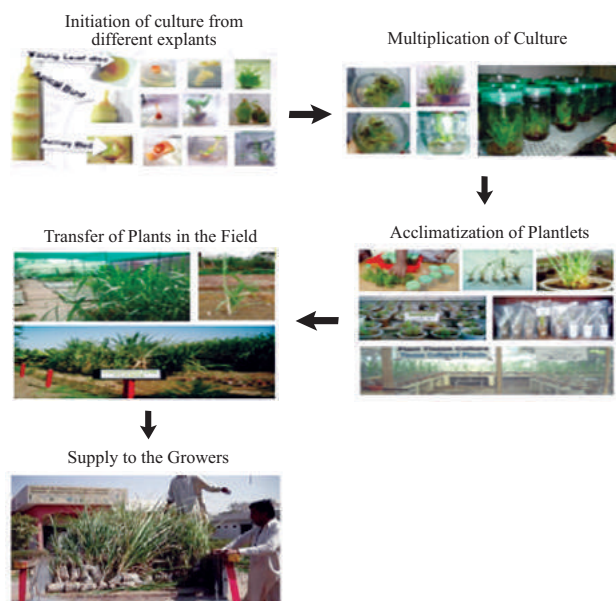
**Research Highlights:**

- There is a continuous challenge to increase sucrose yields and develop stress tolerant clones of sugarcane through R&D. To cope with the issue related to sugar industry the research has been conducted on improvement of sugarcane variety in Plant Tissue Culture Lab PCSIR Karachi. Stress tolerant and high yielding variety of sugarcane (KLC-1) has successfully been developed through tissue culture technique.
- Healthy explants were selected for initiation of culture, surface sterilized and inoculated in media supplemented with different growth regulators etc. After in-vitro mass multiplied through micro-propagation, these plantlets were acclimatized in green house for 3 months before transfer in the experimental field.
- The tissue culture plants in the field have shown very high yield and quality in growth. The average tillers per plant were 40, nodes were 18, and the average height of the plants was about 8 ft with a girth or around 4.2 inch.

**Source of Funding:**

SGI (Rs. 4.05 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Sugarcane is one of a major crop of Pakistan and ranked 5th area wise, nearly 10th production wise. The share of sugar industry in value added of agriculture and GDP are 3.2 and 0.7 percent, respectively. However, the production and yield per hectare is far below its actual capacity and it stands at almost lowest in the world. It is reported that in Pakistan sugarcane production suffers a loss of over two billion rupees per annum, its growth and sucrose contents are severely affected by various stresses. These include unhealthy seeding material, diseases, salt and drought stress etc. The key factor is non availability of good quality seeding material. These problems consequently affect the production of sugar industry. Improvement of crop through conventional method is time consuming and tedious process.
- This project aims to develop healthy and high yielding Sugarcane seeding material through Tissue Culture Technique, and to support growers by providing healthy and high yielding Sugarcane seeding material.



**Name of Laboratory/ Centre/Unit:**

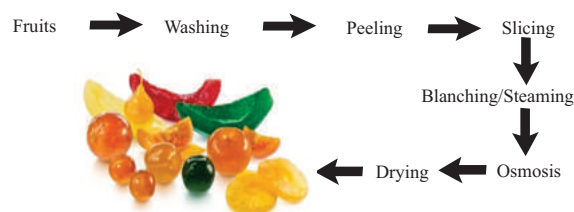
FMRRC/ KLC

**Source of Funding:**

SGI (Rs. 2.5 Million)

**Title of Project: Development of Technology for Candied Fruit Processing**

**Graphical Abstract:**



**Project Leader:**

Dr. Muhammad Samee Haider, PSO

**Project Associate(s):**

Dr. Omer Mukhtar Tarar, PSO

Ms. Nida Saleem, SSO

Mr. Umed Ali Soomro, SSO

**Areas of Research:**

Food Preservation, Fruit dehydration

**Duration:**

02 Years

**Research Highlights:**

- One of the natural preservation technology are being applied worldwide is Candied Fruit which is referred as crystallized fruit or glacé fruit, in which whole fruit, small pieces or peels are impregnated with sugar and subsequently drained and dried.
- It is a delicate and intricate operation requires very specific technical knowledge; comprises of more or less cooking in sugar up to soluble solid's concentration; preserving it from biological alteration over a long period of time.
- The project is designed thereafter for the development of candied fruit technology in order to overcome seasonal surplus loss / spoilage and inadequate local cold storage facilities by converting the fruit into marketable and profitable product.
- Fruits that can be candied at the proposed Lab. scale are: Mango, Apples, apricots, pears, figs, cherries, tropical fruits in slices /dices or pieces, oranges and lemons as well as their peels do well candied and make a nice citrusy candied fruit, pineapple slices etc.

**Project Outcome w.r.t. Socio economic Development of the Country:**

- This project will help the food producers or confectionery manufacturers to select the technology for processing of candied fruit and at the same time post-harvest losses of fruits especially perishable fruits can be reduced by preserving them. Several ancillary industries such as the production of cans, bottles, caps, etc. may be established which will generate employment opportunities. The fruit processing, preservation and value added product development trainees will help to control food security issues as well. There is a considerable scope for expansion of fruit preservation industry in Pakistan which in turn will also help in horticulture and gaining foreign exchange.
- This research project is meant for development of new fruit processing technologies at Lab-scale. Therefore, financial benefits relate to the successful development of the technologies which could be leased out to food processors and confectionery manufacturers for processing of candied fruit. It will resultantly support to curtail the post-harvest losses of perishable fruits hence it will boost the income of the farmers. Whereas the value added products could also be exported to earn the foreign exchange. It will create the job opportunities in the private sector. Ultimately the expansion of fruit preservation industry in Pakistan could be perceived.



**Name of Laboratory/ Centre/ Unit:**

FMRRRC/KLC

**Title of Project: Recovery and Value Addition of Protein from By-Products of Food and Agro Processing Industries**

**Project Leader:**

Dr. Omer Mukhtar Tarar, PSO

**Project Associate(s):**

Dr. Muhammad Samee Haider, PSO

Engr. Nazir Ahmed Tunio, PE

Mr. Tariq Bakshish, EO

**Area(s) of Research:**

Protein Processing

**Duration:**

02 Years (Subject to Availability of Funds)

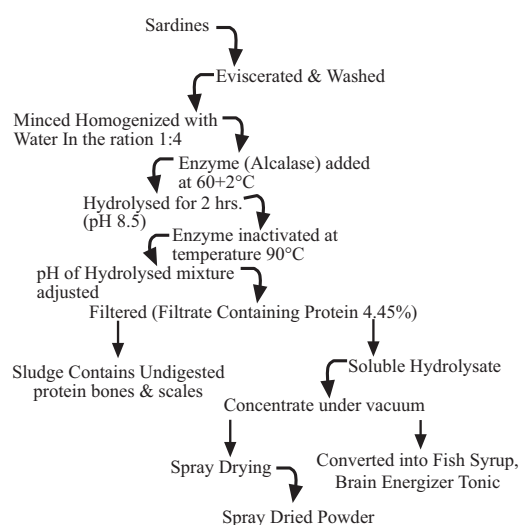
**Research Highlights:**

- Establishment of pilot plant facility for protein extraction and value addition.
- Optimization of process of protein extraction and hydrolysate development from oil seed and poultry by-products to achieve high yield and quality.
- Excelling the pilot plant into a unique protein processing research and pilot scale production facility.

**Source of Funding:**

SGI (Rs. 30 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- It can act as a model unit for scaling up this business at industrial scale.
- This project will strengthen the industry resulting in the uplift of the economy.
- It will surely reduce the country's dependence on imported protein materials resulting in saving hard earned foreign exchange.



**Name of Laboratory / Center / Unit:**

CSE/KLC

**Title of Project: Establishment of Ingress Protection Testing Facility (Environmental Testing) of Home Appliances Parts and Other Products**

**Project Leader:**

Mr. Shahid Bhutto, PSO

**Project Associates:**

Dr. Nusrat Jalbani, PSO

Dr. Akhtar Shareef, PSO

**Area(s) of Research:**

Environmental Sciences and Physics

**Duration:**

02 Years

**Research Highlights:**

Ingress protection testing is required worldwide to grade the protection level of any home-appliance parts and other products.

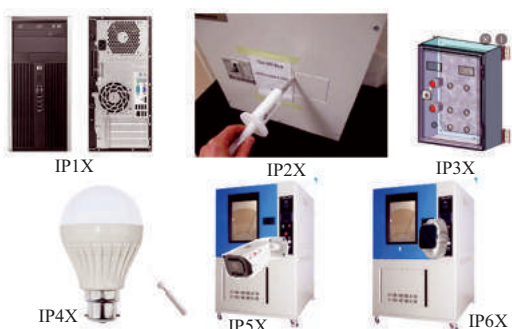
- High-quality products recognition
- Nurture the quality culture in the country
- Evaluation of Environmental/Climate impact on the products
- Achieve the confidence of clients in the products
- Enhance product recognition at international standard; ultimately increase exports of the country
- The facility will also be utilized for commercialized R & D.

**Source of Funding:**

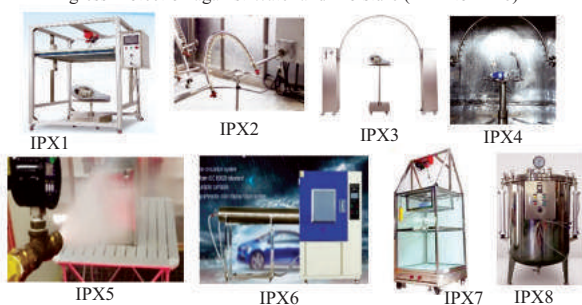
SGI (Rs. 15 Million)

**Graphical Abstract:**

Ingress Protection against Solid foreign bodies and Dust particles (IP1X to IP6X)



Ingress Protection against Water and Moisture (IPX1 to IPX8)



**Project Outcome w.r.t. Socio-economic Development of the Country:**

The establishment of the Ingress Protection Lab will have the following socio-economic outcomes:

- Revenue generation by international recognition and standardization of products through value addition.
- Home-appliance parts and other products could be exported with enhanced quality as per IEC-60529.
- Job creation by induction of new technologies into Pakistani’s market.
- Reduction of risk burden by providing high-quality products
- Establishment of IP testing (14 new parameters) facility at PCSIR-Karachi.
- Reduce import by providing the masses with competitive products.



**Name of Laboratory/ Centre/ Unit:**

APC&IC/KLC

**Title of Project: Smart Growing Chamber**

**Project Leader:**

Dr. Abid Karim, SSO

**Project Associate(s):**

Mr. Shaikh Kamaluddin, SSO

**Area(s) of Research:**

Solar Radiation, Automation, Controls, Bio Materials, Horticulture.

**Duration:**

02 Years

**Research Highlights:**

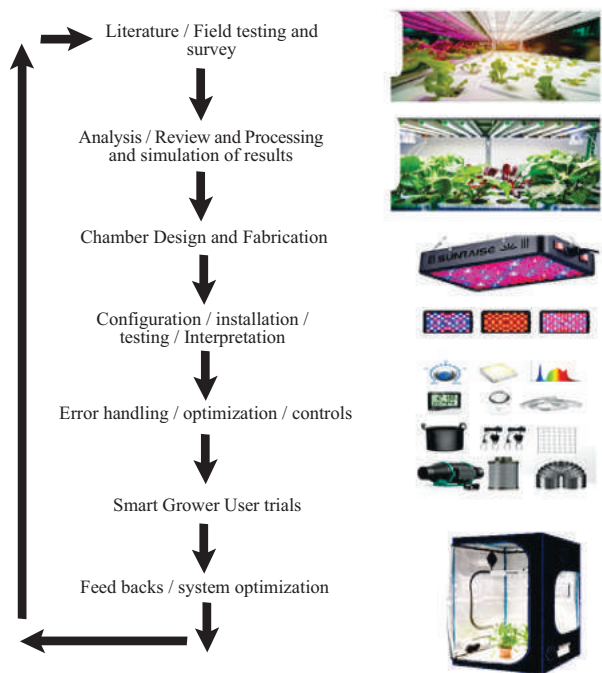
- Optical / solar spectrum / devices testing, analysis and interpretation and their effect on the plants.
- The high tech and automation will be used for creating natural sun light spectrum along with the plant’s friendly environment for the growing species.
- This increase the production by 3 to 7 times per square acre / meters where the contaminated water with fertilizer / insecticides can be recycled and reused.
- Pakistan imported USD 98.5 Million of spices in 2020.
- Farmers are avoiding to grow the spices / herbal / medicinal plants which need extensive care / maintenance / automation and trained-manpower in order to compete the imported products due to migration of trained manpower / labor to urban areas.

**Source of Funding:**

SGI (Rs. 15.00 Million)



**Graphical Abstract:**



**Project Associate(s):**

Mr. Sohail Akhtar, SSO  
 Dr. Abid Karim, SSO  
 Mr. Zain-ul-Abdin, EO

**Area(s) of Research:**

Testing of batteries, Electrical Vehicle, batteries operation and performance testing, BMS, back up Storage

**Duration:**

02 Years

**Research Highlights:**

- The rechargeable batteries are in use for a variety of human activities. Electric vehicles require batteries of varying energy densities. Fundamentally, different chemistries and approaches employed in very demanding needs of batteries energy storage. But battery are not tailored and designed for a specific use. For example in mobile phone use, present lithium-ion batteries are not powerful enough, for long run time in mobile phone and higher energy consumption in smart phone.
- Several types of materials, are used for rechargeable lithium-ion batteries. The dynamic development of various technical fields, where chemical power sources are used is causing a significant growth for energy storage power sources with better battery demand.
- The project would performed:
  - > Establishment of Accredited Lab For EV Batteries testing
  - > To develop R&D Lab for batteries Development
  - > To follow international certification and standards such as ISO, 17025 etc

**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Design and development of the prototype model for the Smart Growing chamber
- Control parameters of Artificial Light to mimic the natural sun light including temperature, humidity etc.
- Automation and software development
- Testing, validation and simulation of result in real time scenario.
- Correction, updating and design optimization.
- User trials



**Name of Laboratory/ Centre/ Unit:**

CDLE/KLC

**Title of Project: Establishment of Testing Facilities for Electrical Vehicles Batteries**

**Project Leader:**

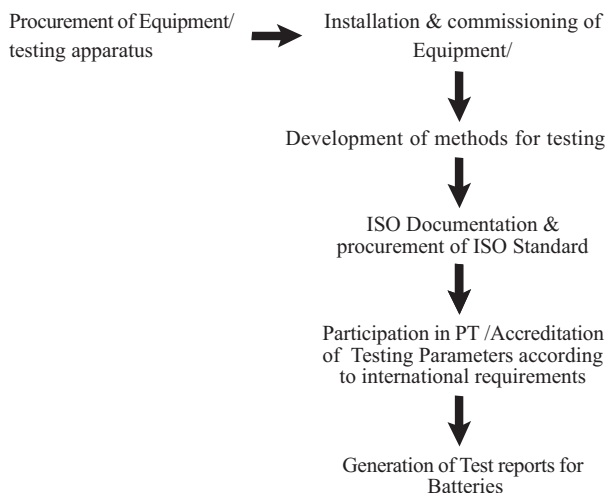
Mr. Aqeel Ahmed Khan, SSO/OIC-CDLE

Alternatively, dry batteries are maintenance free and have higher efficiency but no proper testing Lab in Pakistan for performance test of these imported batteries. In this regard, it is high time to develop fully automated accredited laboratory for different type of batteries performance test and in future process for recycling of these batteries by indigenous resources.

**Source of Funding:**

S GI (Rs. 150 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- It will create jobs opportunities for Engineers and Scientist.
- Successful completion and commercialization of the project will lead to utilization of indigenous work force by boosting their skills
- Economically benefits like reduction of import of products which accused of a major role in GDP and economy.
- Current demand for industries & energy sector



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Up-gradation of Pesticides Residue Lab for Facility Generation of VOC including Fumigants in Different Commodities**

**Project Leader:**

Dr. Rabia Nazir, PSO

**Project Associate(s):**

Dr. Shafaq Mubarak, SO

**Area(s) of Research:**

Agro-chemicals

**Duration:**

01 Year

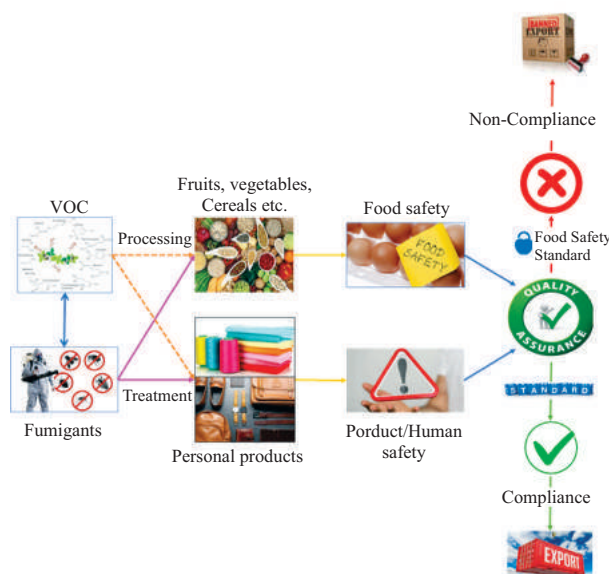
**Research Highlights:**

- Facility generation for the customers to ensure the quality of their products.
- Accreditation of the items in scope for ensuring world-wide acceptance of the test reports issued.
- Enhancement of exports by facilitating compliance with the imposed regulations for export of food commodities

**Source of Funding:**

S GI (Rs. 16.85 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Cost effective
- Safe products availability in market for consumer use
- Foreign exchange saving
- Export enhancement





**Name of Laboratory/ Centre/ Unit:**

ACRC/LLC

**Title of Project: Installation of Green House for Innovative Farming of Ginger and other Important Crops at LLC**

**Project Leader:**

Dr. Syed Hussain Abidi, Chairman PCSIR

**Project Associate(s):**

Dr. Qurat-ul-ain Syed, DG

Dr. Rabia Nazir, PSO

Dr. Imran Kaleem, SSO

**Area(s) of Research:**

Agriculture

**Duration:**

02 Years

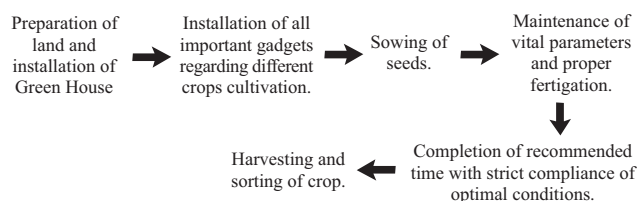
**Research Highlights:**

- Hydroponic farming.
- Automation of greenhouse for water conservation and controlled used of pesticides and nano-fertilizers.
- Pilot Production of crops (ginger, turmeric and mint) under controlled environmental conditions and utilization of these for production and commercialization of various products derived from their extracts.
- Pre-harvest interval studies of the different crops and pesticides.
- Minimum residue limits study of different crops and pesticides.
- Optimization of conditions for yield enhancement of the ginger seeds

**Source of Funding:**

SGI (Rs. 6.55 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- This project may be considered as a torch bearer of Import Substitution slogan of PCSIR as Ginger and other imported agricultural commodities will be considered in this project.
- The different varieties of ginger will enable in production of food drinks and commercialization of technology developed.
- The process for optimized production / extraction of methanol from selected varieties of mint can also be commercialized with respect to production and technology transfer.
- The project will also assist industries in testing their newly developed pesticides and determine pre-harvest interval.
- Export substitute



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Green House with Automation for Cultivation of Hemp at LLC**

**Project Leader:**

Dr. Rabia Nazir, PSO

**Project Associate(s):**

Dr. Awais Ali, (Consultant Plant Breeding)

Mr. Sohaib Qayyum, RO

**Area(s) of Research:**

Agriculture

**Duration:**

02 Years

**Research Highlights:**

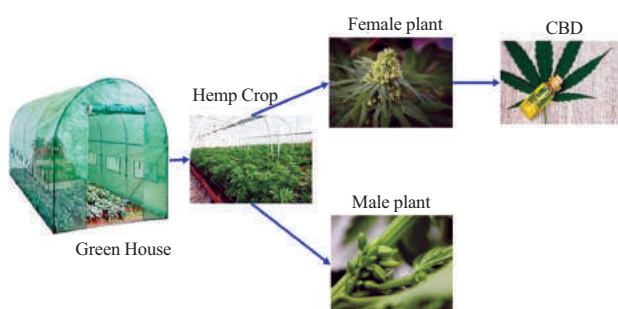
- Develop dedicated green-house facilities for breeding of hybrid varieties of cannabis with male and female plants.
- Optimize the varieties for CBD.
- To produce hemp year-round in controlled environmental facilities.

- To optimize growing conditions for hemp cultivars to enhance crop yield.
- Automation of green house (climatic control for automatic controlling of temp. and humidity, irrigation timings and volume, auto mixing of nutrients, automatic fertigation, pH & conductivity monitoring of plant growth media)

**Source of Funding:**

SGI (Rs. 36.5305 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Provision of controlled green-house facility for growing hemp throughout year
- Global economic value
- Automatic control enabling better growth of crops
- Auto variations in the greenhouse conditions to optimize yield
- Self-reliance in Hemp crop production
- In-house availability for CBD that can be further used for manufacturing various products of medicinal importance
- Export substitute



**Name of Laboratory/ Centre/ Unit:**

FBRC/ LLC

**Title of Project: Installation of Aquaculture (Biofloc) Integrated with Aquaponics at PCSIR Lahore for Innovative Farming of Imported Fish Breeds of High Economic Importance**

**Project Leader:**

Dr. Syed Hussain Abidi, Chairman PCSIR

**Project Associate(s):**

Dr. Quratulain Syed, DG  
 Dr. Imran Kalim, SSO  
 Engr. Ali Imran, JE

**Area(s) of Research:**

Food & Nutrition

**Duration:**

02 Years

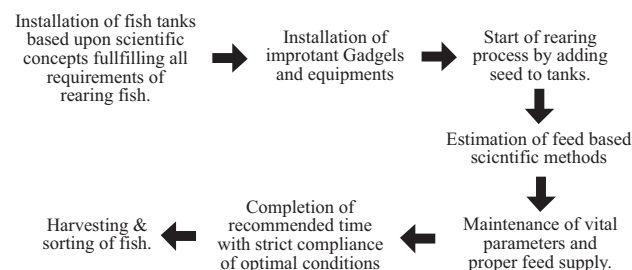
**Research Highlights:**

- The fundamental aim of this project is directly linked with Prime Minister’s vision that is “Import Substitution” and it is also need of the hour. In this project, those fish species will be studied which are imported to Pakistan in huge quantities, for example every year tonnes of Pangasius, Tilapia and Shrimps are imported, so if these species can be grown in higher quantities locally, it will be a great achievement and a huge amount of foreign exchange can be saved.
- Establishment of R&D facility for sustainable Biofloc Farming in PCSIR.
- Study trials for finding out different species suitable to this system for development of best economic model for sustainable aquaculture in Pakistan.
- Development of new fish products as protein rich foods.

**Source of Funding**

SGI (Rs. 9.073 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- This research project based upon Biofloc farming can make a significant contribution to the national

economy by giving a comprehensive & rapid scientific turnkey solution to fish farmers who may initiate this productive activity at any place in the entire country.

- This R&D will support the economic scenario of Pakistan due to its adaptability and ever increasing demand in case of both domestic and export sectors.
- This project will support the beginners or startups by developing state of the art Biofloc farming and Recycled Aquaculture System (RAS) backed by Modernized R&D and high graded scientific equipment and for sure it will be economically viable as well. This concept will support many people to start this business that will assist the concept of Import Substitution & Export Enhancement.



**Name of Laboratory/ Centre/ Unit:**  
FBRC/ LLC

**Title of Project: Customization of Old Existing Juice and Squash Production Facility at PCSIR Laboratories Complex, Lahore**

**Project Leader:**  
Dr. Shahid Masood, SSO

**Project Associate(s):**  
Dr. Asma Saeed, CSO

**Area(s) of Research:**  
Food Technology

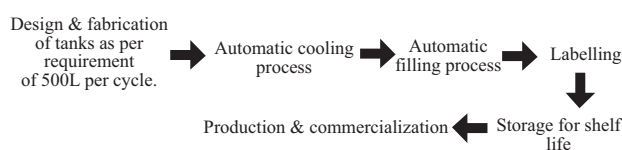
**Duration:**  
01 Year

- Research Highlights:**
- The utilization of seasonal fruits to conduct R & D in the development of food products and their shelf life studies is one the all season running project throughout the year. The consumption of developed products and the demand by various vendors to lease the process is one of the key activities all around the year. Therefore, this commercial activity is foremost for FBRC at Lahore Unit.

- The project is based on the renovation and up gradation of automatic semi pilot scale production unit for seasonal drinks / squashes preparations.
- To develop food recipes and products as per demand of industry.
- To utilize native seasonal fruits to develop innovative food products.
- Shelf-life studies of developed project.

**Source of Funding**  
SGI (Rs. 2.00 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- To develop facility for small medium entrepreneurs (SMEs) to formulate new R & D based food products for commercialization.
- Elimination and prevention of food borne illness and contamination is essential as it can serve as transmission source of disease-causing micro-organism directly to the consumers.
- To lease out processes as of requirement of industry.



**Name of Laboratory/ Centre/ Unit:**  
FBRC/LLC

**Title of Project: Up-gradation and Renovation of Old Dehydration Unit for Dehydration of Sugar Cane and Sugar Beet Molasses with Starch Based Preparations**

**Project Leader:**  
Dr. Shahid Masood, SSO

**Project Associate(s):**  
Dr. Asma Saeed, CSO  
Ms. Alim un Nisa, PSO  
Dr. Muhammad Ashraf, SSO

**Area(s) of Research:**

Food Technology

**Duration:**

01 Year

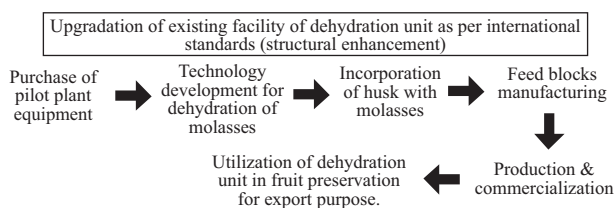
**Research Highlights:**

- Molasses is considered an energetic feedstuff due to its high content of easily fermentable sugars. However, it is also rich in mineral salts, present in a bio available form. Low cost allows it to be a very popular food and feedstuff as a partial substitute for cereals. But its handling and storage in liquid form is not economical and easy. Because of its viscosity, there are many difficulties in the application of sugar beet molasses in the food industry (baking, confectionery, meat).
- In the current study the viscous molasses will be dehydrated in to easy to apply and storage form feasible for food, feed and agriculture industry.
- The use of crop byproducts, such as molasses, in animal nutrition to improve the nutritive value of coarse and poorly desired feedstuff.
- Up-gradation of existing infrastructure to provide better working environment for scientists.

**Source of Funding:**

SGI (Rs. 12 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- The consumption of developed products and the demand by various vendors to lease the process
- Conversion of sugarcane industry waste in to easy to handle and storage valuable ingredients for application ingredient for food, feed and agriculture industry.

- More R&D based business from private sector
- More productivity and improved efficiency and better quality of final products



**Name of Laboratory/ Centre Unit:**

MBC/PLC

**Title of Project: Green House with Automation for Cultivation of Hemp at PCSIR-Peshawar**

**Project Leader:**

Dr. Hina Fazal, SSO

**Project Associate(s):**

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**Area(s) of Research**

Agriculture/ Hydroponic

**Duration:**

02 Years

**Research Highlights:**

- Hydroponics is a method of growing plants without soil. It has many advantages over conventional farming. It creates and maintains an ideal environment for cultivation of plants, Year-Round Crop production can be carried out, Hydroponics system is more sustainable than conventional farming. It allows achieving higher productivity in a relatively small space by reducing resource waste, transportation, costs and lower labor costs.
- By automation of greenhouse, one can manage environmental factors including heat, humidity, light levels and ventilation. It reduces energy cost and combats location issues. Hydroponic systems disrupt the traditional way of crop production by introducing revolutionary concept to simplify complexities and to maximize yield with minimum usage of natural resources.
- For cultivation of industrial hemp, initially an hydroponic green house has been constructed on an area of 3000 m<sup>2</sup> at PLC with all the accessories regarding steel structure, covering material, exhaust

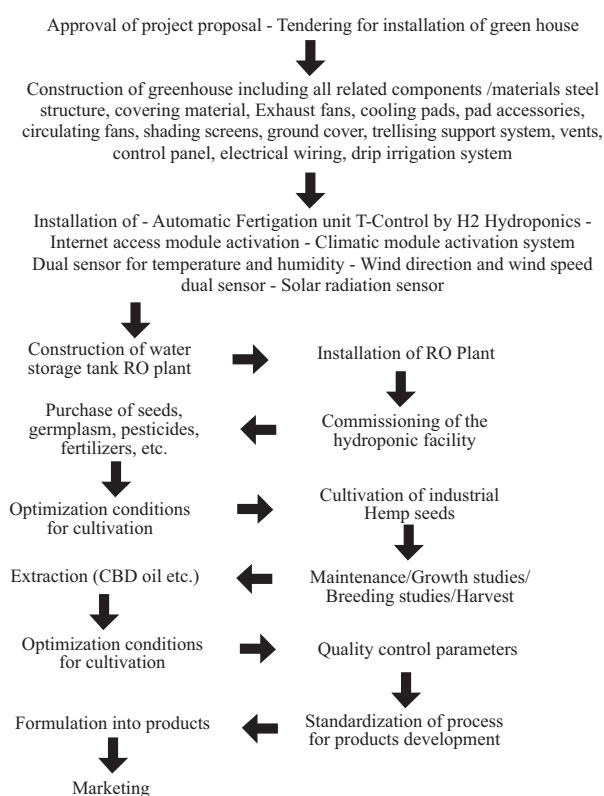
fans, cooling pads, pad accessories, circulating fans, shading screens, ground cover, trellising support system, vents, RO plant, control panel, electrical wiring, drip irrigation system etc.

- Moreover, the facility will ensure automated delivery of agrochemicals to the plants on need basis thereby controlling the wastage of chemicals and over dosing.

**Source of Funding:**

SGI (Rs. 37.743 Million)

**Graphical Abstract:**



**Project outcome w.r.t. socio-economic Development of the Country:**

- Large scale cultivation of industrial hemp will be carried out in hydroponic greenhouse.
- Offseason crop will be cultivated by optimization of physical and chemical parameters for uninterrupted supply of herbal raw material.
- Agro-technologies for this highly valuable crop will be developed and transfer to various stakeholders.

- The successful cultivation will lead to the commercial production of raw material for extraction of CBD and other medicinally important phytochemicals.
- Supply of material for various processes and products development.
- Plant breeding and other techniques will be studied.
- Jobs creation and Human Resource Development.



**Name of Laboratory/ Centre/ Unit:**

MSC/PLC

**Title of Project: Establishment of Pilot Plant Facilities for the Production of Calcium-Based Chemicals from Marble Waste Powder**

**Project Leader:**

Dr. Engr. Waheed-Ur-Rehman, SE

**Project Associate(s):**

Mr. Amin-Ur-Rehman, PSO

**Area(s) of Research:**

Chemical Engineering

**Duration:**

01 Year

**Research Highlights:**

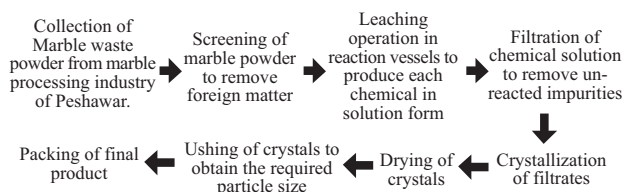
- Establishment of model demo unit for developing cost effective technology for the production of calcium-based chemicals from marble waste powder.
- Minimizing the major environmental hazards like deterioration of soil and its nutrients, water holding capacity of soil, aesthetic quality of the area and health hazards, caused due to the marble waste generation.
- Creating awareness among the marble processors for the effective utilization and value-addition of marble waste powder.

**Source of Funding:**

SGI (Rs. 13.50 Million)



**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Mitigation of environmental impacts of marble waste powder.
- Practical training of marble processors/industrials to set-up their own production units for calcium-based chemicals.
- Awareness campaign and publicizing the information for long term economic benefits and conservation of valuable resources.



**Name of Laboratory/ Centre/ Unit:**

PCSIR Head Office

**Title of Project: Installation of 3.5- MW Solar Power Systems for the Conservation of Energy at PCSIR Labs. Complex, Lahore, Karachi & Peshawar**

**Project Leader:**

Engr. Ghulam Shabbir, Director (Technology)

**Project Associate(s):**

Engr. Haris Ikram, SE

**Area(s) of Research:**

Energy

**Duration:**

01 Year

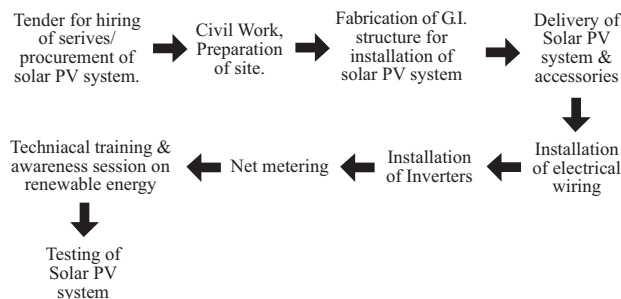
**Research Highlights:**

- Installation of 1.2. MW, 1.3 MW and 0.55 MW solar PV system at PCSIR Lahore, Karachi and Peshawar, respectively.
- Provision of un-interruptible electricity Supply
- Self-reliance in electricity

**Source of Funding:**

SGI (Rs. 495.439 Million, Phase-I)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- The dependence of PCSIR on national grid will save huge amount of energy, which will be available to the other consumers/ industry and eventually reduce energy shortfall and load on national grid will be reduced.
- Solar energy is an instrumental SDGs (Sustainable Development Goals) pillar in providing sustainable clean energy for all. Solar energy is free of any kind of emission and every addition in solar energy will be a step towards energy and environment preservation while playing a positive role in the global energy crisis.



**Name of Laboratory/ Centre/ Unit:**

PCSIR Head Office, Islamabad

**Title of Project: Construction of Three Floor (1<sup>st</sup>, 2<sup>nd</sup>, & 3<sup>rd</sup>) on Extension Building of PCSIR Head Quarter, Islamabad**

**Project Leader:**

Engr. Nazar Ahmed Bhutta, Director (Works)

**Project Associate(s):**

Mr. Ghulam Yaseen Jalbani, JE

**Area(s) of Research:**

Construction



**Duration:**

01 Year

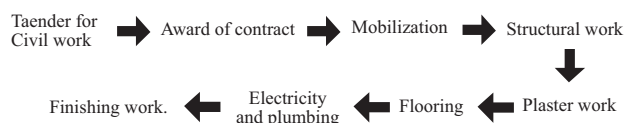
**Research Highlights:**

- The PCSIR Extension Building Basement was built in the year 2004 and Ground Floor (Guest House) built in 2010. The strength of officers and officials have increased which require more space for accommodation of officers, storage of official records and scrapes material, Spare parts of vehicle and furniture, electrical material and ACs etc.
- At this time, it is essential to construct three floors for proper sitting arrangement of officers and officials to enhance working capacity of employees and to increase the aesthetic view of the Building.

**Source of Funding**

SGI (Rs. 290.081 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- By the construction of three floors the problem of congestion in sitting arrangement will be solved. Therefore, the working capacity of employees will increase and work efficiency will be enhanced.



**Name of Laboratory / Center/ Unit:**

LRC/PCSIR

**Title of Project: Development of State-of-the-Art R&D, Training and Testing Facilities at Leather Research Centre (LRC) to Comply with ZDHC, REACH, LWG & CE Marking to Support Export Oriented Leather Sector of Pakistan**

**Project Leader:**

Mr. Barkat Ali Solangi, PSO

**Project Associate(s):**

Dr. Muhammad Kashif Pervez, CSO/Director  
 Mr. Uzma Nadeem, SEO  
 Ms. Tahira Ayaz, SSO  
 Dr. Rajkumar Dewani, SSO

**Area(s) of Research:**

Leather Industry

**Duration:**

01 Year

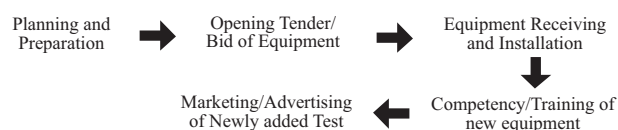
**Research Highlights:**

- To modernize the Leather Research Centre to fulfill the Directive(s) and/or Regulation(s) i.e. REACH, ZDHC, LWG, & CE Marking of leather goods/products as per international standards and compliance.
- To provide the assistance to the Pakistani Leather Sector to capture the market of European Union countries and all international levels.
- To check the hazardous substances in raw leather and finished leather products by qualitative and quantitative testing analysis as the guide line of International Directive(s) and Regulation(s).
- To develop the new tests method on the modern equipment and instruments as per international requirements.
- To monitor COD, BOD5, TS, TDS, SS, P, N, Chloride, Alkalinity etc.
- To Produce Competent Human Resource Development Programs in the light of modern standards and to compete with the international quality standards.
- To provide complete technical and management assistance to the local tanneries in order to overcome the whole national and international issues of Leather Industry of Pakistan.

**Source of Funding:**

SGI (Rs. 100.65 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- The intended output of the project is to provide and facilitate the Local Leather Industry, surrounding in terms of testing analysis of hazardous/toxic chemicals in their products.
- By providing the testing services to local industry huge amount of revenue will be generated. Technical guidance and consultative services will help the local manufacturers to improve quality of their products to meet international standards.
- Export enhancement and revenue generation.
- This project will impact on quality and quantity of production and quality of the product.
- Provision of quality services will ensure safe products availability to the consumers as per LWG, REACH, ZDHC& CE Certification. Increase in exports will enhance socio-economic status.
- Establishment of new amenities in Laboratory Management System will provide facilities to leather, textile & allied industry and exporters and will be of immense region and full-fill the needs of upcoming small and medium scale industries according to national and international scenario.
- Development of testing and calibration laboratories in compliance with international standards will help the local products to gain access in world market i.e., Europe, America, UK etc. there by increasing economic growth.
- Most of the tests are shifted towards our competitors i.e. SGS, Inter Tech., TTI etc. due to lack of modern facilities at Leather Research Centre. Leather Research Centre has not a capability to perform all the physical and chemical tests under one roof. Nowadays, most of the tests are performed on the sophisticated analytical instruments according to the buyer's demand. Our leather industries send all the test of leather to our competitors those have a modern facility as well as latest instruments. The result is in the form of loss of revenue and transfer of revenue to the other countries.
- Providing quality testing and calibration services at competitive prices to the local industry and exporters will enhance confidence of clients on the test reports and calibration certificates generated by the accredited testing and calibration laboratories.

**Name of Laboratory/ Centre/ Unit:**

NPSL/PCSIR

**Title of Project: Facility Development regarding Estimation and Optimization of Water Quality Parameters for Aquaculture at NPSL**

**Project Leader:**

Dr. Raheela Chaudhry, SSO

**Project Associate(s):**

Ms. Ambreen Sadozai, SSO

**Area(s) of Research:**

Aquaculture

**Duration:**

02 Years

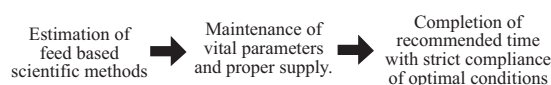
**Research Highlights:**

- Facility Development for the estimation of NH<sub>3</sub> and other anions in the field of water, wastewater and solution testing.
- ISO/IEC 17025 accreditation of estimation of NH<sub>3</sub> and other anions in Environmental testing field for quality assurance.
- Optimization for farm conditions especially water related parameters to prevent potential adverse effects.

**Source of Funding:**

SGI (Rs. 2.00 Million)

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Concept clarification of aquaculture farmer through technology transfer and capacity development; as the country needs adequate attention and action for the sustainable production of improved and good quality fish to improve the livelihoods of the population.



## In-House R&D Projects PCSIR Laboratories Complex, Karachi (KLC)

**Name of Laboratory/ Centre/ Unit:**  
ACRC/ KLC

**Source of Funding:**  
PCSIR In-house R&D

**Title of Project: Synthesis and Characterization of Chitosan and its Application for Polymeric Based Packaging Materials**

**Graphical Abstract:**

**Project Leader:**

Dr. Sofia K. Alvi, PSO

**Project Associate(s):**

Dr. Razia Sultana, CSO

Dr. Saima Imad, PSO

Dr. Tahir Rafique, PSO

Mr. Muhammad Aijaz, SSO

Mr. Sheraz Shafique, SSO

Syed Junaid Mehmood, SO

**Area(s) of Research:**

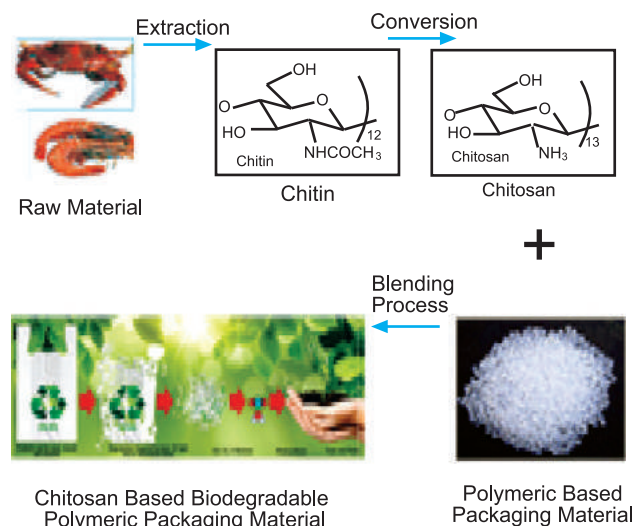
Chemical Sciences / Industrial Chemistry, Advance Materials / Polymeric Based Composites Materials

**Duration:**

03 Years

**Research Highlights:**

- Purified chitin is converted to chitosan by hydrolysis of chitin acetamide groups under alkaline condition, however, hydrolysis of acetamide is carried out under inert atmosphere to avoid depolymerization and to prevent chain degradation.
- The wide varieties of chitosan applications, for example, in agriculture, and agro-chemistry, food, aquaculture, cosmetics, pharmaceutical industries, textile and fiber industries, paper industry, wastewater treatment etc. are due to its functional properties, unique cationic nature, its biocompatibility and biodegradability.
- This project is conceived to utilize natural polymer “chitosan” with widely used polymeric materials to make them eco-friendly.



**Project Outcome w.r.t. Socio-economic Development of Country:**

- According to a UNDP report, more than 3.3 million tons of plastic is wasted each year in Pakistan that is a continuous threat to the environment and municipal system. An efficient way to deal with the problem is to replace the packaging materials to biodegradable materials.
- The available options for biodegradable plastics are somehow expensive and not manufactured locally.
- Chitosan (CAS No. 9012-76-4) has been identified as a remarkable macromolecular structure with several intrinsic characteristics that make it eco-friendly and potential substitute for polymeric packaging material.
- Development of biodegradable bags utilizing this indigenous raw material will provide an excellent import substitution solution.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ KLC

**Title of Project: Design and Fabrication of Laboratory Scale Prototype Industrial Wastewater Treatment Plant for Cultivation of Vegetables and Fruits**

**Project Leader:**

Engr. Aijaz Ali Panhwar, SE

**Project Associate(s):**

Mr. Kamran Farooq, SE

Mr. Mansoor Iqbal, SE

Dr. Sofia Qaisar, SSO

**Area(s) of Research:**

Water treatment

**Duration:**

02 Years

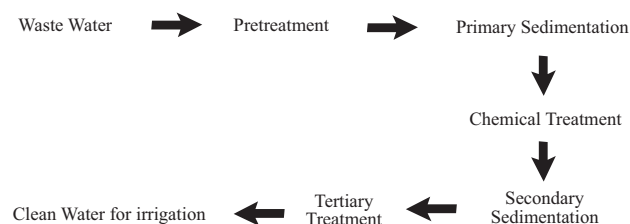
**Research Highlights:**

- The prototype laboratory scale water treatment plant will be utilized to treat industrial waste water.
- Treated water is used for agriculture purpose to save fresh water resources.
- In comparison study for the cultivation of vegetable (Okra) with fresh water and treated water, revealed that the plant do not have toxic chemicals and grew as like control plant.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Wastewater has become the threat to our water resources, agriculture land and environment, and as per reported literature, about 80% of wastewater discharge without any treatment.
- Chemical treatment is a very effective and time saving technique for removal of hazardous chemicals from wastewater.
- To design and fabricate laboratory scale prototype industrial wastewater treatment plant and also study the effect of treated water on cultivation of vegetables/fruits, etc. will be among the key investigations of the project.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ KLC

**Title of Project: Development and Commercialization of Standard Reference / Quality Control Materials for the Estimation of Major and Trace Elements in Soil**

**Project Leader:**

Dr. Saima Imad, PSO

**Project Associate(s):**

Dr. Tahir Rafique, PSO

Mr. Sheraz Shafiq, SSO

Ms. Sidra Noman, RA

Ms. Sadia Fatima, RA

**Area(s) of Research:**

Agriculture, Soil, Quality Assurance

**Duration:**

03 Years

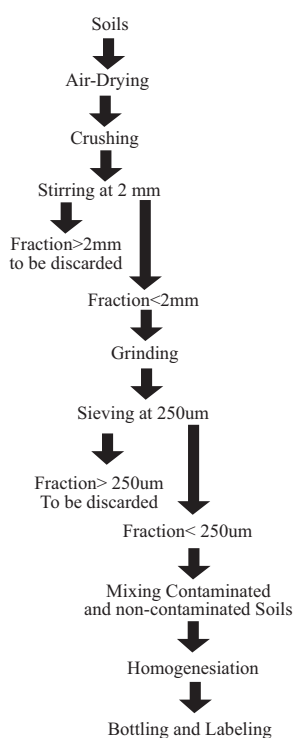
**Research Highlights:**

- Due to the high cost and difficulty in availability, CRMs can't be routinely used in daily laboratory work, and therefore Laboratory Reference Materials (LRM) or Quality Control Materials (QCM) are preferred.

- To prepare Standard Reference Material for the estimation of major and trace elements in soil & study different parameters like homogeneity, stability and shelf life of reference material.
- Confirmation of the known values of different parameters of the prepared reference material by ILC (Inter-laboratory Comparison).

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w. r.t. Socio-economic Development of Country:**

- The prepared reference materials expected to help agriculture sector, research and development organizations and educational institutions and will have long lasting social, environmental and economic impacts.
- To improve the performance of analytical services & to commercialize the prepared reference materials as well as paper publication.
- Agriculture sector will be benefited by improving soil testing capabilities with accuracy.



**Name of Laboratory/ Centre/ Unit:**

CDLE/ KLC

**Title of Project: Design and Development of Growth Chamber (Digital) (Temp Range: 0 to 50 °C) with Humidity Control and Day/Night Timer**

**Project Leader:**

Mr. Sohail Akhtar, SSO

**Project Associate(s):**

Mr. Aqeel Ahmed Khan, SSO

Mr. Zain ul Abdin, EO

**Area(s) of Research:**

Agriculture, Agri-Based Laboratories, Institutes, and Universities.

**Duration:**

03 Years

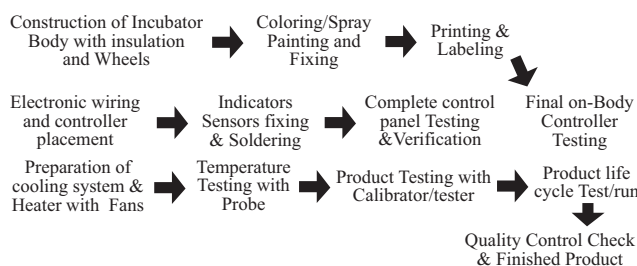
**Research Highlights:**

- Growth Chamber is used in agriculture and botanical researches for example, plant pathology, seed germination studies, plant research (photosynthesis /nutrition studies), and plant tissue culture studies etc.
- Growth chambers constitute a valuable tool for investigations of plants, and produces real time environmental conditions favourable for Plants growth.
- To develop commercial products from locally available an indigenous resource for local market and upgrade laboratory equipment on engineering lab scale with price reduction and import substitution.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**





**Project Outcome w.r.t. Socio-economic Development of Country:**

- Indigenous Technology
- Import Substitute
- Low cost product
- Ready for commercialization



**Name of Laboratory/ Centre/ Unit:**

ESC/ KLC

**Title of Project: Designing and Fabrication of Low-Cost Heating Ventilation and Air Conditioning (HVAC) System by using LPG**

**Project Leader:**

Engr. Adeel Ahmed Khan, SE

**Project Associate(s):**

- Engr. Aman ullah Lakho, SE
- Mr. Muhammad Rehan, EO
- Mr. Muhammad Mazhar Khan, TO
- Mr. Mansoor Hai, TO
- Mr. Tariq Mughal, UDC

**Area(s) of Research:**

Energy Conservation and Renewal Energy

**Duration:**

02 Years

**Research Highlights:**

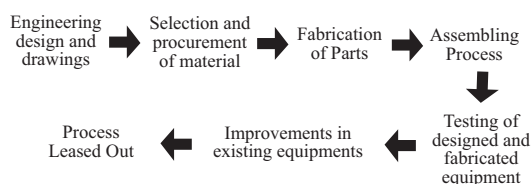
- LPG has come to play an innovative role as a refrigerant. It serves as the best contender to replace CFCs for domestic refrigerators and air conditioners.
- R-290 is the common name for high purity propane (C3H8) suitable for use in the refrigeration and air conditioning industry.
- The LPG is stored in the liquefied state before its utilization as a fuel. The energy spent for pressurizing and liquefying is not recovered afterwards. If it is expanded in the evaporator. It will get vaporized and absorbed heat to produce cooling.

- This property has been used in refrigeration and air conditioning so that the LPG can be used further for combustion as a fuel thus serves as energy conservation equipment also.
- LPG is extracted at high pressure in liquefied state from the storage device. Its pressure and flow rate is controlled by a valve which is then connected to an evaporator through which LPG flows. It gets converted into gaseous state after absorbing heat from the surroundings and thus expands by creating cooling effect
- After leaving the evaporator the LPG is in the gaseous state it is then directed towards the burner, engine or any gas turbine to start them and acts as fuel for them. Thus no LPG is consumed for cooling purpose.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The research proposal is ecofriendly since no harmful gases are emitted during its operation and uses green technology methods thus eliminating the use of ozone depleting refrigerants.
- Since the cost of the equipment is much lesser than the traditional refrigeration and air conditioning devices so that it can be easily purchased by the consumers available in the local market.
- Cooling will be achieved free of cost as no electricity is needed to operate the refrigerator and air conditioner.
- Since no LPG is consumed during the cooling process only expansion of high pressure LPG creates cooling effect thus after absorbing heat from the surrounding the LPG is converted into gaseous state thus can be further utilized for cooking, automobile fuel or any other industrial purpose.



- Since no electricity is needed for operating the equipment there should be a big saving of fuel for producing electricity, thus saving revenue to the country also.



**Name of Laboratory/ Centre/ Unit:**  
ESC/ KLC

**Title of Project: Development & Fabrication of Atmospheric Water Generator (AWG)**

**Project Leader:**  
Engr. Nazir Ahmed Tunio, PE

**Project Associate(s):**  
Dr. Nighat Sultana, CSO  
Mr. Muhammad Farhan, SSO  
Mr. Tariq Bakshish, EO  
Mr. Umair Ihsan, EO  
Mr. Rehan, EO  
Mr. Mazhar Ali, TO  
Mr. S. Kazim Raza, TO  
Mr. M. Tarique Mughal, UDC

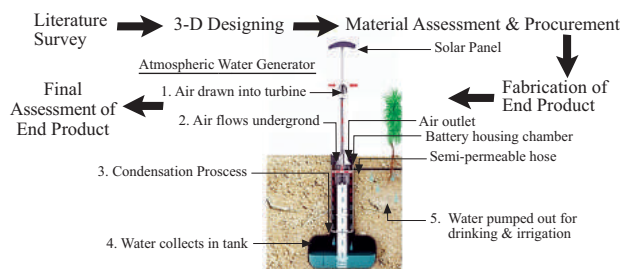
**Area(s) of Research:**  
Environmental Science

**Duration:**  
02 Years

- Research Highlights:**
- The major aim of the project is to provide safe and clean drinking water to those areas which are facing water scarcity problems.
  - An experimental setup will be constructed to extract water from the atmosphere.
  - This project will employ dehumidification/condensation technology for extracting water from the humidity present in the air.
  - In the coastal areas with relative humidity (RH) around 50 to 65% like Karachi, Gawadar as well as, arid regions with RH around 10 to 20 % such as Thar Desert, can extract water from atmosphere.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The designed AWG will extract minimum of 3 gallons of water per day in arid areas (RH < 20%) and maximum of 9 to 11 gallons per day in coastal areas (RH > 50%).
- It will help to reduce the load over the ground water reserves.
- The water generated through AWG can also be used to irrigate the land on small scale in arid zone of the country.
- By the export of AWG in Middle East, central Asia and Africa it can generate foreign reserve also.



**Name of Laboratory/ Centre/ Unit:**  
ESC/ KLC

**Title of Project: Designing and Fabrication of Thermo Electric Cooler Based Air Conditioner (Peltier Effect)**

**Project Leader:**  
Engr. Aman ullah Lakho, SE

**Project Associate(s):**  
Engr. Adeel Ahmed Khan, SE  
Mr. Abdul Rasheed Solangi, SEO  
Mr. Muhammad Rehan, EO  
Syed Kazim Raza, TO  
Mr. Muhammad Mazhar Khan, TO  
Mr. Muhammad Tariq Mughal, UDC

**Area(s) of Research:**  
Refrigeration and Air Conditioning

**Duration:**

02 Years

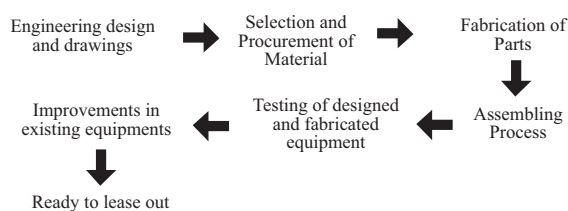
**Research Highlights:**

- Thermo electric cooler is environment friendly system which does not produces harmful gases during its operation
- Low cost cooling device as compared with conventional air conditioners available in the local market
- Can creates cooling in summer and heating in winter thus serves as dual purpose in its operation
- Low operation cost that is operate able at low energy levels thus does not require heavy electrical consumption during its operation

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The designing and fabrication of the Peltier Effect Air conditioners from indigenous material serve dual purpose like cooling in summer and heating in winter
- The size of this project is minimized as compared with present AC systems and easily installable in the desired premises
- The cost of this equipment should be much lesser than the present locally available AC systems, and therefore will generates revenue to the Government by saving foreign exchange of the country for importing parts of present AC systems
- Due to low electricity consumption for use, this projection would save electricity billing of the consumers, and thus saving energy for the country.



**Name of Laboratory/ Centre/ Unit:**

CES/ KLC

**Title of Project: Microbial Citric Acid Production: An Import Substitute Production from Food/ Kitchen Waste**

**Project Leader:**

Dr. Tooba Naveed, SSO

**Project Associate(s):**

Mr. Niaz Ahmed, SSO

**Area(s) of Research:**

Biotechnology, Solid Waste Management

**Duration:**

02 Years

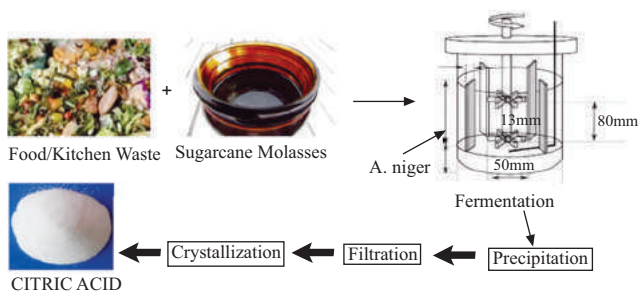
**Research Highlights:**

- Citric acid is the second largest fermentation product that is used in fairly significant amount in various industries.
- Increased demand for citric acid has led to searching for high yielding fermentable strains of micro-organisms and cheaper fermentation substrate in many countries.
- To investigate food/kitchen waste as the main carbon source and to determine the effect of media components and operating conditions on the yield of citric acid by *Aspergillus niger* under submerged fermentation is the main point of interest in this study.
- Findings of this study will provide necessary information regarding viability of food /kitchen waste as substrate for citric acid production. Therefore, this study proposes the use of molasses and food waste as an alternative and economic source of substrate for local production of citric acid.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Pakistan annually imports approximately 35,000 tones citric acid to fulfill its requirements.
- The outcomes of this study will have created an opportunity to invest into this business to produce citric acid for local and export purpose.
- Beside this, we can save the foreign exchange which is being problematic for the importers of this product as a result of soared exchange rate.
- It would definitely representing an efficient perspective of minimizing food waste management/ disposal problems, indirectly reducing the population health hazards faced due to indiscriminate dumping of the solid waste
- In the current scenario, there is an urgent need to develop alternative local production of citric acid from various indigenously available sources in which food waste and molasses seems to be a promising option.



**Name of Laboratory/ Centre/ Unit:**

CES/ KLC

**Title of Project: Design & Fabrication of Pinhole Tester for Paper (Analytical Equipment)**

**Project Leader:**

Mr. Shahid Bhutto, PSO

**Project Associate(s):**

Dr. Nusrat Jalbani, PSO

Dr. Akhtar Shareef, PSO

**Area(s) of Research:**

Paper Technology

**Duration:**

03 Years

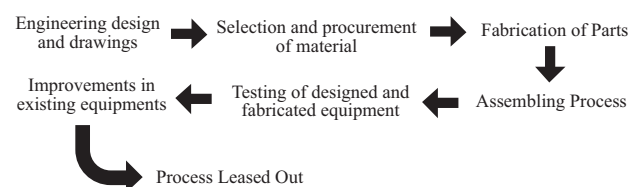
**Research Highlights:**

- To provide updated and enhanced services to importers and regulatory authorities.
- To develop Analytical Equipment (PIN HOLE TESTER) as import substitute.
- To provide new testing facility to paper and paper board importers.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The present study has been planned to develop new cost-effective and indigenous technology for Analysis of PIN HOLE in Paper Board.
- The specialty of this technique would be fast detection and ease of handling.
- The PIN HOLE Tester would be assessed to be economical and to be user friendly.
- Once the equipment is prepared and found ready for consumer use, it will enhance number of clients/samples testing at PCSIR Labs.
- Complex and being an import substitute will off course reduce pressure on country's socio-economic and preparatory step towards technological development of our country.
- The project is in line with PCSIR functions to provide solution of such problem in public and private sector worthy for masses.



**Name of Laboratory/ Centre/ Unit:**

CES/ KLC

**Title of Project: Synthesis of Graphene Oxide for Environmental Remedies/Treatments**

**Project Leader:**

Mr. Shahid Bhutto, PSO

**Project Associate(s):**

Dr. Nusrat Jalbani, PSO

Dr. Akhtar Shareef, PSO

- Production of economical house hold water purification component (Absorbent).
- Job creation by induction of new technologies into Pakistani's market.
- Reduction of health burden by providing low cost air-purification and water treatment by synthesized nano-composites.
- Synthesis of GO and rGO for research purpose to uplift/help the researchers/scholars within the country.



**Area(s) of Research:**

Environmental Nanotechnology

**Duration:**

03 Years

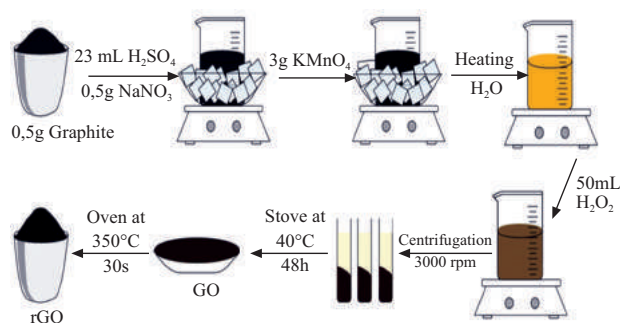
**Research Highlights:**

- Degradation and removal of organic dye.
- Heavy metal removal from water and wastewater (water purification).
- Carbon dioxide removal from ambient air.
- Disinfection of water (water purification).

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Revenue generation by utilization of natural resources with value addition.

**Name of Laboratory/ Centre/ Unit:**

CES/ KLC

**Title of Project: Watermark, UV-Feature and Chemical Sensitivity Properties Development on Ordinary or Thermal paper**

**Project Leader:**

Shahid Bhutto, PSO

**Project Associate(s):**

Dr. Nusrat Jalbani, PSO

Dr. Akhtar Shareef, PSO

**Area(s) of Research:**

Environmental Nanotechnology

**Duration:**

03 Years

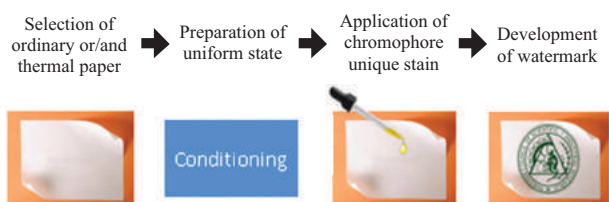
**Research Highlights:**

- Development of unique watermark on ordinary or thermal paper.
- Decorating the ordinary/thermal paper with UV-feature properties.
- Addition of chemical sensitivity property in paper.
- Value addition to ordinary paper.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Reduction in fraudulent and increase in vigilance.
- Less dependency on foreign technology.
- To save foreign exchange by development of security paper within country, and to support legal requirements of official matters confidentiality.
- The addition of watermark/UV-feature/chemical sensitivity will increase the trustfulness of clients in financial and legal matters pertaining to private and public businesses that ultimately results in business growth.
- Synthesis of GO and rGO for research purpose to uplift/help the researchers/scholars within the country.



**Name of Laboratory/ Centre/ Unit:**  
PRC/ KLC

**Title of Project: Evaluation of Selected Blue Green Algae and Fungi for their Nutritional Value and their Use as Effective Food Supplement**

**Project Leader:**

Dr. Shagufta Shaikh, SSO

**Project Associate(s):**

Dr. Muhammad Nadeem, PSO  
Dr. Kauser Siddiqui, PSO  
Dr. Kanwal Abbasi, SSO

**Area(s) of Research:**

Microbiology, Food Biotechnology

**Duration:**

03 Years

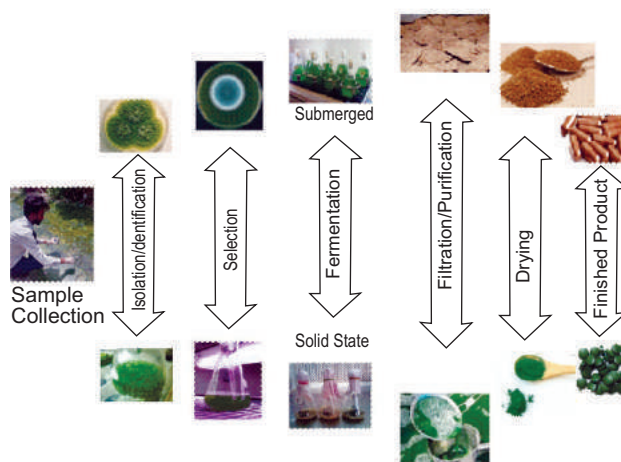
**Research Highlights:**

- Isolation, optimization and propagation of different species of microalgae and fungi which are reported to be used as food supplements
- Successfully grown species are evaluated for nutritional contents and feasibility to formulate products for food supplementation and as nutraceutical medicine
- Two formulations are likely to be prepared; their brochures will be prepared for commercial use.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Microorganisms that can produce large amount of protein will be used as protein supplement for humans and animals and therefore formulations will be served as cheap source of essential nutrients especially protein and can be commercialized
- Halal source of health supplements contrary to imported ones will be an eye catching and in demand product for old people and children in tablet/dried powder (sachet) forms





**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Production of Highly Potential Standardized Herbal Extract for Various Herbal Formulations**

**Project Leader:**

Mr. Muhammed Saleem Qazi, PSO

**Project Associate(s):**

Mr. Mahmood-ul-Hassan, PSO

Ms. Nighat Sultana, CSO

**Area(s) of Research:**

Natural products and microbial transformation

**Duration:**

03 Years

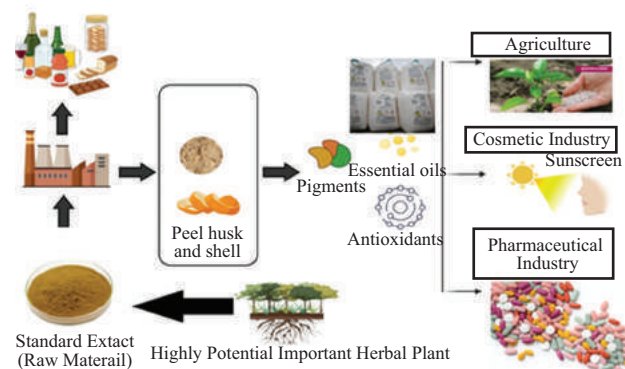
**Research Highlights:**

- Despite Pakistan's extensive herb flora, many are still imported from other countries because there is not a proper infrastructure for processing them into standardized finished raw materials.
- Substitute of imported standardized herbal extracts (*Adhatoda vasica*, *Tribulus terrestris* and *Glycyrrhiza glabra* etc.) for pharmaceutical and Cosmetic.
- To introduce the spray drying technology on pilot scale studies for these potential standardized herbal extracts and in finished form of powder, tablets or encapsulation etc.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To reserve the foreign exchange as substitute of import of *Adhatoda vasica*, *Tribulus terrestris*, *Glycyrrhiza glabra* etc.
- Standardized herbal extracts (*Adhatoda vasica*, *Tribulus terrestris*, *Glycyrrhiza glabra* etc.) will be leased out to M/S Musani Group of Industries.
- Development of skilled manpower



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Extraction, Purification & Characterization of Maltase Enzyme from Seedling of Pisum sativum Seed for Starch Processing**

**Project Leader:**

Dr. Saeeda Bano, PSO

**Project Associate(s):**

Dr. Muhammad Nadeem, PSO

Dr. Kauser Siddiqui, PSO

Dr. Samina Iqbal, SSO

Dr. Kanwal Abbasi, SSO

**Area(s) of Research:**

Biochemistry, Enzymology, Biotechnology

**Duration:**

02 Years

**Research Highlights:**

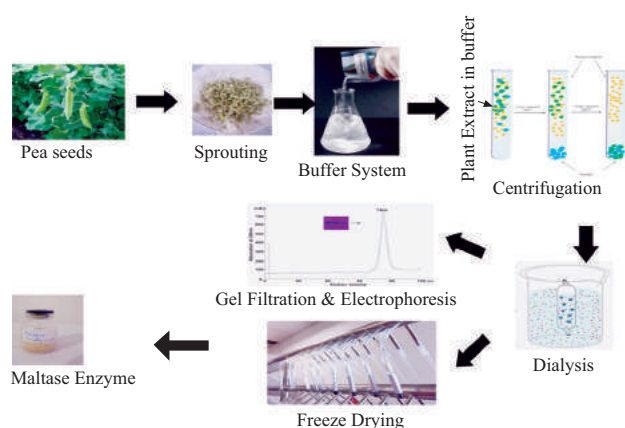
- Maltase or alpha glucosidase (EC 3.2.1.20) is an exo-glycosidase that catalyzes the release of  $\alpha$ -D-glucose from the non-reducing end of substrates.
- Plant maltase is extensively used in biotechnology and has important applications in both the food and the pharmaceutical industries such as, the production of glucose syrup and in brewing industry.
- Crude maltase from seedling of *Pisum sativum* was extracted and optimized for production



- Partially purified Maltase was studied for physicochemical properties
- Partially and fully Purified maltase will be used for industrial purpose like in food and pharmaceutical industries
- Lead anti-diabetic compounds will be screened by virtue of maltase Inhibition

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Keeping in view the maltase inhibition scenario, a large number of maltase inhibitors (Natural and Synthetic) are being used as anti-diabetic drugs for diabetes mellitus Type II.
- The maltase enzyme recovered from *Pisum sativum* is beneficial in nutraceutical and pharmaceutical enzyme industry, as well as, in starch processing industries
- The process may be commercialized



**Name of Laboratory/ Centre/ Unit:**  
FMRR/ KLC

**Title of Project: Utilization of Neem (*Azadirachta indica*) for Better Crop Yield as Organic Pesticide cum Fertilizer**

**Project Leader:**  
Dr. Beena Naqvi, PSO

**Project Associate(s):**  
Mr. Muhammad Ashraf, SE

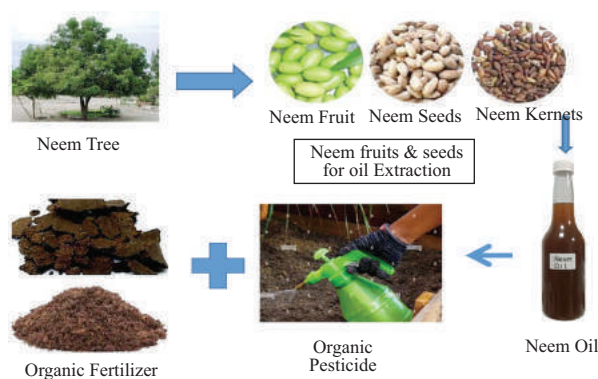
**Area(s) of Research:**  
Agriculture

**Duration:**  
02 Years

- Research Highlights:**
- The *Azadirachta indica* (Neem) possess high potential to protect crop as a biological control.
  - Neem plants contain several thousands of chemical constituents of special interest i.e. terpenoids, Azadirachtin (A to K) and more than 20 sulphur containing compounds.
  - Economical and eco-friendly utilization of oil extracted from Neem (*Azadirachta indica*) for crop improvement can be achieved via extensive R&D.
  - Formulated pesticides cum fertilizers with the help of Neem extracts and oil use for organic farming.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Pakistan's economy is agrarian and a major challenge of agriculture is to increase productivity without damaging the environment.
- *Azadirachta indica* (Neem) has a high potential to protect crop as a biological control via controlling agricultural pests, without serious impacts on the environment, non-target organisms, and animal and human health.

- Formulation of economical and eco-friendly pesticides and fertilizers from *Azadirachta indica* will ultimately support the Agriculture sector by increasing per acre production up to or close to its actual capacity without creating environmental problem.



**Name of Laboratory/ Centre/ Unit:**  
PRC/ KLC

**Title of Project: Bioactive Chemical Profiling of Micro Propagated, *In vitro* Tissue Culture and Naturally Growing Plantlets of *Chrysanthemum grandiflorum* and *Stevia rebaudiana***

**Project Leader:**  
Dr. Salman Tariq Khan, SSO

**Project Associate(s):**  
Dr. Beena Naqvi, PSO  
Dr. Abdul Hafeez Laghari, SSO

**Area(s) of Research:**  
Bio-analytical

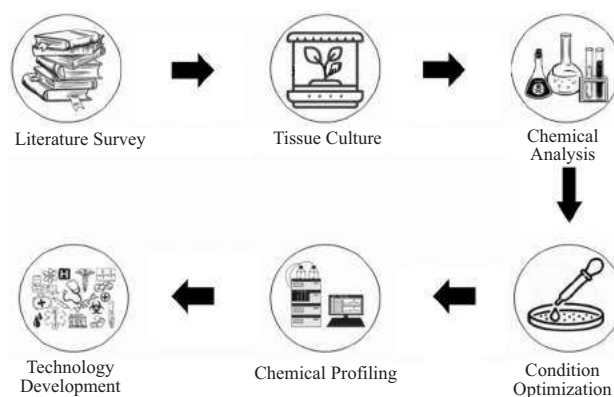
**Duration:**  
02 Years

**Research Highlights:**

- Allopathic system has been relying on plant biomolecules as early source/direction to lead to get desired therapeutic formulation due to versatile biosynthesis of valuable secondary metabolites in plants.
- Biosynthesis can be controlled by micro-propagation as per required quantity to get valuable compound in bulk with customized molecular structure of biomolecules by changing recipes of media used for growth of plants.
- This technique can lead to get alternative therapeutic agents for preparation of effective formulations.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Compilation of data about chemical contents of Micro propagated, *in vitro* culture and naturally growing plantlets of *Chrysanthemum grandiflorum* and *Stevia rebaudiana* will find a possible source of new or valuable biomolecules.
- Optimization of protocol to grow *Chrysanthemum grandiflorum* and *Stevia rebaudiana* with maximum yield of valuable compound to produce as an alternative source.
- Production of valuable import substitute biomolecules through tissue culture with increased yield will help health sector to be self-dependent.
- Development of proposed technology will strengthen export sector resulting in revenue generation.



**Name of Laboratory/ Centre/ Unit:**  
PRC/ KLC

**Title of Project: Development of Herbal Formulations Based on *Allium sativum*, *Aloe vera*, *Trigonella foenum-graecum* for the Management of Hyperlipidemia**

**Project Leader:**  
Dr. Tehmina Sohail, SSO

**Project Associate(s):**  
Dr. Hina Imran, SMO  
Dr. Shazia Yasmeen, PSO  
Dr. Rashid Ali Khan, PSO

**Area(s) of Research:**

Herbaceuticals

**Duration:**

02 Years

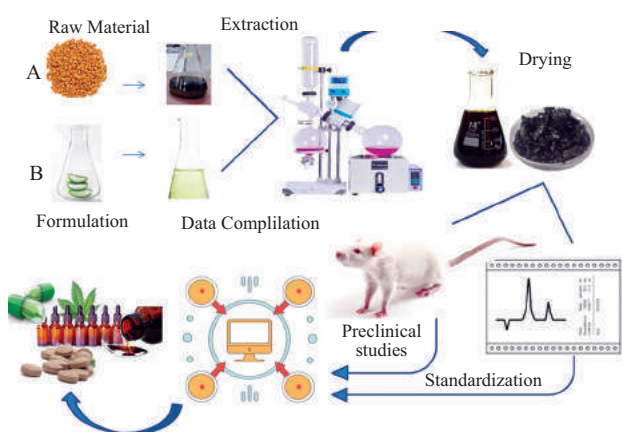
**Research Highlights:**

- Hyperlipidemia is a medical state characterized by an elevation of lipid profile in the blood which is the source of heart attack, coronary artery syndrome, stroke, atherosclerosis, myocardial infarction and pancreatitis.
- Lipid panel measures different types of lipids from a blood sample, including: Total cholesterol (TC). Low-density lipoprotein (LDL) cholesterol: “bad cholesterol”, and very low-density lipoprotein (VLDL) cholesterol (This is a type of cholesterol that’s usually present in very low amounts in fasting blood sample.
- The plants for example, *Allium sativum*, *Aloe vera*, *Trigonella foenum-graecum* plants are hereby selected against Hyperlipidemia on the basis of their medicinal properties along with their availability in local market so that the end product will be cost effective and easily available.

**Source of Funding:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To formulate a cost-effective herbal medicine.

- Formulation with superior safety and efficacy with fewer side effects.
- Product from locally available raw material will discourage the import substitution and will boost up the economy.
- Being the indigenous product, it will be easily approachable to end user.



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Soluble Fertilizer Formulations of Organometallic Complexes for Foliar Feeding**

**Project Leader:**

Dr. Amir Ahmed, PSO

**Project Associate(s):**

Dr. Kamran Ahmed Abro, SSO  
Mr. Irshad Ahmed Khan, EO

**Area(s) of Research:**

Agriculture Sector

**Duration:**

03 Years

**Research Highlights:**

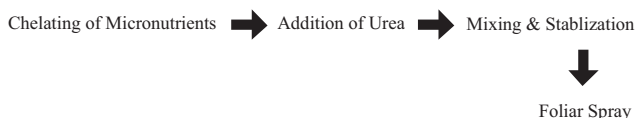
- Fertilizers supply elements needed for plant nutrition, with Nitrogen (N), Phosphorus (P) and Potassium (K) as principal components, nevertheless, micronutrients replenishment is seldom done.
- There is a need for new fertilizer formulations and new methods of fertilizer application that supply of nutrients in a readily available form and which can be applied as a foliar product.
- Foliar feeding constitutes one of the important milestones in the progress of agricultural crop production.
- Ionic preparations of fertilizers are acidic in nature, which are injurious to plants, however, organic complexes form of mineral fertilizers are neutral or alkaline which are readily assimilated by plants.

- The formulations of Organometallic Complexes as prepared in this project are therefore assumed of great importance these days with great market demand.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Production of valuable import substitute foliar fertilizer through local technology
- The implementation of the proposed idea would increase the yield of crop and help agricultural sector to be self-dependent.



**Name of Laboratory/ Centre/ Unit:**

FMRRRC/ KLC

**Title of Project: Process Development for Amino Acid Based Organic Fertilizer from Food Processing By-Products**

**Project Leader:**

Dr. Muhammad Samee Haider, PSO

**Project Associate(s):**

- Dr. Omer Mukhtar Tarar, PSO
- Mr. Umed Ali Soomro, SSO
- Mr. Nida Saleem, SSO
- Mr. Waqas Afzal, SO

**Area(s) of Research:**

Protein Hydrolyzates, Organic Fertilizer

**Duration:**

02 Years

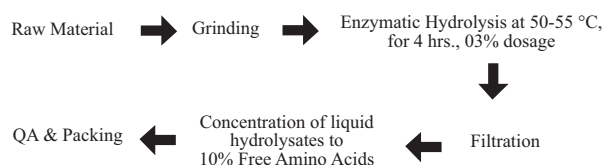
**Research Highlights:**

- Process development for the production of free amino acids foliar via various hydrolysis techniques utilizing indigenous resources as substrate.
- Substrates (defatted soy meal, canola meal, defatted protein wastes, fish wastes or protein hydrolyzates) were studied for the identification to be used as a best source for attaining free amino acids in which defatted soy meal and canola meal were selected due to its economic and quality amino acid value.
- Protein was isolated and hydrolysis was optimized to get the maximum yield of free amino acids for the foliar production.
- Process has been developed on Lab scale for foliar solution, optimized up to 10% of protein hydrolysates (free amino acids).
- Quality evaluation like amino acid profile, proximate composition and shelf life study of the finished product were conducted.
- Pilot plant study was also taken into account.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Liquid amino acid based fertilizers are growing in prominence for their numerous benefits such as, slow and sustained nutrient release; even and balanced distribution of nutrients for plants; easy application and convenience; ready and faster nutrient absorption than compared to granular fertilizers.
- All of the advantages of foliar fertilizer makes it suitable candidate for application on horticultural crops, field crops, and turfs & ornamentals.
- About 14,000 Tons of foliar fertilizer has been imported in Pakistan during year 2018 to fulfill the product needs.



- This project will be beneficial in terms of processing indigenous protein rich materials i.e., soybean meal, canola meal, wheat gluten, fish wastes and other protein rich resources from food and feed industries into free amino acids solution to produce a cheaper, sustainable and effective liquid fertilizer with great significance for our native crop productivity.



**Name of Laboratory/ Centre/ Unit:**

FMRRC/ KLC

**Title of Project: Development of Nursery of Superior Quality Sugarcane via Bud Chip Technique**

**Project Leader:**

Dr. Beena Naqvi, PSO

**Project Associate(s):**

Mr. Muhammad Ashraf, SE

**Area(s) of Research:**

Agriculture

**Duration:**

01 Year

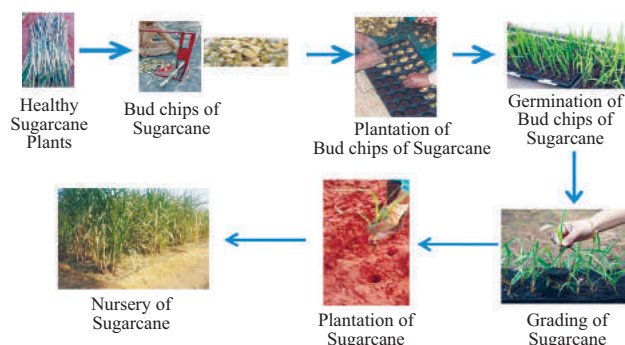
**Research Highlights:**

- Sugarcane crop requires huge quantity of seed cane for planting under conventional method, which contributes a major share in cost of cultivation.
- Large quantity of seed material poses a big challenge for transportation and handling.
- Bud chips technique saves the cost and reduce inconveniences associated with conventional planting methods
- Sugarcane planting in order to enhance per-acre yield of crop in a feasible manner that enhance income of the growers and reducing the cost of input.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Sugarcane is one of a major crop of Pakistan and ranked 5th area wise, and nearly 10th production wise with the share of value added of agriculture and GDP are 3.2 and 0.7 percent, respectively.
- Pakistan sugarcane production suffers a loss of over two billion rupees per annum due to one of the key factor of non- availability of good quality seeding material.
- This project will provide improvement and innovation in propagation technique of sugarcane plant.
- Bud chip technology involves separating the buds alone from cane and planting seedlings raised from buds in a nursery using small plastic cups or trays.
- Planting single bud chips over conventional methods has many advantages with respect to germination, crop establishment, growth and development of sugarcane crop.
- Sustainable sugarcane bud chip technology influences various yield attributes such as plant stand, millable cane per clump and weight of single cane and higher yield.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ KLC

**Title of Project: To Produce Eco-Friendly Antimicrobial Textile Fabrics by Applying Natural Dyes and Finishes**

**Project Leader:**

Ms. Munazza Sohail, SSO

**Project Associate(s):**

Mr. Mansoor Iqbal, SO  
 Mr. Kamran Farooq, SEO  
 Ms. Shagufta Shaikh, SSO  
 Ms. Nida Zaidi, RA

**Area(s) of Research:**

Textile dyes/Finishes

**Duration:**

02 Years

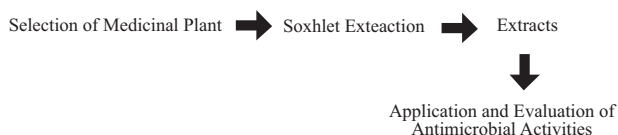
**Research Highlights:**

- Antimicrobial finish is considered as the important parameter for the functional textiles which find a variety of application such as health and hygiene products, specially the garments worn close to skin and several medical applications, such as infection control.
- Antimicrobial fabrics are valuable fabrics and of basic need in recent covid-19 pandemic.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Textile researchers and industrialists faced many challenges and problems due to the increasing global competition in textile sector.
- Consumers have great emphasis and appreciation for the value added apparel fabrics having novel finishes.
- Functional finishes have a great importance due the attributes such as, wrinkle resistance, soil release, water repellency, flame retardancy and resistance to microbial invasion.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ KLC

**Title of Project: Characterization and Beneficiation of Bentonite Clay for Industrial Applications**

**Project Leader:**

Dr. Saima Imad, PSO

**Project Associate(s):**

Dr. Tahir Rafique, PSO  
 Mr. Sheraz Shafiq, SSO  
 Ms. Sidra Anwer, RA  
 Ms. Sadia Fatima, RA

**Area(s) of Research:**

Mineral Processing and Beneficiation

**Duration:**

02 Years

**Research Highlights:**

- Resource identification and sampling of local Bentonite.
- Physical and chemical characterization, as well as, evaluation of collected samples.
- Beneficiation of favorable samples for various industrial applications such as, improvement of swelling index, and bleaching properties

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**





**Project Outcome w.r.t. Socio-economic Development of Country:**

- Strong hygroscopic and expandable Bentonite is a non-metallic mineral, and because of special layered structure, it possesses a large specific surface area with excellent adsorptive properties.
- For specific industrial use, the Bentonite properties can be controlled and the conversion of Bentonite from one form to another can be possibly obtained by chemical treatment and purification process.
- In Pakistan, workable deposits of Bentonite occur at different places in Sindh, Panjab, Khyber Pakhtunkhwa provinces and Azad Kashmir, however, a large quantity of purified Bentonite is being imported for various industrial exercises.
- Therefore, it is imperative to develop new research techniques in order to produce particular quality Bentonite for its subjective use in local industry.



**Name of Laboratory/ Centre/ Unit:**

APC&IC/ KLC

**Title of Project: Establishment of Flow Metering Laboratory**

**Project Leader:**

Mr. Aftab Ahmed Usmani, SSO

**Project Associate(s):**

- Mr. Arif Karim, PSO
- Mr. Faisal Ghazanfar, SSO
- Mr. Naseem Ahmed, SEO
- Ms. Seema Firdous, SSO

**Area(s) of Research:**

Instrumentation, Testing and Calibration

**Duration:**

02 Years

**Research Highlights:**

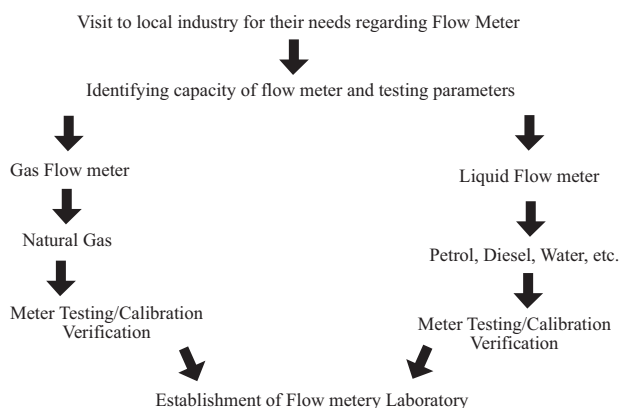
- To develop testing and calibration facility for gas and liquid flow meters.

- In the liquids the flow metering will serve the areas in fuel measurement, such as Petrol, diesel and other utility fuels.
- This project will develop testing and calibration facility of water flow meters, which may be a simple domestic flow meter or industrial flow meters.
- In addition, the completed study will develop the facility for testing, calibration or verification of domestic and industrial gas flow meters.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The successful execution of the project will help in import substitution and export promotion.
- This project will create opportunities for employment, and improve living standards of citizens.
- Besides, this projection will help to provide quality products and services to the user/citizen.



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Process Optimization for the Isolation of Pungent Component Capsaicin from Capsicum Fruits for Medicinal Purpose**

**Project Leader:**

Dr. Shazia Yasmeen, PSO

**Project Associate(s):**

Dr. Ghulam Fareed, SSO  
 Dr. M. Aijaz Anwer, SSO  
 Dr. Sadia Ferheen, PSO  
 Dr. Rashid Ali Khan, PSO

**Area(s) of Research:**

Natural Product Chemistry

**Duration:**

01 Year

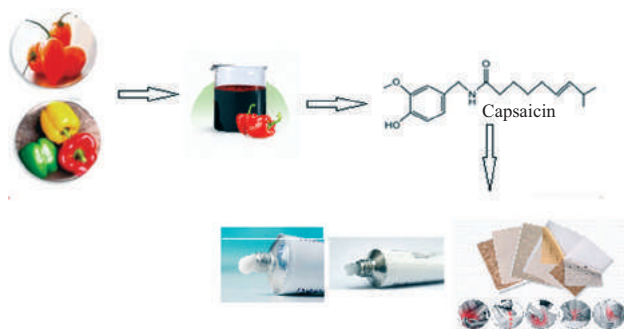
**Research Highlights:**

- The genus *Capsicum* belongs to the *Solanaceae* family that have several domesticated species of capsicum (chilli peppers).
- Pungency, a commercially important attribute of peppers, is due to the presence of phytochemicals from the characteristic capsaicinoids group.
- The two most abundant capsaicinoids in chilli are capsaicin and dihydrocapsaicin, both constituting about 90%, with capsaicin accounting for 71% of the total Capsaicinoids in most of the pungent varieties.
- Capsaicin pharmaceutical properties with many uses as an analgesic against arthritis pain and inflammation effects on the gastrointestinal tract, the cardiovascular and respiratory systems, anticancer effect, as well as, the sensory and thermoregulation systems.
- In this project, varieties of capsicum will be extracted to obtain pure capsaicin, and further used in analgesic preparations such as, ointments, creams and patches.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- There is an increasing demand for capsaicin as raw material from pharmaceutical firms worldwide, and therefore the aim of the present study is to find a simple, fast, and reproducible method for its extraction from the fruit of capsicum.
- The level of the capsaicin in the seasonal pepper is around 0.025%, and in the hot pepper around 0.25%.
- Capsaicin is being used in topical analgesics as it is reported to be effective against aches and pains of various muscle or skeletal origin.
- Physicians prefer over oral drugs to avoid addiction, and hepatic metabolism, and this recommendation to human being is in line with the findings of this project.



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Development of Color Test Reagents/Kits for Preliminary Identification of Narcotics Material**

**Project Leader:**

Dr. Amir Ahmed, PSO

**Project Associate(s):**

Dr. Kamran Ahmed Abro, SSO  
 Mr. Irshad Ahmed Khan, EO

**Area(s) of Research:**

Applied Research in Pharmaceutical, Narcotics Drug

**Duration:**

01 Year

**Research Highlights:**

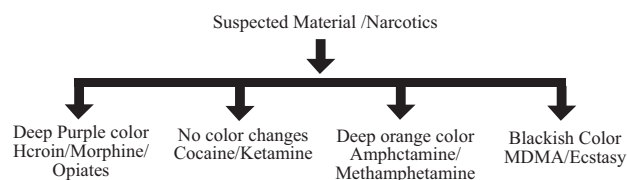
- The term amphetamine type stimulants (ATS) refer to a range of drugs mostly derived from the phenethylamines that are central nervous system (CNS) stimulants, and first synthesized more than a century ago for medical applications.

- Amphetamine (AMPT) and methamphetamine (MAMPT) both increase the release of dopamine, noradrenalin, adrenaline and serotonin, stimulate the central nervous system, and have a range of effects including increased energy, feelings of euphoria, decreased appetite, elevated blood pressure and increased heart rate.
- In view of the rapid increase in the undercover manufacture, traffic and abuse of a variety of ATS/Narcotics, there is need for law enforcement to identify these substances and differentiate between them due to the similarity in chemical structure.
- Various Pakistan Security agencies like Anti-Narcotics Force (ANF) working under the umbrella of Ministry of Interior & Narcotics Control, Pakistan Cost guard and Pakistan Maritime Security Agency, Pakistan Custom is trying to halt the drug trafficking and work closely with Pakistan Council of Scientific & Industrial Research Laboratory Karachi unit to analyze the seizure material.
- The PCSIR Lab. target is to develop the reliable, easy to handle field testing kit to facilitate the Law enforcement agencies, the field-testing kits that consist of color test reagents for the preliminary identification of drugs of abuse (hereinafter referred to simply as drugs/ Psychotropic substance) in their pure and/or diluted forms to determine compliance with those requirements.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Drug smugglers, middle man put their benefit and supply the illegal drug to the local community thus make a victim of them by illegal drug habit especially youth.

- Currently all the equipment and other testing kits for narcotics, used by our security agencies (to the best of our knowledge) are imported from other countries which put a burden to our economy
- PCSIR Karachi lab is developing kits for narcotics (cost effective with equal performance) within the country that make much easier for the Law enforcement agencies to improve vigilance not only at border but also surrounding by the border.



**Name of Laboratory/ Centre/ Unit:**

FMRRC/ KLC

**Title of Project: Risk Mitigation Strategies and Fabrication of Mini Pasteurizer to Improve Milk Safety and Microbial Quality in Karachi**

**Project Leader:**

Dr. Muhammad Naseem Khan, SSO

**Project Associate(s):**

Dr. Abdul Basit Khan, PSO  
 Dr. Zulfiqar Ali Mirani, SSO  
 Ms. Anila Siddiqui, SSO

**Area(s) of Research:**

Food Safety, Food Microbiology

**Duration:**

02 Years

**Research Highlights:**

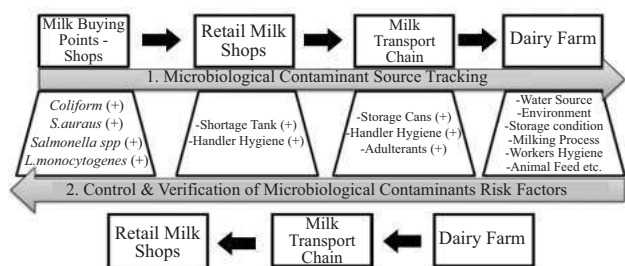
- Milk is a valuable and an absolute source of human diet because it constitutes all important nutrients, therefore its consumption increased globally.
- It is calculated that >95% milk is sold in market in raw form. Being a large population under poverty line could not afford to reliance on the processed milk, therefore to standardize the quality and safety of the raw milk available at the local retail shops is the first priority.
- Assessment of microbiological quality of milk at every level is essential to identify critical points for microbial contamination.

- Development of risk mitigation plan to improve overall quality and safety of local milk distribution chain via source tracking and control strategy.
- Designing and development of low cost home-based mini-pasteurizer.

**Source of Funding:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The proposed project will hopefully generate a baseline data with reference to milk handling at every level.
- Assessment of microbiological quality of milk from grass to glass helps to track sources of contamination.
- Risk documentation associated to local dairy industry and development of mitigation strategy to minimize/eliminate those risks.
- Furthermore, it would be an added advantage if the individual consumer is provided with a research-based, economical, safe and easy to handle mini-pasteurizer for optimum milk safety and quality.



**Name of Laboratory/ Centre/ Unit:**

FMRRC/ KLC

**Title of Project: Synthesis & Application of Metal Nanoparticles using Microalgae to Detoxify Mycotoxin Contamination in Poultry and Fish Feed**

**Project Leader:**

Dr. Farman Ahmed, PSO

**Project Associate(s):**

Dr. Muhammad Asif Asghar, SSO

**Area(s) of Research:**

Nanotechnology, Detoxification, Toxicology

**Duration:**

02 Years

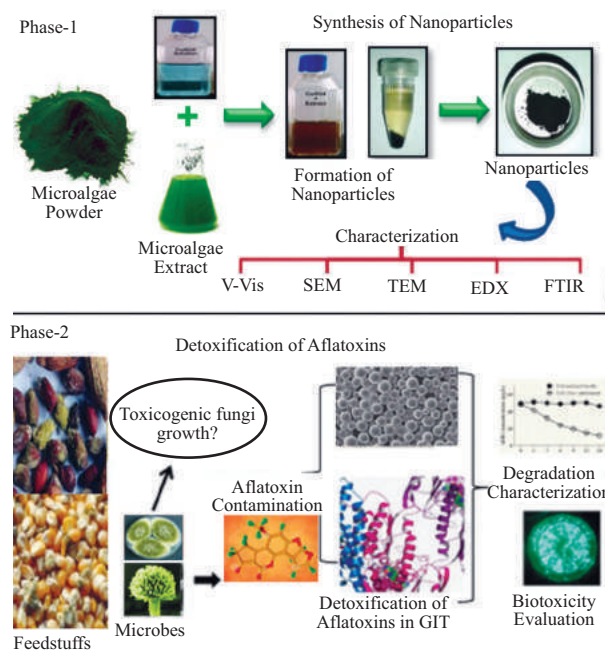
**Research Highlights:**

- In the proposed study, engineered metal nanoparticles (NPs) will be synthesized using green microalgae biomass as a novel and easy-to-handle method.
- Microalgae can be considered a powerful nanofactory, accomplished in making a wide range of NPs. This approach is fast, cost-effective and eco-friendly.
- NPs supplemented feed will attract a lot of attention in the agricultural industry because of the potential of NPs to improve nutritional attributes, safety and quality.
- NPs supplemented poultry & fish feed will decrease numbers of harmful bacteria in the chicken & fish micro-biomes and hence can potentially be used to improve growth and performance.
- Feeding of microalgae nanoparticles with diet will improve the digestive efficiency, immunity and performance in livestock and aquatic animals.

**Source of Funding:**

PC SIR In-house R&D

**Graphical Abstract:**





**Project Outcome w.r.t. Socio-economic Development of Country:**

- Reducing AFs with this technology will improve food/feed production and incomes of small farmers as they will be able to participate in local and formal trade initiatives.
- Pakistan is the agricultural country and therefore PCSIR have gotten good opportunity to assist the grower, farmers and consumers for the control of pathogenic microorganism as well as AFs production.
- The Nanotechnology based product produce by this project will help not only PCSIR economy but also help Pakistan to compete in international growing technology.
- Pakistan has vast dairy and poultry industries which are prone to the fungal attack as well, AFs contamination, and therefore, PCSIR could help these industries for the control of AFs contamination.
- Nanotechnology can boost the economic growth, as well as, improve the capacity and quality in industrial sectors to significantly change the human life, social environment and country's economy.



**Name of Laboratory/ Centre/ Unit:**

FMRRC/ KLC

**Title of Project: Application of Edible Nut Shells as a Nanoadsorbent to Minimize Aflatoxins Contamination in Poultry Feed**

**Project Leader:**

Dr. Muhammad Asif Asghar, SSO

**Project Associate(s):**

Dr. Farman Ahmed, PSO

**Area(s) of Research:**

Nanotechnology, Toxicology, Poultry Industry

**Duration:**

01 Year

**Research Highlights:**

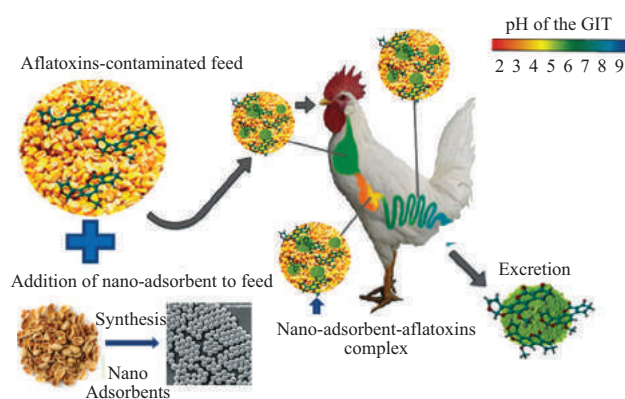
- A large quantity of edible nuts is consumed in Pakistan and generates a significant amount of waste material (Shells).

- The cost-effective nanoadsorbents from the edible nut shells (waste material) will be synthesized for the reduction of aflatoxins toxic effects in poultry feed.
- The utilization of the nanoadsorbents in feed is a new technology which enhances the meat and egg production and quality, growth, immune-modulation and antioxidant status.
- Nanoadsorbents supplementation will improve the blood biochemistry and liver histology, decreased the DNA damage, growth performance and decrease the aflatoxins residual in poultry exposed to aflatoxins.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The production of nanoadsorbent in this project is cost-effective, simple, fast, easy to produce at large scale, environmentally friendly and biocompatible.
- The importance in terms of socio-economic including revenue generated, source of employment and other goods and environmental management. The cost of initial materials or substrate is very less or negligible.
- The production of the nanoadsorbent at large scale is economical and more feasible.
- Animal health and safe food are also important in the current scenario of socio-economic conditions and increasing consumer awareness. The use of edible nut shells (waste product) decreases environmental contamination.



- The application of nanotechnology to harness the by-products of agro-industries can increase economic viability and sustainability in animal production systems.



**Name of Laboratory/ Centre/ Unit:**

FMRRRC & CDLE/ KLC

**Title of Project: Designing & Fabrication of Portable Ultrasonic Humidifier for the Cultivation of Mushroom in Agri-Lab**

**Project Leader:**

Dr. Sofia Qaisar, SSO

**Project Associate(s):**

- Mr. Aqeel Ahmed Khan, SSO
- Mr. Sohail Akhtar, SSO
- Mr. Aijaz Pahwar, SE
- Mr. Mohammad Mazhar, TO

**Area(s) of Research:**

Agriculture, Mushroom Farming, Food Cold Storage, Vegetable Market

**Duration:**

01 Year

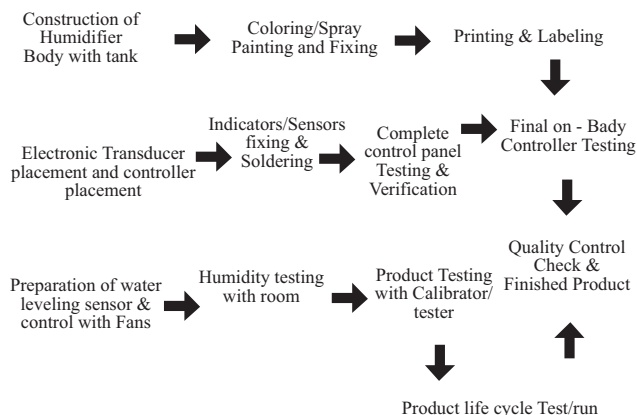
**Research Highlights:**

- Humidity control is the critical factor for the customized indoor agriculture, green houses, indoor environment and in cold storage of vegetables and fruits.
- The Ultrasonic humidifier can be place in room/labs or inside the fruiting area.
- The amount of humidity that can be produced by the humidifier is determined by the number of discs the unit has in it.
- By means of practice, mushrooms can be easily grown indoors on many materials and in alignment with the seasonal and cyclical nature of plants growing.
- The designing and fabrication of a humidifier with the help of indigenous resources is focused in this project specially, for edible mushroom for cottage industry and related sector/farms.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- In agriculture and food industries, the moisture control up to specific humidity is the prime concern thus the humidifier development that will lead its roll in enhancing socioeconomic development of the country.



**Name of Laboratory/ Centre/ Unit:**

CDLE/ KLC

**Title of Project: Development of Digital Fundus Images Dataset for Artificial Intelligence Based Model Development and Performance Testing**

**Project Leader:**

Mr. Ghulam Mustafa, SE

**Project Associate(s):**

Mr. Aqeel Ahmad Khan, SSO

**Area(s) of Research:**

Artificial Intelligence

**Duration:**

02 Years

**Research Highlights:**

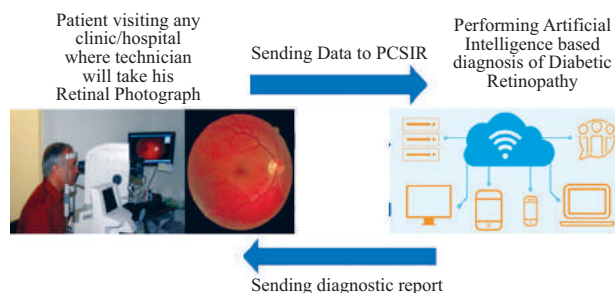
- Retina is the photosensitive layer present inside human eye which is responsible to receive photons and convert them into electrical signals. These electrical signals are carried to brain through optic nerve to convert them into meaningful information. Visual disorders like Age related Macular Degeneration, Diabetic Retinopathy, Glaucoma and hypertensive retinopathy affects retinal layer and optic disc's structure. These pathological changes progress gradually through the period of time and can lead to complete blindness if not detected timely. A regular checkup of fundus is therefore recommended to observe and treat preventable vision impairments. This increases the economic burden on patient and overload the available diagnostic facility. High patient ratio also increases the chances of human error due to improper image acquisition and undetected pathological structures by specialist.
- Advancement in the field of Artificial Intelligence (AI) is supporting clinical diagnosis. Ophthalmologist are increasingly taking benefit from the AI based decision support system in their diagnosis. Incorporating technological solution has reduced the cost and time of patient and has significantly improved the accuracy in clinical diagnosis. Most of these AI based solutions have been developed using high quality expensive fundus camera. These solutions can therefore perform well on high quality image data and therefore remains successful in the developed countries.
- The training and testing of Artificial Intelligence based models is done using labelled datasets of certain diseases. This dataset plays vital role in both the development and testing phase of an AI based project.
- In this R&D project, we propose a collaborative project for the development of digital fundus images dataset with professional's labelling according to the presence of various retinal impairments. Al-Ibrahim hospital has showed their consent for collaboration and has also issued ethical approval of research. This dataset will be published online for free to the researchers to support them in their research related to automated diagnosis of retinal related disorders. The publication of this dataset

will give PCSIR as the first national institute in Pakistan publishing dataset for supporting AI based research.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic development of Country:**

- To support the technological industry in the development of low cost solutions.
- After successful completion of this project, PCSIR recognize at international platform for supporting AI based research.



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: Isolation and Screening of Antimicrobial Fractions/Compounds from *Acacia nilotica*, *Prosopis juliflora* and *Alstonia scholaris***

**Project Leader:**

Dr. Nighat Sultana, CSO

**Project Associate(s):**

Mr. Muhammed Saleem Qazi, PSO  
Mr. Mahmood-ul-Hassan, PSO

**Area(s) of Research:**

Natural product, Antimicrobial activity of medicinal plants

**Duration:**

03 Years

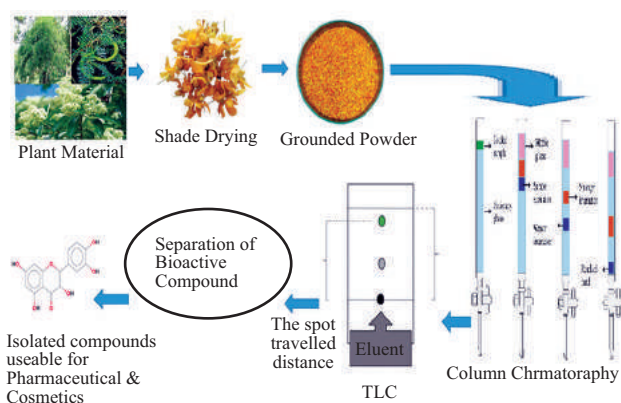
**Research Highlights:**

- Around 750 national and multinational pharmaceutical companies manufacture, import active pharma ingredients (APIs). A few national pharmaceutical companies (NPCs) have established basic manufacturing plants (BMPs) that produce active pharma ingredients (APIs). According to estimate, 95 per cent of the APIs is imported.
- *Acacia nilotica*, *Prosopis juliflora* and *Alstonia scholaris* were studied for antimicrobial studies and the plant showing the required characteristics and screened for the isolation, purification and characterization of the secondary metabolites.
- The main objective of extraction of bioactive compounds is to search new analogue of bioactive compounds with improved efficacy.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

There are many potential herbal extracts imported in the country but some of that important herbal extracts/products can be produce locally for the valuable industrial use like; *Acacia nilotica*, *Salvadora persica* and *Camellia sinensis* etc. The impact of the project is as followings:

- To extract bioactive natural product which lead to herbal medicine
- To substitute the import by utilizing indigenous resources of the country
- The product will be economical and import substitution.

- The project is also directly related to the health and social welfare as it deals with the quality of herbal product which is used by 60% of our population.



**Name of Laboratory/ Centre/ Unit:**

PRC/ KLC

**Title of Project: To Develop the Method for Extraction of *Osmium tenuiflorum* Leaves and to Study its Efficacy**

**Project Leader:**

Dr. Nighat Sultana, CSO

**Project Associate(s):**

- Engr. Muhammad Ali Imran, SE
- Engr. Nazir Ahmed Tunio, PE
- Mr. Muhammad Farhan, SSO
- Mr. Abdul Rashid Solongi, SEO
- Mr. Tariq Bakshish, EO
- Mr. Umair Ihsan, EO
- Mr. M. Tariq Mughal, UDC

**Area(s) of Research:**

Herbal Medication

**Duration:**

02 Years

**Research Highlights:**

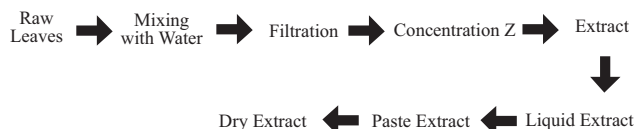
- To develop material & method for extract of *Ocimum tenuiflorum* leaves, material used (Aqua, Methyl alcohol, Ethyl alcohol, Acetone, Hexane & Chloroform)
- Tulsi having multiple therapeutic actions including adaptogenic, antimicrobial, anti-inflammatory, cardioprotective, and immunomodulatory effects, yet to date there are no systematic reviews of human research on tulsi's clinical efficacy and safety.
- The reviewed studies reinforce traditional uses and suggest tulsi is an effective treatment for lifestyle-related chronic diseases including diabetes, metabolic syndrome, and psychological stress.

Further studies are required to explore mechanisms of action, clarify the dosage and dose form, and determine the populations most likely to benefit from tulsi's therapeutic effects.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The plant kingdom of tulsi is an excellent source of potential drugs.
- It is very abundantly available in our region and can utilize as a cheap source of herbs medicine.
- In recent years there has been an increasing awareness about the importance of therapeutic plants.
- Medicinal plants are rich source of different types of medicines and produce bio active molecules.
- Herbal supplements come in all forms: dried, chopped, and powdered or liquids can be used in various ways including pills, brewed as tea, apply as gels, lotions or creams.



## PCSIR Laboratories Complex, Lahore (LLC)

**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Eco-friendly Pesticides from Agricultural Source**

- Applicability to conventional pesticide resistant pests
- Development of less toxic but powerful pesticides.
- Self-reliance and import substitution



**Project Leader:**

Dr. Rabia Nazir, PSO

**Project Associate(s):**

Dr. Shafaq Mubarak, SO

**Area(s) of Research:**

Agro-chemicals

**Duration:**

01 Year

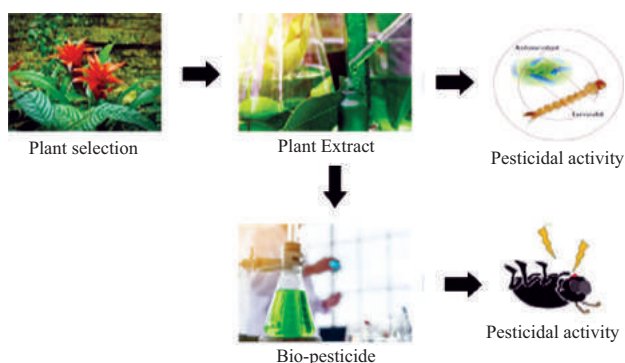
**Research Highlights:**

- Selection of plants for development of pesticides
- Pesticidal activity of plant extracts
- Development of eco-friendly pesticides from plant extracts
- Pesticidal activity of developed eco-friendly pesticides

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Green synthesis of nano-pesticides

**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Flavors and Fragrances**

**Project Leader:**

Ms. Asma Inayat, PSO

**Project Associate(s):**

Dr. Zahida Parveen, PSO

Dr. Saima Siddique, SSO

**Area(s) of Research:**

Applied Chemistry

**Duration:**

01 Year

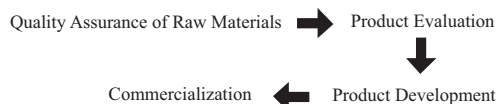
**Research Highlights:**

- Development of indigenous technology for formulation of flavors/fragrance.
- Import substitution and development of local industry
- Advisory and quality control services to manufacturers, processors and consumers

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Strengthening of local industry



- Low-cost quality product availability to consumer
- Import substitution



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Non-Edible Oil based Softeners for Leather**

**Project Leader:**

Ms. Asma Inayat, PSO

**Project Associate(s):**

Mr. Shahid Rehman Khan, SSO

**Area(s) of Research:**

Leather and its constituents

**Duration:**

01 Year

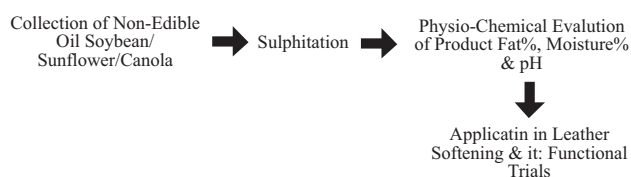
**Research Highlights:**

- Sulfonation of vegetable oils

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

Disposal of waste oil creates huge environmental problems. Their utilization in form of softening agents would play an important role in:

- Waste reduction
- Import substitution of leather softening agents
- Development of local entrepreneurship



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Fluorine-free Oil and Water Repellent for Cotton Fabric**

**Project Leader:**

Ms. Filza Zafar Khan, PSO

**Project Associate(s):**

Syed Faheem Shah, EO

**Area(s) of Research:**

Textile Finishing

**Duration:**

01 Year

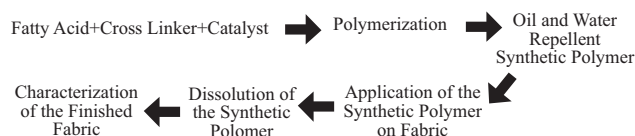
**Research Highlights:**

- Fluorinated compounds exhibit durable oil and water repellency, however, expose adverse effect on human and ecology.
- In the proposed research, a bio-based fluorine-free, environment-friendly, and nontoxic fatty acid will be polymerized with a bio-based cross-linker in the presence of a catalyst.
- Fluorine-free oil and water-repellent will be developed to fabricate hydrophobic and oleophobic cotton fabric.
- The resultant hydrophobic and oleophobic fabric will exhibit greatly improved durability.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Textile products are the prominent and leading export, however, pollute the environment to a greater extent.

- The research will promote environment friendly practices, sustainable production practices and minimizing the presence of dangerous chemicals in textile products to save the planet from their hazardous impact.
- Development of a feasible process to be sold to the local industry subject to customer demand for import substitution of textile finishing agents.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Technology Development for Production of Heat Reflective Coating**

**Project Leader:**

Mr. Faisal Ahmed, PE

**Project Associate(s):**

Dr. Muhammad Zia-ur-Rehman, PSO

Mr. Muhammad Fayyaz, JE

**Area(s) of Research:**

Coatings

**Duration:**

01 Year

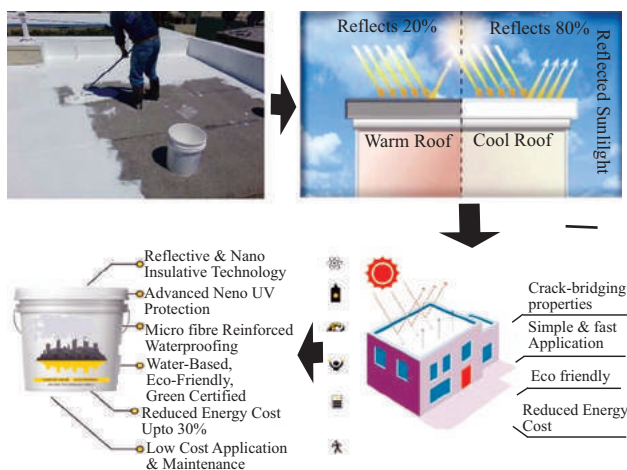
**Research Highlights:**

- Formulation of coating characteristic evaluation
- Feasibility report

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Easy and fast application to reduce complexity and labor hours.
- Long-lasting performance to avoid costly and frequent re-application.
- Ease of removal and disposal of materials in the case of unavoidable substitution.
- Materials based on unregulated and user-friendly raw materials (i.e., water-based versus solvent-based, low emissions, etc.).
- Energy savings/ reduced air conditioning costs by reflecting the heat waves.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Skin Foundation Cosmetics**

**Project Leader:**

Dr. Saima Siddique, SSO

**Project Associate(s):**

Dr. Zahida Parveen, PSO

**Area(s) of Research:**

Applied Chemistry

**Duration:**

01 Year

**Research Highlights:**

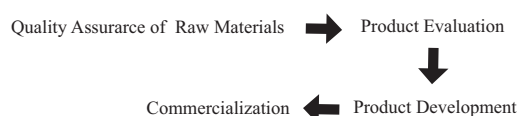
- Colored facial cosmetics are important part of the dermatologic armamentarium. They can camouflage contour and pigment abnormalities, provide moisturization, enhance oil control, add sun protection, deliver barrier-enhancing agents and create a sense of personal well-being. This variety of functions accounts for the tremendous variety available for consumer purchase.
- Currently, most of the skin foundations are of import origin and thus are expensive. So there is a need to develop skin foundation formulations to cater cottage industry. The main objectives are;

- Development of indigenous technologies for formulation of skin foundation cosmetics.
- Import substitution and development of the local industry.
- Pilot plant production of developed products.
- Advisory and quality control services to manufacturers, processors and consumers

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Easy and fast application to reduce complexity and labor hours.
- Long-lasting performance to avoid costly and frequent re-application.
- Ease of removal and disposal of materials in the case of unavoidable substitution.
- Materials based on unregulated and user-friendly raw materials (i.e., water-based versus solvent-based, low emissions, etc.).
- Energy savings/ reduced air conditioning costs by reflecting the heat waves.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Synthesis of Synthetic Resins for Protective Coatings**

**Project Leader:**

Mr. Raza Hussain, SSO

**Project Associate(s):**

Dr. Saira Taj, PSO

**Area(s) of Research:**

Polymer Technology

**Duration:**

02 Years

**Research Highlights:**

- Synthesis of alkyd resins by poly-condensation of polyols and dicarboxylic acid or its anhydride.
- Synthesis of modified alkyds through conventional and non-conventional reaction routes.
- Evaluation of products of reaction.
- Film forming tendency and stability of water-based alkyds.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Contribution towards development of modified alkyds at indigenous scale.
- Enhancement in use of renewable components in paint formulations.
- Use of environment friendly paints/coatings.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Preparation of Value-Added Products from Chrome Shaving**

**Project Leader:**

Mr. Shahid Rehman Khan, SSO

**Project Associate(s):**

Ms. Asma Inayat, PSO

**Area(s) of Research:**

Leather and its products.

**Duration:**

01 Year

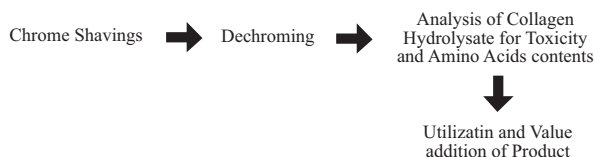
**Research Highlights:**

- Waste utilization.
- Pollution reduction
- Valorization of waste.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Chrome shaving waste is category I waste, and if not dumped properly, will contaminate soil and water with harmful chemicals.
- Utilization of this waste into value added product will not only prevent from aforementioned credential requirements including land, money and will be helpful in preparation of useful product from waste source with in the country.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Synthesis and Characterization of Guar Gum Derivatives and its Utilization in Different Industries**

**Project Leader:**

Mr. Atif Latif, SSO

**Project Associate(s):**

Mr. Ehsan Ul Haq, PSO

**Area(s) of Research:**

Paper Industrial Chemicals

**Duration:**

02 Years

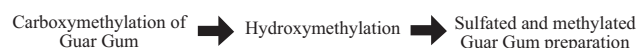
**Research Highlights:**

- To modify guar (Carboxymethyl guar gum, Hydroxymethyl guar gum, Hydroxypropyl guar gum, Methylated guar gum, Sulfated guar gum and Guar gum esters) to enhance and diversify its properties and application.
- Application and property study of product on paper & paper board, textile and pharmaceutical.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The guar gum (GG) project is mainly focused on the strengthening the local paper, textile and pharmaceutical industry of Pakistan.
- Increase Productivity by producing indigenous raw material and Transferring Technology and its commercialization.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development and Synthesis of Eco-friendly Azo Synthetic Dyes and their Applications**

**Project Leader:**

Dr. Azra Yaqub, SO

**Project Associate(s):**

Mr. Mehroze Ahmad Khan, SO

**Area(s) of Research:**

Synthetic dyes

**Duration:**

02 Years

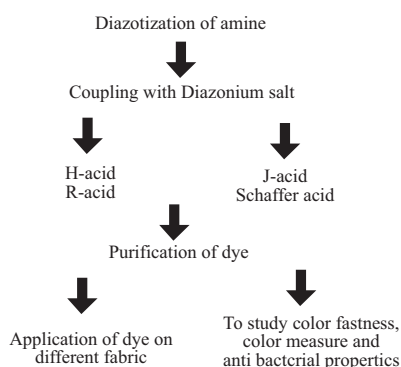
**Research Highlights:**

- Development of synthetic azo dyes
- To study color fastness properties
- To study color-measurement properties
- To study antimicrobial properties of dyes

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Azo dyes represent the largest production volume of dye chemistry today.
- Azo dyes play crucial role in the governance of the dye and printing market.
- Various properties, for example, color fastness and color-measurement properties, and antimicrobial properties will be optimized to introduce the targeted dyes for practical application in different industries.
- To minimize the import demand of the country.



**Name of Laboratory/ Centre/ Unit:**

ACRC/ LLC

**Title of Project: Development of Dispersing Agent in Textile**

**Project Leader:**

Syed Faheem Shah, EO

**Project Associate(s):**

Ms. Filza Zafar Khan, PSO

**Area(s) of Research:**

Textile

**Duration:**

01 Year

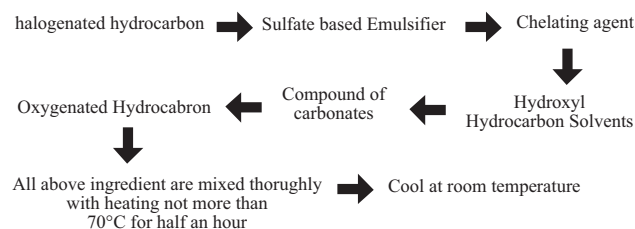
**Research Highlights:**

- Extremely strong decomposition of mineral greasy dirt from fabric and garments at stitching unit as well as nontoxic and non-stimulated.
- Cost is cheap and range of application is very extensive

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Import substitution.
- Development of a feasible process to be sold to the local industry subject to customer demand.



**Name of Laboratory/ Centre/ Unit:**

FBRC/ LLC

**Title of Project: Development of Banana Peel Powder and its Application as Wound Healing Allergies and Skin Irritations**

**Project Leader:**

Dr. M. Khalid Saeed, PSO



**Project Associate(s):**

Dr. Naseem Zahra, SO  
Dr. Ijaz Ahmad, CSO

**Area(s) of Research:**

Food and Nutraceutical Products

**Duration:**

01 Year

**Research Highlights:**

- The fruit and peel of banana is usually consumed fresh or processed into different products at nutraceutical and pharmaceutical industries and other small and industrial scales, such as, dried fruit, chip, ice-cream, bread, flour and ingredients for functional foods.
- The peel of banana accounts for about 35% of the whole fruit weight and this is a potential material for further utilization, and has been traditionally used as a medicine.
- Banana been found to contain high levels of dietary fibre and phenolic compounds that exhibit potent antioxidant capacity, antimicrobial, antifungal, antibiotic, phytochemical and antibiotic properties.
- The properties of banana peel can put to be good use. The peel is used for home remedy for treating several skin problems including, wound healing, allergies and skin irritations.

**Source of Funding:**

PCSIR In House R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Better utilization of banana peel waste.
- Extraction of natural antioxidants.
- Feedstock Preparation.
- Banana peel powder has been used as a herbal medicine for the treatment of various ailments, such as burn, cough, ulcer and diarrhoea etc.

- Banana peel has been applied to promote wound healing caused by burns



**Name of Laboratory/ Centre/ Unit:**

FBRC/ LLC

**Title of Project: Establishment of Techniques to Determine Enzymatic Antioxidant**

**Project Leader:**

Dr. Ijaz Ahmad, CSO

**Project Associate(s):**

Ms. Muafia Shafiq, SSO  
Ms. Shamma Firdous, PSO

**Area(s) of Research:**

Toxicology/Agriculture Sector & Academia

**Duration:**

01 Year

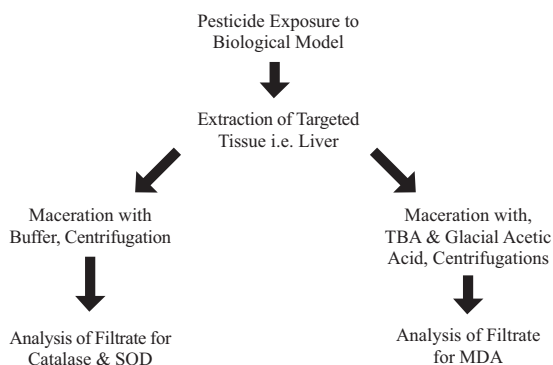
**Research Highlights:**

- The extensive use of pesticides in agriculture, as well as, in public health protection has triggered severe environmental and health hazards that pose harmful effects on both terrestrial and aquatic ecosystems, and on human.
- One of the main hostile effects of pesticide exposure to biological models is oxidative stress, that leads towards production of Reactive Oxygen Species (ROS).
- Antioxidants are the first line of defense against the damages caused by free radicals and are critical for the optimum health of animal cells.
- Malondialdehyde (MDA) level is a good indicator of lipid peroxidation of animal tissue after pesticide exposure. Similarly, Super Oxide Dismutase (SOD), catalase (CAT) and glutathione reductase enzymes activity also suggest about the toxicity effects induced after pesticide exposure.
- This study was aimed to establish a facility in toxicology lab of PCSIR Lahore for the determination of MDA level, SOD, CAT and Glutathione reductase activity in animal tissues.

**Source of Funding:**  
PC SIR In-house R&D

**Duration:**  
01 Year

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Present project was aimed to establish the techniques to determine the activities of selected enzymes involved in antioxidant defense system.
- This is the future's need of agroindustry (to determine the toxic limits of any prepared pesticide) and academia (research involved in animal models).
- The establishment of these proposed techniques will be helpful to detect pesticide toxicity within biological systems and reduce the risk of illness.



**Name of Laboratory/ Centre/ Unit:**  
FBRC/ LLC

**Title of Project: Quality Parameters Evaluation of Moringa Leaf Powder and its Utilization in Conventional Foods**

**Project Leader:**  
Ms. Shumaila Usman, SSO

**Project Associate(s):**  
Dr. Ijaz Ahmad, CSO  
Dr. Saima Nazir, SSO  
Ms. Ammara Yasmeen, SO

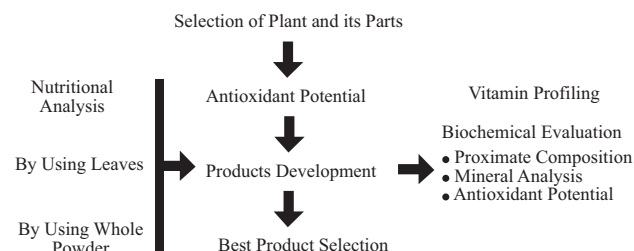
**Area(s) of Research:**  
Food & Nutrition

**Research Highlights:**

- Considering the poverty level, and the nutritional loss of the people, science always tried to help to triumph over both poverty and nutritional loss.
- Herbs that are unnoticed can recover the nutritional deficiencies.
- *Moringa* variety is one of the herbs that help to accomplish nutritional loss.
- All parts of the plant of *Moringa oleifera* are full of nutrition, and that is why it is known as “*Miracle Tree*”.
- The roots, leaves, flowers, buds, pods and the juice of roots, buds, and flowers have great importance for the medicinal uses, and this work was designed considering the above mentioned facts.

**Source of Funding:**  
PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Current research work will have great impact on economy of our country in regards of profitable product development with low investment.
- A major issue of malnourishment in poor areas of country may be overwhelmed by providing the products of moringa at economical rate.
- The developed process may be introduced in public to create awareness about neglected plant source rich of nutrients beneficial to human health reducing various diseases by very low cost.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Synthesis and Characterization of Mg-Zn-xHA Alloy Developed by Powder Metallurgy Technique for Biodegradable Orthopedic Implants**

**Project Leader:**

Ms. Farzana Habib, PSO

**Project Associate(s):**

Engr. Muhammad Irfan, SE  
 Engr. Badaruddin Soomro, JE  
 Engr. Waqas Iqbal, JE  
 Ms. Sumera Nosheen, SSO

**Area(s) of Research:**

Biomaterials

**Duration:**

01 Year

**Research Highlights:**

- Mg-based materials are gaining continual interest due to their usefulness in a wide range of applications, such as, in automotive, aerospace, electronics, maritime, defense, sports sectors and biomedical domain.
- Most metallic implants are too stiff (young's modulus 100-200Gpa) but Mg has an elastic modulus (young's modulus 40-45Gpa) close to natural bone (young's modulus 10-30Gpa). Therefore, stress shielding which is a challenge for metallic implant will be reduced in bone tissue near magnesium implants.
- A very good biocompatibility of Mg belongs to the human body's indispensable trace elements, and can achieve self-degradation in the human body, avoiding the secondary removal of orthopaedic accessories used to support fractured and damaged bones, as well as reducing the economic burden and physical pain of patients.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**

Green Formation of Material → Sintering of Material at different Temperatures → Characterization of Material

**Project Outcome w.r.t. Socio-economic Development of Country:**

- To develop biodegradable orthopedic implants by powder metallurgy technique and to study the feasibility of developed material in Pakistan's environmental conditions and its electrochemical study.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Porous Structure Coating of Titanium on Surgical Implants to Promote Osseointegration**

**Project Leader:**

Engr. Waqas Iqbal, JE

**Project Associate(s):**

Ms. Farzana Habib, PSO  
 Engr. Muhammad Irfan, SE  
 Engr. Badaruddin Soomro, JE  
 Ms. Sumera Nosheen, SSO

**Area(s) of Research:**

Biomaterials

**Duration:**

01 Year

**Research Highlights:**

- Currently, different types of biomaterials are developing rapidly.
- Among which the metallic materials are widely used in clinical practices
- The rate of osseointegration and the percentage of bone-to-implant contact (BIC) are highly dependent on the surface properties of implant.

- The implant surface is modified before implantation frequently, which can not only improve the mechanical properties of the implant, but also polish up bioactivity on a cellular level.
- Many coating and roughening techniques are used to improve cell and bone-bonding to the implant surface
- Titanium and its alloys are the most commonly used materials for permanent implants and show a vast number of remarkable properties

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**

Coating of Material → Study of Material in different solution → Characterization of Material

**Project Outcome w.r.t. Socio-economic Development of Country:**

- After successful trials, the biocompatible coating will be developed on implants.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Enhancement of Magnetic Losses in Hybrid Polymer Composites with Different Types of Ferrites and Conductive Fillers**

**Project Leader:**

Ms. Sumaira Nosheen, SSO

**Project Associate(s):**

Ms. Farzana Habib, PSO/Head  
 Engr. Muhammad Irfan, SE  
 Engr. Bilal Waseem, JE

**Area(s) of Research:**

Advanced Engineering Materials

**Duration:**

01 Year

**Research Highlights:**

- At present, the development of new electromagnetic wave absorbers (EWAs) is being encouraged as these materials provide an efficient means for reducing radiation pollution generated by electromagnetic devices (TV and radio broadcasting, radar systems, microwave ovens, mobile phones, etc.)
- Ferrite polymeric materials with a hybridized system have been the subject of considerable interest in the research area where magnetic response is required.
- Herein, electromagnetic properties of materials would be tuned to meet requirements of high absorption

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**

Development of different Composition → Study of their magnetic Behavior → Characterization of Material

**Project Outcome w.r.t. Socio-economic Development of Country:**

- As improving of electromagnetic properties of ferrite composites in microwave region is the major development of hybrid polymer composites and these are further used in vast field of applications including electronic appliances, radars and aeroplanes etc.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Development and Characterization of (Fe<sub>21</sub>Mo<sub>2</sub>C<sub>2</sub>Mn) Coatings for Different Automobile Applications**

**Project Leader:**

Engr. Muhammad Irfan, SE

**Project Associate(s):**

Engr. Badaruddin Soomro, JE  
Mr. Salman Ahmad, Sr. Tech

**Area(s) of Research:**

Thermal Spraying Technology

**Duration:**

06 Months

**Research Highlights:**

- The wear and friction properties of automotive parts are very important issue during sliding motion, and therefore, most of the parts are worn out during operation in different environments.
- The problem may be overcome by the application of hard coatings.
- Thermally sprayed coatings of (Fe based Mo coatings) are widely used to mitigate the wear & friction problem of automobile parts in different environments

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- After successful study, the coatings services will be provided for different automobile parts (synchronizing rings) for protection against wear, friction & corrosion.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Development of Sacrificial Metallic Coatings by Value Arc Technique for Submarine Applications- A New Cost-Effective Solution for Corrosion Protection of Subsea Structures**

**Project Leader:**

Engr. Badaruddin Soomro, JE

**Project Associate(s):**

Engr. Muhammad Irfan, SE  
Engr. Waqas Iqbal, JE  
Mr. A. Karim Aziz, TO  
Mr. Salman Ahmad, Sr. Tech

**Area(s) of Research:**

Thermal Spraying Technology

**Duration:**

01 Year

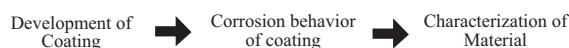
**Research Highlights:**

- Currently, protection of structures from corrosion used under sea water environments is very important issue.
- The estimated cost of corrosion is high, and calculates financial loss of about 3.4% of global GDP in accordance to the NACE report.
- The sacrificial coatings are cost effective solution for corrosion protection.
- Thermally sprayed coatings of (Zn, Al) are widely used to mitigate the corrosion problem of such type of structures of subsea environments.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- After successful study, the cost effective sacrificial metallic coatings services will be provided for submarine structures/parts for protection against corrosion



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Development of T7-A Spring Steel Material**

**Project Leader:**

Engr. Farooq Iftikhar, SE



**Project Associate(s):**

Engr. Muhammad Irfan, SE  
 Engr. Muhammad Nouman, JE  
 Engr. Ahmed Raza, JE  
 Mr. Saad Ayub, Sr. Tech.

**Area(s) of Research:**

Conventional Strategic Material

**Duration:**

06 Months

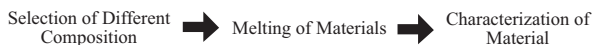
**Research Highlights:**

- Material Development (melting and casting)
- Heat Treatment
- Characterization (mechanical, chemical and hardness)
- Product development (spring)

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Research and Development on conventional strategic materials (spring steel) is the need of time on priority basis to achieve self-reliance and to develop materials that can substitute imported materials using indigenous resources.



**Name of Laboratory/ Centre/ Unit:**

PITMEM/ LLC

**Title of Project: Development & Optimization of Heating/Cooling Parameters for High Fragmentation Steel (HF-1) to Improve the Mechanical Properties of Material**

**Project Leader:**

Engr. Muhammad Nouman, JE

**Project Associate(s):**

Engr. Muhammad Irfan, SE  
 Engr. Farooq Iftikhar, SE  
 Engr. Ahmed Raza, JE  
 Mr. Saad Ayoub, Sr. Tech

**Area(s) of Research:**

Conventional Strategic Materials

**Duration:**

06 Months

**Research Highlights:**

- Material Development
- Pre heat treatment
- Forging
- Post heat treatment
- Characterization

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Research and Development on conventional strategic materials (spring steel) is the need of time on priority basis to achieve self-reliance and to develop materials that can substitute imported materials using indigenous resources.



**Name of Laboratory/ Centre/ Unit:**

UMW/ LLC

**Title of Project: Design & Fabrication of Novel Solar Condensers to Extract Pure Drinking Water from Air**

**Project Leader:**

Syed Zaheer Abbas, SO

**Project Associate(s):**

Mr. Umair Ejaz, Sr. Tech.  
 Mr. Saad Ayub, Sr. Tech.

**Area(s) of Research:**

Conventional Strategic Materials

**Duration:**

02 Years

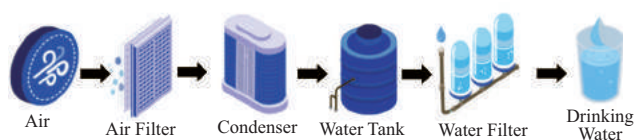
**Research Highlights:**

- Air is a cleaner platform than soil, and water production from the air eliminates the need for groundwater pumping and the fear of soil contamination.
- The quality and taste of the water that is processed using air-to-water technology is of the highest standard.
- Special types of DC inverter compressors are modified as condenser which gets power from solar plates.
- When atmospheric humidity condenses, it falls as rain, and therefore one can replicate this natural process of condensation by simulating the dew point, which thereby allows it to make water continuously, even in low humidity conditions.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Cost effective as compared to other mega projects of drinking water
- Choice of power options i.e., with wind, solar or generator
- Sustainable sources like wind and solar are environmentally and climate friendly with no carbon footprint
- One can create or harvest water directly where it is needed for decentralized water production to reduce or eliminate water distribution costs



**Name of Laboratory/ Centre/ Unit:**

UMW/ LLC

**Title of Project: Design & Fabrication of Solar Tracker to Improve Performance of Photovoltaic Solar Panels**

**Project Leader:**

Mr. Umair Ejaz, Sr. Tech.

**Project Associate(s):**

Syed Zaheer Abbas, SO  
Mr. Saad Ayub, Sr. Tech.

**Area(s) of Research:**

Energy Materials Applications

**Duration:**

06 Months

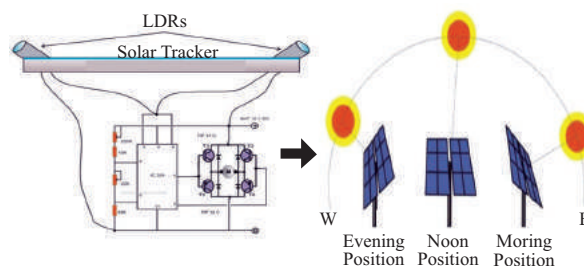
**Research Highlights:**

- The most-common applications for solar trackers are positioning photovoltaic (PV) panels (solar panels) and positioning space telescopes for solar absorption.
- By keeping the panel perpendicular to the Sun, more sunlight strikes the solar panel, less light is reflected, and more energy is absorbed, that is converted into power.
- A solar panel that is exactly perpendicular to the Sun produces more power than a solar panel that is not perpendicular, and small angles from perpendicular have a smaller effect on power output than larger angles.
- In addition, Sun angle changes north to south seasonally and east to west daily. As a result, although tracking east to west is important, north to south tracking has a less-significant impact.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Fabrication of systematic laboratory level and its feasibility study at commercial level.
- Investigation of components to reduce the price of product.
- By proper tracking system, the efficiency of an installed system can be increased upto 30% having great impact on socioeconomic development.



**Name of Laboratory/ Centre/ Unit:**

UMWLLC

**Title of Project: Design & Fabrication of Piezoelectric Transducer Systems for Displacement-Based Smart Applications**

**Project Leader:**

Syed Zaheer Abbas, SO

**Project Associate(s):**

Mr. Saad Ayub, Sr. Tech  
Mr. Umair Ejaz, Sr. Tech.

**Area(s) of Research:**

Energy Materials Applications

**Duration:**

06 Months

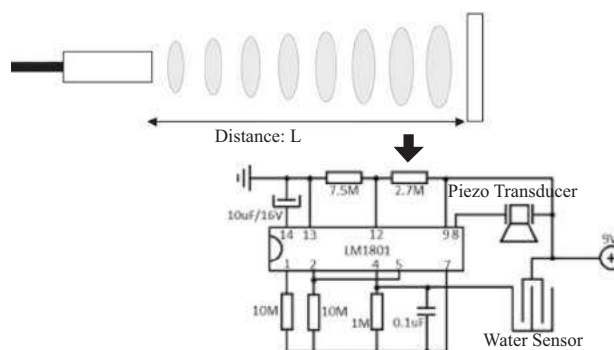
**Research Highlights:**

- Ultrasonic level sensors measure the distance to the target by measuring the time between the emission and reception.
- An optical sensor has a transmitter and receiver, whereas, an ultrasonic sensor uses a single ultrasonic element for both emission and reception.
- Transparent targets can be detected since ultrasonic waves can reflect off a glass or liquid surface and return to the sensor head.
- Detection is not affected by accumulation of dust or dirt.

**Source of Funding:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Presence detection is stable even for targets such as mesh trays or springs, even transparent objects.
- High speed detection like tank level indicator and several smart uses in domestic and industrial applications can make a strong impact on socioeconomic Development of the country.



**Name of Laboratory/ Centre/ Unit:**

UMW/ LLC

**Title of Project: Design & Development of Centrifuge having 3000 RPM and Outer Shell Diameter of 3 Feet**

**Project Leader:**

Engr. Bilal, JE  
Engr. Ali Imran, JE

**Project Associate(s):**

Engr. Abdullah Saqib, JE

**Area(s) of Research:**

Filtration Techniques, Liquid/Solid Separation

**Duration:**

03 Months

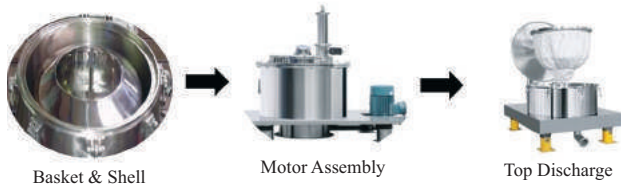
**Research Highlights:**

- Material selection.
- Sizing of shell and basket.
- Fabrication, operation.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- By getting expertise in the development of semi-industrial scale centrifuge machine, it may pave way for reduction of imports in this context.



**Name of Laboratory/ Centre/ Unit:**

UMW/ LLC

**Title of Project: Design & Development of Punch and Die for Universal Testing Machine (UTM) Samples of Rubber/Plastic**

**Project Leader:**

Engr. Ali Imran, JE

**Project Associate(s):**

Engr. Abdullah Saqib, JE

**Area(s) of Research:**

Dies & Moulds

**Duration:**

06 Months

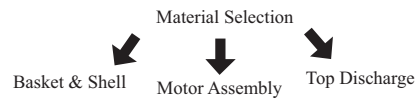
**Research Highlights:**

- Material Selection
- Design
- Fabrication, operation

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- By getting expertise in the development of punch & die for UTM samples, it may pave way for reduction of imports in this context.



**Name of Laboratory/ Centre/ Unit:**

UMW/ LLC

**Title of Project: Reverse Engineering of Imported Paddler Machine for De-Inking of Ink Pads Required in Elections**

**Project Leader:**

Engr. Ali Imran, JE /Head UMW

**Project Associate(s):**

Engr. Abdullah Saqib, JE

**Area(s) of Research:**

Reverse Engineering, Twin Rollers Press

**Duration:**

03 Months

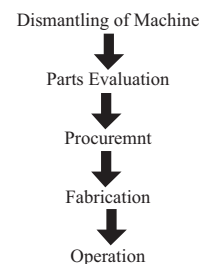
**Research Highlights:**

- Reverse Engineering
- Twin Rollers Press Development

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- By getting expertise in the development of paddler machine through local resources, it may pave way for reduction of imports in this context.



**Name of Laboratory/ Centre/ Unit:**  
UMW/ LLC

**Title of Project: Catalytic Conversion of CO<sub>2</sub> to Value Added Chemicals by Following H<sub>2</sub> Route.**

**Project Leader:**  
Engr. Ali Imran, JE

**Project Associate(s):**  
Engr. Abdullah Saqib, JE

**Area(s) of Research:**  
CO<sub>2</sub> utilization, catalytic conversion

**Duration:**  
01 Year

- Research Highlights:**
- Catalyst synthesis
  - Monolith preparation
  - Development of testing rig
  - Reaction monitoring
  - Product characterization.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- By getting expertise in the CO<sub>2</sub> vs H<sub>2</sub> reaction and having experimental set up within PCSIR, it may pave way for reduction of CO<sub>2</sub> as greenhouse gas.
- Understanding of reaction pathways and mechanisms may contribute for development of feasible mechanism for production of value-added chemicals as well.



**Name of Laboratory/ Centre/ Unit:**  
CEPS/ LLC

**Title of Project: UF and MF Membranes Fabrication Technology Development for Water Purification**

**Project Leader:**  
Dr. M. Hammad Khan, PSO

**Project Associate(s):**  
Dr. M. Tahir Butt, PSO

**Area(s) of Research:**  
Water Purification/ Material Science/ Nano-technology

**Duration:**  
1.5 Years

- Research Highlights:**
- Membrane separation is a state-of-the-art technology for water purification.
  - Commonly used ones are microfiltration (particle separation), ultrafiltration (purification), nano-filtration (desalination) and reverse osmosis membranes (desalination).
  - Objective will be to develop technology for simple membranes (for aqueous phase separations), as the project is focused at simple membrane fabrication.

**Source of Funding:**  
PSF

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Limited know-how about the fabrication of the membranes in Pakistan industrial sector as achieved in phases.
- This project will be focused on the polymer and water industry to improve the employment and better quality of life through pure water available to a common man.





**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Development of Colloidal Sulphur from Indigenous Sulphur Ore**

**Project Leader:**

Ms. Samreen Zahra, PSO

**Project Associate(s):**

Mr. Ansar Mahmood, SSO

Mr. Rashid Mahmood, SO

**Area(s) of Research:**

Mineral Beneficiation and Utilization

**Duration:**

01 Year

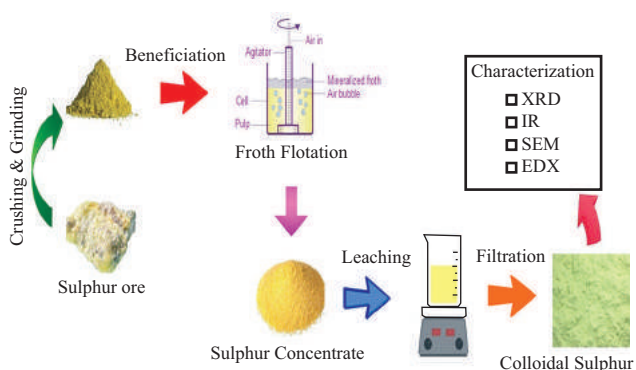
**Research Highlights:**

- Beneficiation of sulphur ore through froth flotation process to produce sulphur concentrate.
- Leaching of obtained sulphur concentrate.
- Preparation of colloidal sulphur from leach solution.
- Characterization of obtained product through X-ray diffraction technique, Infrared Spectroscopy, Scanning Electron Microscopy, Energy dispersive X-ray spectroscopy

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Colloidal sulphur has various industrial applications particularly in medicinal and pharmaceutical industry owing to its unique properties like fungicidal character.
- This project is aimed at the development of an improved method for the preparation of colloidal sulphur through exploitation of indigenous mineral resources employing a process which is simple and economically feasible for industrial scale production resulting in saving of foreign exchange.



**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Beneficiation of an Indigenous Low Grade Phosphate Rock of Hazara Division for Industrial Utilization**

**Project Leader:**

Mr. M. Arif Bhatti, PSO

**Project Associate(s):**

Mr. Uzma Zafar, PSO

Mr. Zahid Mehmood, PSO

**Area(s) of Research:**

Mineral Beneficiation and Utilization

**Duration:**

01 Year

**Research Highlights:**

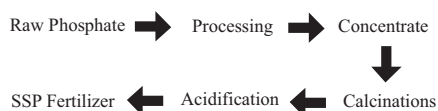
- Phosphorous, nitrogen and potassium are the three major plant nutrients of NPK fertilizers that are used to enhance the growth of food crops throughout the world.
- Phosphate compounds particularly superphosphates are used as fertilizers to make up its deficiency in the soil.
- Pakistan has limited reserves of phosphate rock in Hazara Division, wherein, low-grade phosphate ore needs processing to meet the requirements of the phosphate industry.

- The proposed study is aimed at the development of a suitable process for up gradation of indigenous low-grade phosphate rock of Hazara division to produce a commercial grade phosphate concentrate.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The project is very much relevant to national priorities, as uses the indigenous phosphate rock to produce value added end product of SSP at low cost utilizing indigenous technology.
- The developed technology would lead to establishment of local industry, employment of people, meet the local demand, import substitution and saving of foreign exchange.



**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Beneficiation Studies of Graphite from Hazara Division**

**Project Leader:**

Dr. Irfan Hafeez, PSO

**Project Associate(s):**

Mr. M. Arif Bhatti, PSO

**Area(s) of Research:**

Mineral Beneficiation and Utilization

**Duration:**

01 Year

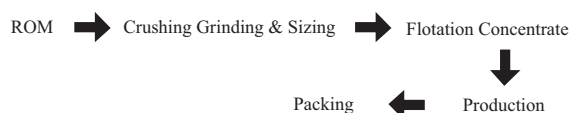
**Research Highlights:**

- This deposit of ore is newly explored by local persons of the area. Samples were procured from mine site and chemically evaluated which found positive for presence of graphite contents in low percentage.
- Beneficiation/ up-gradation studies are necessary on lab scale prior to its utilization.
- The lab scale investigation for up-gradation of ore may be healthy step for import substitution.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Presently, all the graphite concentrates and graphite-based products are being imported from different countries.
- Mineral beneficiation-based technology will be a better substitute to reduce the import, and will be useful for local mineral-based industry, human resources development and employment.



**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Process Development of Di-Calcium Phosphate (DCP) from Low-grade Indigenous Phosphate Rock**

**Project Leader:**

Ms. Uzma Zafar, PSO

**Project Associate(s):**

Mr. Arif Bhatti, PSO

**Area(s) of Research:**

Mineral Processing and Beneficiation

**Duration:**

01 Year

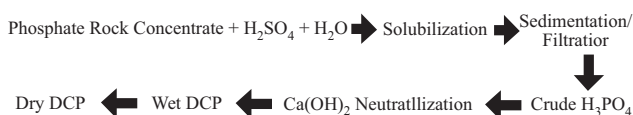
**Research Highlights:**

- Di-Calcium Phosphate (DCP) is the most used mineral supplement in animal/ poultry feed.
- A new process to produce DCP using phosphate rock has been planned.
- Beneficiation of low-grade indigenous phosphate rock containing 10-20% P<sub>2</sub>O<sub>5</sub> will be used for the preparation of industrial grade phosphate rock concentrate.
- The process combines leaching of concentrate feed followed by neutralization and selective precipitation of DCP, for good yield and feed grade product of high quality.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The main source of phosphorous is a relatively abundant phosphate rock raw material.
- The economic interest in producing DCP powder product directly from phosphate rock concentrate resides in its low price as compared to production from phosphoric acid.
- It is an extremely commendable from an economical viewpoint for the replacement of respective commodity import.



**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Beneficiation of Low-Rank Coal to Produce Good Quality Coal for Industrial Utilization**

**Project Leader:**

Mr. Zahid Mahmood, PSO

**Project Associate(s):**

Mr. M. Arif Bhatti, PSO

Mr. M. Asif Ali, Technician

**Area(s) of Research:**

Coal Beneficiation and Utilization

**Duration:**

01 Year

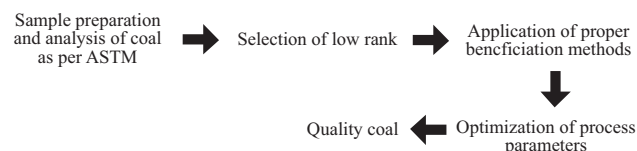
**Research Highlights:**

- In Pakistan, many coal depositions are immature.
- The ash and sulphur content have been found to be on the higher side with low GCV.
- The aim of this research work is to up-grade indigenous low rank coal i.e. arranged from salt range, Punjab.
- The objective of the project is to optimize process parameters to develop environmentally friendly clean coal fractions having reduced percentage of ash and sulphur and improved heating value.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The project will be helpful for utilization of indigenous low rank coal to produce good quality coal.
- Saving of valuable revenue.



**Name of Laboratory/ Centre/ Unit:**

MPRC/ LLC

**Title of Project: Beneficiation of Low-Grade Indigenous Iron Ore to Produce Metallurgical Grade Iron Concentrate and its Direct Reduction to Produce Iron Metal**

**Project Leader:**

Mr. M. Arif Bhatti, PSO

**Project Associate(s):**

Dr. Irfan Hafeez, PSO  
Ms. Uzma Zafar, PSO

**Area(s) of Research:**

Mineral Beneficiation and Utilization

**Duration:**

01 Year

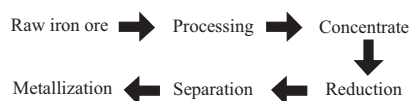
**Research Highlights:**

- Pakistan is endowed with million tons of iron ore, coal and limestone etc. and these indigenously available raw materials have not yet been utilized for the production of iron and steel.
- Midrex, Corex, HYL, Krupp-Renn and SL-RN are more famous method for production of iron and steel on commercial scale worldwide, and are considered as less capital intensive and environmental friendly.
- The proposed study is aimed at the development of a suitable process for up-gradation of indigenous low-grade iron ore of Hazara division to produce a metallurgical grade iron concentrate and subsequent utilization of it to produce iron metal by direct reduction method on lab scale.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The indigenous low grade iron would be upgraded to produce value added metallurgical iron concentrate. This concentrate would be used to produce iron metal at low cost which is great demand of the country.
- The developed technology would lead to establishment of local mineral industry, employment of people, meet the demand, import substitution and saving of foreign exchange.

- The project is relevant to national priority of self-reliance.

**Name of Laboratory/ Centre/ Unit:**

GCRC/ LLC

**Title of Project: Nanomaterial Based Coatings for Functional Impacts on Different Substrates**

**Project Leader:**

Dr. Phool Shahzadi, SO

**Project Associate(s):**

Mr. Akhtar Shahnaz, SO  
Dr. Bakht Bahadur Rana, CSO

**Area(s) of Research:**

Sheet Glass Industry

**Duration:**

02 Years

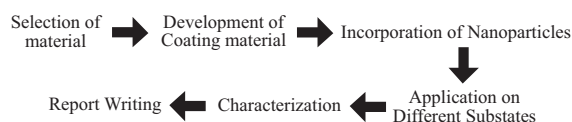
**Research Highlights:**

- Antimicrobial
- Strong hydrophobicity
- Hydrophobicity
- Excellent self-cleaning performance on contamination.
- UV Protective
- Abrasion-resistance
- Transparency

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Local sheet glass industry can get benefited from this project
- UV-stability enables functionality for a number of years, approximately the lifetime of the coated surface

- To boost up local glass Industry, to reduce unemployment, and to save foreign exchange



**Name of Laboratory/ Centre/ Unit:**  
CDLE/ LLC

**Title of Project: Design & Development of Corona Discharge Tube**

**Project Leader:**  
Mr. Pir Bukhsh Khan, SSO

**Project Associate(s):**  
Mr. Muhammad Saleem, SEO

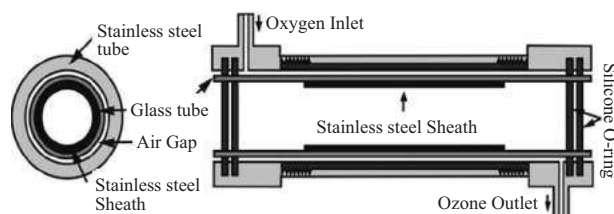
**Area(s) of Research:**  
Design Development of Laboratory Equipment

**Duration:**  
03 Months

- Research Highlights:**
- Centre for Development of Laboratory Equipment has already been developed Ozone Generator but its parts has to import from other country which cost much more.
  - The corona discharge tube going design first time in Pakistan.
  - Ozone, when used in the treatment of potable water, is reported as being 100 to 1000 times more effective at eradicating *E. coli* than the traditional, less environmentally friendly, disinfectants such as chlorine and chlorine dioxide.
  - Potentially dangerous contaminants such as cryptosporidium and coli form bacteria which can cause severe intestinal illnesses are also effectively dealt with. However, ozone is highly unstable, readily reverting.
  - A cylindrical geometry is normally used although planar electrode systems have been developed.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- This Research project will provide an in-depth analysis of the ozone applications, including wastewater, potable water and process water treatment; swimming pool and spa water disinfection; agriculture, aquaculture and hydroponics; laundry; landfill leach ate (water that has percolated through a solid and leached out some of the constituents) treatment; groundwater remediation; air and gas purification; odor control in poultry house, Salutory house, medicine; and homeland security.
- The design and development of Corona discharge tube at locally prove to be a good import substitute for the country.





## PCSIR Laboratories Complex, Peshawar (PLC)

**Name of Laboratory/ Centre/ Unit:**

FTC/ PLC

**Title of Project: Development of a Process for the Production of Liquid Fertilizer from Paper Mills Waste Water**

**Project Leader:**

Dr. Javid Ali, SSO

**Project Associate(s):**

Mr. Jehangir Shah, CSO

Dr. Javed Abbas, PSO

Dr. Inayatullah Rehman, SSO

Mr. Muhammad Ilyas, ST

**Area(s) of Research:**

Biotechnology

**Duration:**

02 Years

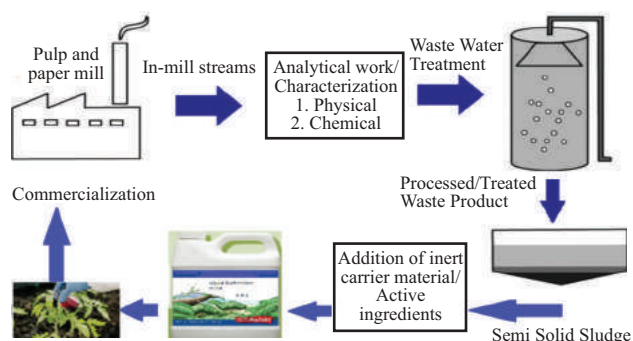
**Research Highlights:**

- To develop a process for the production of liquid fertilizer using pulp and paper mills waste water.
- To save energy, time and space during pulp and paper mills waste water treatment while replacing use of fresh water and chemical fertilizer during irrigation of economic crops.
- To measure the effectiveness of the formulated fertilizer on the growth of different crops/vegetables
- To determine the impact of prepared fertilizer on soil physical and chemical properties, carbon and nitrogen pools and transformations, nutrient leaching, and pollutant processes.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To enhance the agricultural production of the Province, thus increasing farm income.
- With the increase farm income economic activity would be generated which will benefit farmers, entrepreneurs and other stakeholders down the value chain. The project is economically viable as it has long term benefits.
- The project will result in boosting the economy of the province indirectly through increase in agricultural production through new interventions, boosting food industry and other food products through increased raw material.
- This project providing technical services by utilizing indigenous resources and saving precious foreign exchange in future.
- Produce local biotechnology industry needs for socio-economic growth of the country and associated spin-off technologies thereof.



**Name of Laboratory/ Centre/ Unit:**

FTC/ PLC

**Title of Project: Development of Aloe vera Based Blended Fruit Beverages**

**Project Leader:**

Dr. Rehman Ullah Khan, SO

**Project Associate(s):**

Dr. G.M Paracha, SO,

Dr. Abdul Wajid Khalil, SSO

Dr. Javed Abbas Bangash, PSO

**Area(s) of Research:**

Food Science

**Duration:**

02 Years

**Research Highlights:**

- Fruits are rich source of vitamins, organic acids,

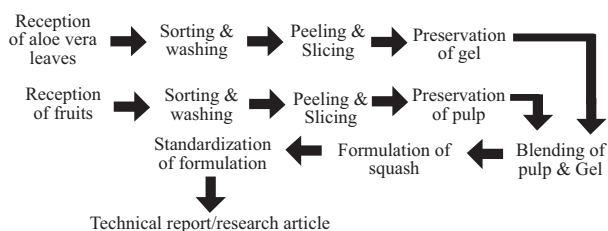
carbohydrates, phenolic acids and minerals. Most of the fruits are climacteric and ripen rapidly after harvest, this limits their storage, handling and transport potential. This can be overcome by processing the ripe fruits (mango, guava, peach etc) pulp to fruit drinks by blending with other medicinal plant like Aloe vera which will improve the sensorial and functional attribute of developed product.

- Blended drinks are good alternative for development of new products to provide benefit of taste, nutrition as well as medicinal properties. The blending of fruits like mango, guava, peach pulp/juice with Aloe vera gel in appropriate proportion could improve the nutritional and therapeutic quality of blended drink.
- Based on the above mentioned potential application, Aloe vera- mango/peach/guava blended drink with improved physicochemical and functional attributes will be studied.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- This project will help the food producers to select the technology/process for utilization of Aloe vera gel along with other fruits and the post harvest losses of the targeted fruits will also be minimized.
- This will enhance the income of the farmers by reducing their post harvest losses and improve their socioeconomic condition.
- The food processing, preservation and development of value added products i.e. aloe vera blended beverages will also help to control food security as well.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Identification and Phylogenetic Analysis of Medicinal Plant Species from Pakistan by DNA Barcoding Approach**

**Project Leader:**

Dr. Muhammad Qaisar, PSO

**Project Associate(s):**

Dr. Yousaf Ali, SSO

Mr. Numan Saleh Zada, RO

**Area(s) of Research:**

Molecular Biology, Medicinal Plants

**Duration:**

02 Years

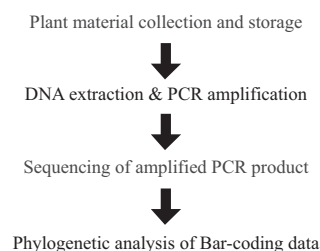
**Research Highlights:**

- DNA barcoding is a molecular technique which has made it possible to identify the herbs and to find the adulterants in HMPs. A DNA barcode is a standardized, short (< 1000bp) and highly variable segment of DNA which is compared to a reference database through a sequence alignment algorithm for species identification.
- In Pakistan, there is high need to develop herbal barcode library for adequate availability of reference sequence data and addition of nuclear markers. DNA barcoding can help the regulatory authorities to devise a mechanism for quality control and can largely support the herbal pharmaceutical industries to restore the eroded consumer confidence.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- To provide standardization and quality control of herbal medicines with established therapeutic value & to revive a traditional healthcare system facing extinction is an important task that can be fulfilled by DNA barcoding of medicinal plants.
- Due to lack of proper monitoring and regulatory system, there is a risk that many medicinal plants and their products sold in the market are taxonomically misidentified, mislabeled, or contaminated. The aforesaid situation emphasizes need for an effective and efficient identification system through barcoding these medicinal plants.
- Hence, where the barcoding will allow the pharmaceutical industry and consumers in Pakistan to authenticate the raw material, it will also provide reference sequences to the scientific community.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Cloning, Functional Expression and Purification of Recombinant *Taq* DNA Polymerase from *Thermus aquaticus***

**Project Leader:**

Dr. Muhammad Qaisar, PSO

**Project Associate(s):**

Dr. Yousaf Ali, SSO

Mr. Numan Saleh Zada, RO

**Area(s) of Research:**

Molecular Biology, Enzymology

**Duration:**

02 Years

**Research Highlights:**

- *Taq* DNA polymerase, originally isolated from *Thermus aquaticus* (*Taq*) is a widely used enzyme in molecular biology so far. The thermostable properties of this enzyme have contributed majorly to the specificity, automation, and efficacy of the polymerase chain reaction (PCR), making it a

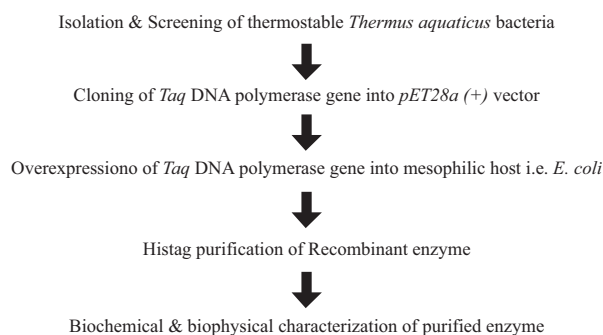
powerful tool for today’s molecular biology researches across the globe.

- The purification of *Taq* DNA polymerase from the native host results in low yield, more labor and time consumption. So far, all the existing methodologies are more laborious, time-consuming and require heavy expense. In proposed project, a novel approach will be used to purify the enzyme with relatively high efficiency, yield and minimum time consumption
- The project will help in finding novel approach to facilitate the availability of polymerases for molecular and diagnostic studies and provide alternative to high-cost commercially available *taq* polymerases.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Pakistan is spending a huge amount of money on the import of enzymes of high industrial value. The acceleration of industrial enzyme discovery will help to facilitate the development of new sustainable industrial processes as well as the burden on country’s weak economy. This will also help our government to reduce the capital investment in import of high value industrial enzymes.
- The proposed research project embodies multifarious impacts. On one hand it involves generation of trained manpower in the cutting-edge areas of molecular biology and biotechnology, and on the other hand it encompasses the application of a biotechnological process in industry for the production of value-added products.

- The proposed research also involved the use of the in-depth information on the advanced molecular biology techniques such as 16S rRNA based identification of microbes, identification and isolation of the genes encoding industrially important enzymes, their amplification and expression to obtain information about the structure and function of proteins that are catalytically active.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Commercial Scale Extraction of Guggul Sterones from *Commiphora mukul***

**Project Leader:**

Ms. Farina Kanwal, PSO

**Project Associate(s):**

Dr. Muhammad Qaisar, PSO  
 Mr. Muhammad Siddique Affridi, PSO  
 Dr. Yousaf Ali, SSO  
 Mr. Roohul Hussain, RO

**Area(s) of Research:**

Pharmaceutical/Neutraceutical

**Duration:**

01 Year

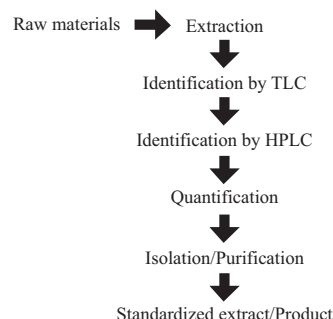
**Research Highlights:**

- Gum guggul is the oleoresin of *Commiphora mukul*, is used in incense, lacquers, varnishes, and ointments, as a fixative in perfumes, and in medicine. Therapeutic uses include treatment of nervous diseases, leprosy, muscle spasms, ophthalmia, skin disorders, ulcerative pharyngitis, hypertension, ischaemia, and urinary disorders.
- The purpose of the project is the commercial scale extraction of guggul sterone. As guggul sterone is procured from Pakistan by India and sold for European market. Therefore, to stop the flow of guggul sterone, it must be extracted on commercial scale and standardized for E and Z isomers and then supplied to European markets.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Several Indian companies supply gum guggul in bulk throughout the world while the raw material is easily available in Pakistan also. In order to save foreign exchange and also to end the market hold of India we aimed this study to prepare ISO certified excellent quality extract which meets all the requirements of International market.
- The product prepared from the indigenously available raw material would easily replace the Indian products & would be affordable by the poor people due to its low price. Also, it would earn a lot of money for the country after the export of the product to other countries.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Preparation of Iron Polymaltose on Semi-Pilot Plant Scale and the Commercialization/Leasing out of the Product/ Process**

**Project Leader:**

Dr. Mushtaq Ahmad, SSO

**Project Associate(s):**

Dr. Humaira Inayat, SSO  
 Dr. Muhammad Qaisar, PSO  
 Ms. Farina Kanwal, PSO  
 Dr. Kishwar Sultan, RO  
 Ms. Sidra Nisar, RO

**Area(s) of Research:**

Pharmaceutics/Health

**Duration:**

02 Years

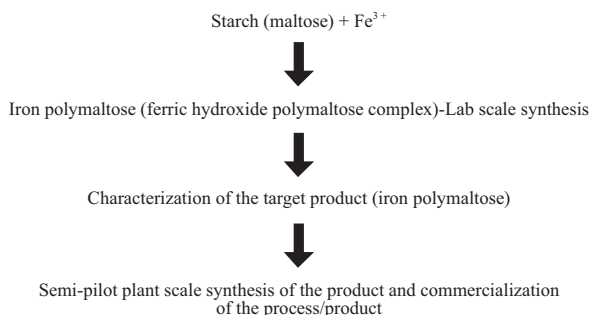
**Research Highlights:**

- Pakistan is already facing financial problems and utilizes sufficient money on import of medicine/raw material for curing and controlling different life-threatening diseases. Iron polymaltose is imported in hundreds of tons annually.
- In the present project, the product will be prepared from the indigenously available raw material. The process will be carried out under environmentally friendly conditions.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The product from locally available raw material would easily replace the drug imported for curing iron deficiency diseases.
- The development of the product/process would not only save a lot of money for the country but also that would be affordable by the poor people of the country due to its low price. Also, it would earn a lot of money for the country after the export of the product to other countries.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Isolation & Purification of Plants Active Constituent as Phytochemical Standards by HPLC**

**Project Leader:**

Mr. Muhammad Siddique Afridi, PSO

**Project Associate(s):**

Ms. Farina Kanwal, PSO

Dr. Yousaf Ali, SSO

Mr. Ruhul Hussain, RO

**Area(s) of Research:**

Pharmaceutical /Neutraceutical

**Duration:**

02 Years

**Research Highlights:**

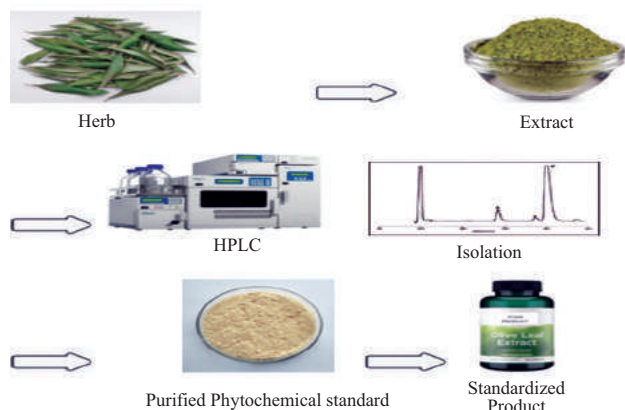
- Validation and standardization is a common problem and key challenge in botanicals and herbal preparations for their extraction, isolation and standardization. HPLC analytical techniques play an important role in standardization and quantification of plant extracts and their products.
- Extraction and isolation of bioactive compounds from plant extracts with the use of advanced HPLC chromatographic techniques. For this purpose, different important medicinal plants will be selected and studied.
- These isolated and purified active constituents will be used as phytochemical standards for HPLC analysis of plant extract, crude sample and finished product.

**Source of Funding:**

PCSIR In-house R&D



**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Using indigenous resources will benefit local people and industries. Economic condition of the local people will improve.
- It will be helpful to save foreign exchange.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Neuropharmacological and Therapeutic Medicinal Potential of Selected Medicinal Plants/Synthetic Drugs e.g, *Cannabis sativa*, *Valeriana wallichii*, *Hypericum perforatum***

**Project Leader:**

Dr. Farah Gul, SSO

**Project Associate(s):**

Dr. Yusuf Ali, SSO  
 Dr. Yaqoob ur Rehman, SO  
 Dr. Muhammad Qaiser, PSO

**Area(s) of Research:**

Pharmacology

**Duration:**

03 Years

**Research Highlights:**

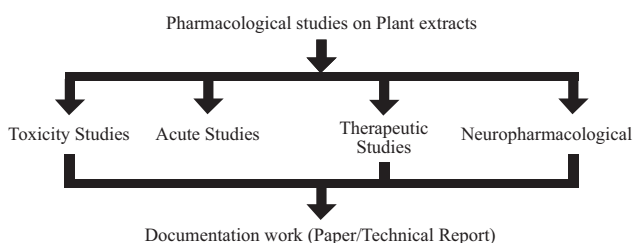
- Exploration of important indigenous medicinal plants

- To evaluate the therapeutic and neuropharmacological potential of selected plants, based on activities performed on experimental animals. Therefore, besides other pharmacological activities, the behavioral studies of plants are of importance for onward evaluation of drug with respect to neurological changes.
- Documentation of work in the form of national/international publication/reports.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The pharmacological investigations in the project will enhance the use of active plants by growing them on large scale and will open the avenues for export of products of these medicinal plants,
- Employment opportunities will be created for workers and will also reduce the burden of foreign exchange expenditure incurred on the import of related drugs.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Pilot Plant Scale Extraction of Oleuropein from Olive Leaves and its Standardization for Commercialization**

**Project Leader:**

Dr. Muhammad Qaiser, PSO

**Project Associate(s):**

Muhammad Siddique Afridi, PSO  
 Dr. Yousaf Ali, SSO

**Area(s) of Research:**

Solvent Extraction, Concentration and Standardization on HPLC.

**Duration:**

02 Years

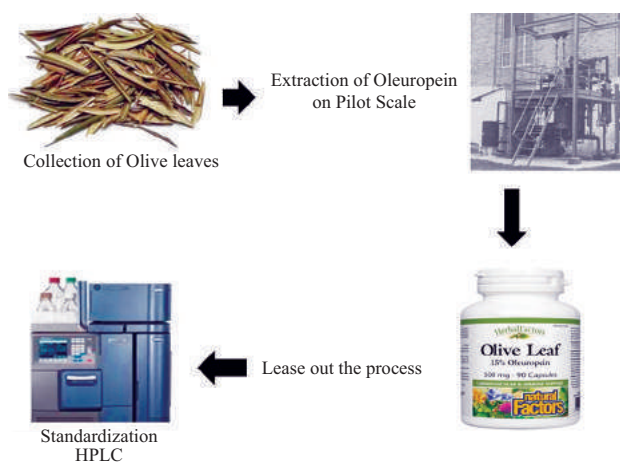
**Research Highlights:**

- Oleuropein is the most representative polyphenolic constituent of olive leaves. Several studies have shown a wide variety of in vitro and in vivo properties for oleuropein, including antioxidant, antiviral, antibacterial, and anti-inflammatory activities.
- Sufficient academic research has been performed to evaluate the beneficial health properties of olive leaf extract, but unfortunately no standardized product is available in local market. In Pakistan, 50 gm dried olive leaves are sold at Rs.150.
- Aim of this project is to produce standardized Olive Leaf Extract on commercial scale in already available facilities of extraction in our Pilot Plant and ultimately standardize the extract using the newly installed State of the Art HPLC.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Demand for the standardized herbal extracts is increasing day by day. Thus commercialization of

the developed product will promote local business, create more job opportunities. Once established locally, the product will be able to be exported to Asian and European countries.



**Name of Laboratory/ Centre/ Unit:**

MBC/ PLC

**Title of Project: Strengthening of Lab for the Quantification of Pesticides and Antibiotic Residues in Different Varieties of Honey Leading to ISO Certification**

**Project Leader:**

Dr. Muhammad Akram, PSO

**Project Associate(s):**

Dr. Muhammad Qaisar, PSO  
Dr. Yousaf Ali, SSO

**Area(s) of Research:**

Analytical Organic Chemistry/Food safety

**Duration:**

02 Years

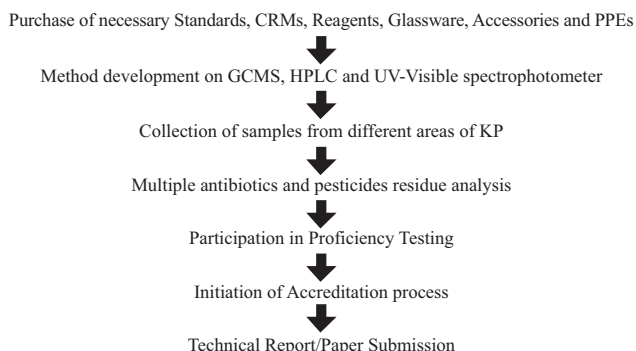
**Research Highlights:**

- Unfortunately, there is not a single Honey Testing Lab in Khyber Pakhtunkhwa which is ISO-17025 certified for Pesticides/Antibiotics Residue analysis. On the other hand, KP is very rich in Honey production and many people are engaged in Honey Business.
- In order to meet the quality criteria, set by Europe and Gulf Countries the exporters are compelled to get their samples tested from foreign labs at the expense of foreign exchange and wastage of time.
- In this project, effort will be made to strengthen the lab for the quantification of pesticides and antibiotic residues in different varieties of Honey leading to ISO Certification

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- This project will be helpful to provide state of the art testing facility at the door step to the Exporters of Honey which will ultimately enhance the export and revenue generation of the country.



**Name of Laboratory/ Centre/ Unit:**  
MSC/ PLC

**Title of Project: Development of Low-Cost Liquid Fertilizers for Agricultural Applications**

**Project Leader:**  
Dr. Engr. Waheed-Ur-Rehman, SE

**Project Associate(s):**  
Mr. Jehangir Shah, CSO  
Ms. Asma Yamin, SSO  
Mr. Sohail Noor, JTO

**Area(s) of Research:**  
Production of Liquid Fertilizers

**Duration:**  
01 Year

**Research Highlights:**

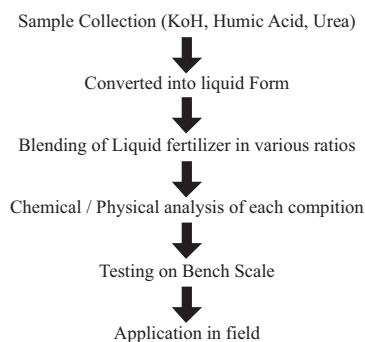
- Now-a-days, farmers can choose between granular and liquid fertilizers to ensure larger, healthier yields.
- When granular fertilizers are applied, they can be dropped in patterns throughout fields that are not

necessarily uniform, which simply is a matter of it being a solid rather than a liquid.

- By contrast, liquid fertilizers can seep into the soil immediately and plants are given faster access to the nutrients. Some plants will give results from this application almost immediately.
- Liquid fertilizers are better at balancing the pH of the soil based on the chemicals they are delivering. Nitrogen, for example, can be incredibly helpful in the right amounts but also can kill plants if over applied. Potassium-based fertilizers can be helpful, too, but only in the right amount. Liquid options can make for healthier plants, which is another reason why they often are a smart option for crops.
- Application of liquid fertilizer proves easier and less time-consuming than granular fertilizer application.
- Efforts will be made to make a cost-effective product that will meet the needs of low-income farmers in rural areas.

**Source of Funding:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Instead of imported chemicals, indigenous raw materials will be used, that will help in saving foreign exchange as well as provide an opportunity to exploit the indigenous resources.
- Liquid fertilizers developed in PCSIR will be an economical option for the farmers.
- Training will be given to local farmers to prepare their own liquid fertilizers.



**Name of Laboratory/ Centre/ Unit:**

ESC/ PLC

**Title of Project: Design & Development of Salt Spray Chamber**

**Project Leader:**

Engr. Noor Faraz Khan, J.E

**Project Associate(s):**

Mr. Muhammad Bilal Afzal, JTO  
 Engr. Ahmad Ali, PE  
 Engr. Muhammad Younas, PE  
 Engr. Fazal Subhan, JE  
 Mr. Muhammad Usman, RA

**Area(s) of Research:**

Metallurgical Testing

**Duration:**

01 Year

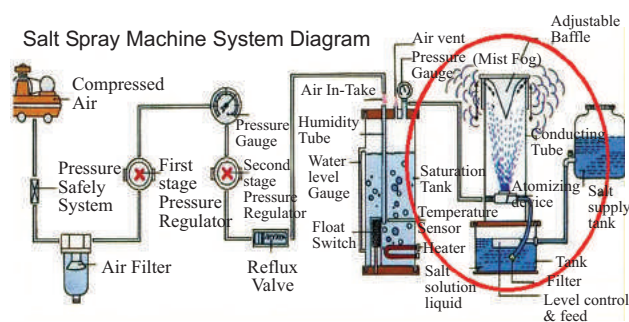
**Research Highlights:**

- Salt Spray Chamber Machine is generally used in various sectors like Industry, Marine, Automotive, Aircraft and military equipment. Increasing need from electronics industry is also propelling the salt spray chamber market. Salt spray chamber plays a vital role in the electronics industry for the testing of electronic components such as electric penal, IC, PCB, switches, etc.
- Design &Development of indigenous Equipment for testing
- Study of Corrosive environment for different materials & Improvement in the life span of ferrous and non-ferrous metals

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The proposed project will increase the testing capacity as large number of customers are refused due to unavailability of this vital facility.
- The proposed project will provide an opportunity to the local community and industry to adopt the indigenous technology for development of testing facility.
- Industries and entrepreneurs will receive guidance and technical expertise on the installation of the commercial plants based on the prototype equipment developed in this project.
- Additional benefits will include generation of employment opportunities, utilization of indigenous resources, and curtailing the huge foreign exchange spent on import of this equipment.



**Name of Laboratory/ Centre/ Unit:**

FTC/ PLC

**Title of Project: Development a Process for the Production of Trichoderma Based Biofertilizer (TBF) Formulation**

**Project Leader:**

Dr. Javid Ali, SSO

**Project Associate(s):**

Dr. Inayatur Rehman, SSO  
 Dr. Javed Abbas, PSO  
 Mr. Muhammad Ilyas, Sr. Tech

**Area(s) of Research:**

Biotechnology

**Duration:**

02 Years

**Research Highlights:**

- Biofertilizer can reduce the excessive use of chemical fertilizers, environmental pollution and helps in reduction of farm management costs. Biofertilizers help us to eliminate the contamination of drinking water and could be considered as

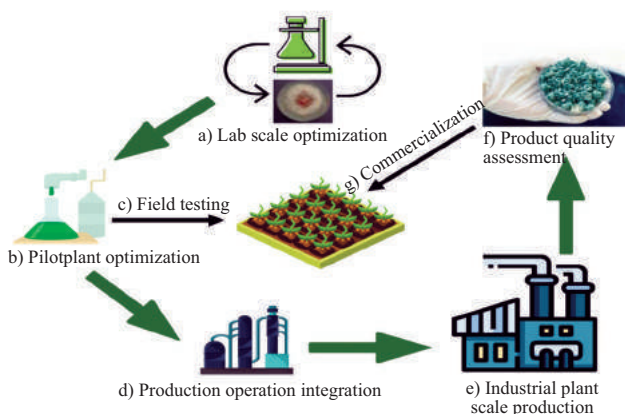
emerging alternatives of the conventional fertilizers.

- Through this project, a laboratory scale production/preparation of *Trichoderma* based biofertilizer research product, its testing and training will be set up to train the farmers/Agri-entrepreneurs. In view of the priority for the promotion of organic farming, special focus needs to be given for the setting up of *Trichoderma* based bio-pesticide unit.
- In present project, quality control of end product and Shelf life studied of different formulation will be performed.
- Awareness campaigns, meeting with farmers and stockholders.
- Publications (Technical reports, patents and research articles).

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The major beneficiaries will be farmers/entrepreneurs practicing crop production. Other beneficiaries shall include unemployed youth and weaker section as the developed technologies shall provide employment opportunities.
- To provide technical services by utilizing indigenous resources and saving precious foreign exchange.
- To produce local biotechnology industry needs for socio-economic growth of the country and associated spin-off technologies thereof.





## PCSIR Laboratories, Islamabad (PLI)

**Name of Laboratory/Centre/Unit:**

PLI/ PCSIR

**Title of Project: Production of Microbial Biopolymer (Polyhydroxy alkanate (PHA) from the Utilization of Eco-friendly Low-Cost Sustainable Carbon Sources**

**Project Leader:**

Ms. Fouzia Hussain, SSO

**Project Associate(s):**

Dr. Tahseen Aslam, PSO

Dr. Uzma Rashid, SSO

Ms. Razia Kalsoom, SSO

Ms. Ammara Kanwal, SO

**Area(s) of Research:**

Microbiology/Biotechnology

**Duration:**

02 Years

**Research Highlights:**

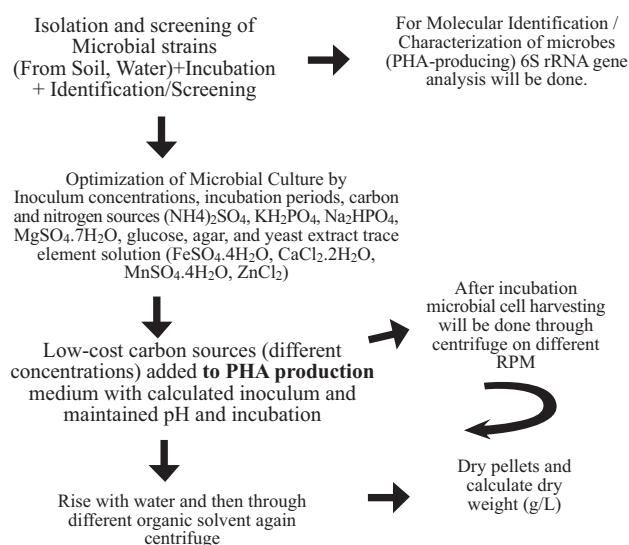
- Poly-R-3-hydroxybutyrate (PHB) was the first PHA family member reported as PHAs synthesized mainly by microbes have properties that are similar to those of synthetic polymers, they are widely used in the production of biopolymers or bioplastics.
- Microbial Polyhydroxyalkanoates (PHAs) can be produced from many renewable resources under varied environmental conditions, which reduces the cost of production.
- Potential therapeutic applications of PHA includes medical implant such as heart valve tissue engineering, vascular tissue engineering, bone tissue engineering, cartilage tissue engineering, nerve conduit tissue engineering as well as drug delivery carrier matrix. PHA implants are found luckily not to cause carcinogenesis during long-term implantation. In short the relatively low cost

of and renewable nature make this class of material particularly attractive to high-value sectors as for the pharmaceutical and biomedical industries

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- With the increasing interest in minimization/elimination of waste and adoption of sustainable processes, the development of green chemistry approaches is desirable. Biopolymers can extensively use as capping and reducing agent for the synthesis of various nanoparticles.
- Biopolymers can be used in food coatings, food packaging materials, and encapsulation matrices for functional foods and can provide unique solutions to enhance product shelf life while also reducing the overall carbon footprint related to food packaging. Within food-related applications, these bio-based materials are particularly useful in three main areas: food packaging, food coating, and edible films for food and encapsulation.



**Name of Laboratory/ Centre/ Unit:**

PLI/ PCSIR

**Title of Project: Evaluation of Dietary Fiber's Role in Management of Urea Metabolism in Biological Systems**

**Project Leader:**

Dr. Uzma Rashid, SSO

**Project Associate(s):**

Ms. Ammarah Kanwal, SO

Ms. Fouzia Hussain, SSO

Ms. Razia Kulsom, SSO

Dr. M. Tahseen Aslam, PSO

**Area(s) of Research:**

Natural product Chemistry, Bio-Technology, Bio-Inorganic Chemistry

**Duration:**

02 Years

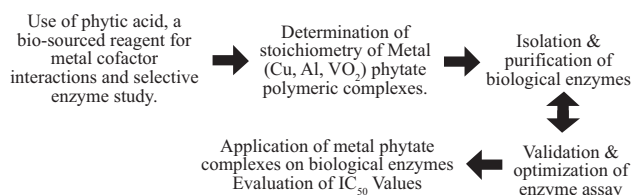
**Research Highlights:**

- To address the effect of dietary fibers and metals phytate role in degradation of urea as Pakistan ranks eight in the list of countries with a high rate of kidney diseases and urea has been routinely monitor as a surrogate marker of renal function.
- To promote economic, organic and indigenous treatment way for the said problem.
- The study involves the isolation, purification and characterization of metal-phytate (substrate) from food fibers and their application on Urease enzyme.
- As kidney patient face impaired urea digestion; this research would provide natural and riskless remedy by means of using food fibers.
- An Economic and ecofriendly choice for management of urease activity in patients with renal impairment.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The project finding would be helpful in order to formulate an alternative approach for use of food as a contemporary medicine for the treatment of urea in impaired renal function population of Pakistan.
- It is the need of time to approach alternative, riskless and ethnic remedial measures as medicines. The study would serve as a food therapy for Urease management and provide a replacement of conventional drugs used for renal diseases that may damage the liver.
- Being economical and ecofriendly process, this would be a worthy addition of Nutraceutical industry.



**Name of Laboratory/ Centre/ Unit:**

PLI/ PCSIR

**Title of Project: Formulation of Value-Added Energy Drink with Fennel Seed Extract**

**Project Leader:**

Ms. Razia Kalsoom, SSO

**Project Associate(s):**

Ms. Ammarah Kanwal, SO

Ms. Fouzia Hussain, SSO

Dr. Uzma Rashid, SSO

Dr. M. Tahseen Aslam, PSO

**Area(s) of Research:**

Product Development and Pharmacological Study.

**Duration:**

02 Years

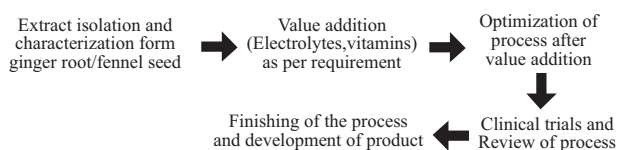
**Research Highlights:**

- To formulate a drink for proper supplies an adequate amount of electrolytes. The major ones are sodium, potassium, and chloride; others include calcium, magnesium, phosphate, and bicarbonate
- To optimize the extraction procedure for yield of phenolic compounds from fennel seeds, its powerful antioxidant activity and a super-coolant make the electrolyte drink incredible and reduce the risk of or another heat-related illness.
- To evaluate the extraction procedure on the basis of antioxidant activity, total phenolic content and total flavonoids contents.
- To supply the perfect amount of electrolytes and other minerals needs for body which losses in the hot summer or sweating.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The electrolytes energy drink with Ginseng root / fennel seed extract can reduce the and other heat-related illness in hot summer season. The drink acts like coolant to stomach and body.
- Transfer of the developed process to beverage industries will provide new opportunity for them to utilize the energy drink based on some natural extract.



## PCSIR Laboratory, Quetta (QL)

**Name of Laboratory/ Centre/ Unit:**

QL/ PCSIR

**Title of Project: Study /Evaluation of Economic Potential of Laterites, Uthal-Bela, Lasbela District, Balochistan**

**Project Leader:**

Mr. Zaheer Ud Din, SSO

**Project Associate(s):**

Mr. Khurum Shazad, SO

Mr. Muhammad Aamir Raza, JEO

**Area(s) of Research:**

Laterites

**Duration:**

02 Years

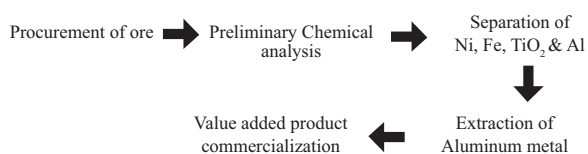
**Research Highlights:**

- Study / Evaluation of Laterite ore
- Qualitative and quantitative characterization of laterites
- To utilize the indigenous coal resources for economic growth of the province and the country

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Value addition for Mine Business
- Utilization of natural resources (Soil treatment, Brick Manufacturing and use in Cement industry)
- To minimize the import of Aluminum metal & save the foreign exchange



## PCSIR Fuel Research Centre, Karachi (FRC)

**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of Project: Process Development to Separate Phenolic Compounds from Coal Based Liquid Oils**

**Project Leader:**

Dr. Naheed Kausar, CSO

**Project Associate(s):**

Mr. Amanat Ali, SO

Engr. Ali Gohar, JE

Mr. Nadir Buksh, SO

Syed Najam Ul Islam, TO

**Area(s) of Research:**

Chemical Process Development/Production

**Duration:**

02 Years

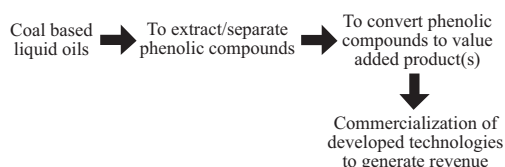
**Research Highlights:**

- The coal based liquid oil mostly contain carboxyl, phenol and carbonyl functional groups, the separation of phenolic compounds excluding carbonylic and carboxylic functional groups is an important and considerable ongoing task all over the world to obtain the maximum yield of highly pure phenolic compound of various properties.
- Development of a process to separate phenolic compounds of high purity by utilizing cracking, extracting and distillation techniques
- Utilization of separated phenolic compounds to prepare various value-added products

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Process development to prepare value added products (such as Water Repellent Product to Treat Wood for Protecting Weather Damage and to Improve Grain Definition and textile dyes etc.) utilizing the phenolic compounds separated from fuel by-products/fractions
- Profit generation by commercialization of the developed technologies by leasing out the developed technologies / process to SMEs
- Publications in the form of patent(s) and paper(s) to generate income in the form of royalty and leasing out the developed technologies
- To produce skilled manpower for producing the value added products of controlled qualities.
- To provide consultancy in the relevant field to clients by enhancing the expertise of FRC technical staff reviewing the published information and to develop viable technologies.



**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of Project: Development of an Alternate Method of Unburned Carbon Measurement in Fly Ash Exploiting Thermo gravimetric Approach and its Comparison with ASTM Standard Test Method of Loss-on-Ignition (LOI)**

**Project Leader:**

Dr. Anila Sarwar, SSO

**Project Associate(s):**

Mr. Santosh Kumar, PSO

Syed Kabir Shah, SSO

**Area of Research:**

Analytical Methodology /testing method development & validation

**Duration:**

02 Years



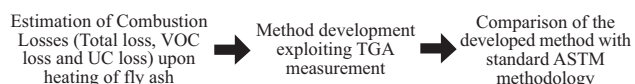
**Research Highlights:**

- It is well reported that standard LOI methods overestimated unburned carbon by at least 20% due to thermal decomposition of minerals, and volatile organic compounds in fly ash. Therefore, there is a strong need to improve the accuracy of unburned carbon determination in coal fly ash.
- This research propose a wet chemical alternative method to measure unburned carbon based on TGA.

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Development of an alternative method to measure unburned carbon based on TGA with improved accuracy.
- This finding has implications in the use of LOI to calculate combustion losses and monitor fly ash quality by power plant managers.
- Profit generation by sale out technology.
- Publication in the form of patent(s) and paper(s).



**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of Project: Process Development to Produce Elements/ Chemicals of High Purity (up to 99.99%) Utilizing Low Grade Materials Through an Energy-Efficient and Inexpensive Path**

**Project Leader:**

Dr. Naheed Kausar, CSO

**Project Associate(s):**

- Mr. Amanat Ali, SO
- Engr. Ali Gohar, JE
- Mr. Nadir Buksh, SO
- Syed Najam Ul Islam, TO

**Area(s) of Research**

Chemical Process Development/Production

**Duration:**

02 Years

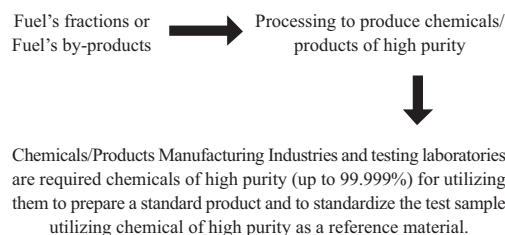
**Research Highlights:**

- To develop viable processes to manufacture silicone / Humic acid / and other chemicals of high purity.
- To develop technologies to manufacture the commercially viable materials from low-quality materials through an energy-efficient and inexpensive path.

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- To develop process to produce chemicals/products of high purity such as Silicon and Humic Acid etc.
- Profit generation by commercialization of the developed technologies by leasing out the developed technologies/process to SMEs
- Publications in the form of patent(s) and paper(s) to generate income in the form of royalty and leasing out the developed technologies
- To provide consultancy in the relevant field to clients by enhancing the expertise of our technical staff reviewing the published information and to develop viable technologies.



**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of Project: A Study on Improving the Properties of Coal Water Slurry and Coal Water & Oil Slurry in Order to Utilize the Indigenous Coal of Various Qualities for Producing Efficient and Clean Fuel for Pakistani Industrial Sector**

**Project Leader:**

Dr. Naheed Kausar, CSO

**Project Associate(s):**

Mr. Amanat Ali, SO

Engr. Ali Gohar, JE

Mr. Nadir Buksh, SO

Syed Najam Ul Islam, TO

**Area(s) of Research:**

Processing of coal to develop clean fuel

**Duration:**

02 Years

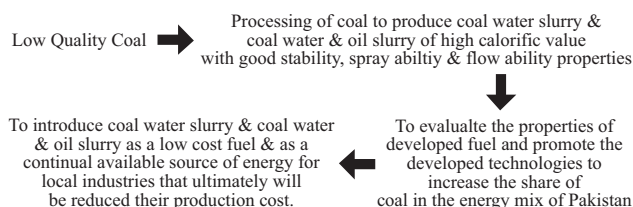
**Research Highlights:**

- Coal water slurry and coal water & oil slurry technologies are growing well to utilize the coal of various qualities as a substitute for oil. Most of Pakistani Coal has high ash and sulfur contents with medium to low calorific value. When low quality coal is burned, it is polluted the environment heavily, it has a lot of ash and slag, and its heating rate is not high enough for industrial use.
- The coal water slurry technology is the most marketable clean coal technology and the calorific value and other properties of coal water slurry fuel could be enhanced by adding oil and other additives such as dispersing and stabilizing agents etc.
- To develop a clean fuel of high calorific value with good stability, spray ability and flow ability utilizing indigenous coal of various qualities, evaluate the properties of developed fuel and promote the developed technologies to increase the share of coal in the energy mix of Pakistan
- To introduce coal water slurry and coal water & oil slurry as a low-cost fuel and as a continual available source of energy for local industries that ultimately will be reduced their production cost.

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Process development to prepare value added products (coal water slurry and coal water & oil slurry of high calorific value with good stability, spray ability and flow ability) utilizing indigenous coal of various qualities
- Profit generation by commercialization of the developed technologies by leasing out the developed technologies / process to SMEs
- To provide consultancy in the relevant field to clients by enhancing the expertise of FRC technical staff reviewing the published information and to develop viable technologies.



**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of the Project: To Develop Analytical Testing Facilities for Liquid Fuel at FRC**

**Project Leader:**

Mr. Santosh Kumar, PSO

**Project Associate(s):**

Mr. Amanat Ali, SO

Mr. Nadir Buksh, SO

**Area of Research:**

Analytical Testing of Liquid Fuel& Furnace oil etc.

**Duration:**

02 Years

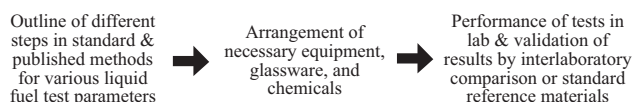
**Research Highlights:**

- At present the scope of analytical testing at FRC is limited to Solid Fuel (Coal, Coke). The purpose of this study is to extend the scope of analytical testing to liquid fuels and enhance self-generated earning of FRC.
- In this research proposal various published and standard procedures would be compared to implement and adopt the methods that could be performed utilizing the existing equipment and facilities.

**Funding Agency:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- To extend the scope of analytical testing for liquid fuels (Petroleum Products and furnace oil etc.) for enhancing the self-generated earning of FRC PCSIR Unit.
- To extend the scope of advisory and quality control services to manufactures, processors and consumers
- To complete all formalities for receiving ISO 17025 :2017 certification from PNAC
- Development of facilities to provide quality and certified testing reports to our existing and potential clientele
- Induction of new tests in the scope of analytical testing of FRC
- To increase in self-generated earning and number of clients of FRC



**Name of Laboratory/ Centre/ Unit:**

FRC/ PCSIR

**Title of Project: Improvement in Commercial Grade Diesel Fuel Quality**

**Project Leader:**

Dr. Anila Sarwar, SSO

**Project Associate(s):**

Syed Kabir Shah, SSO  
Mr. Santosh Kumar, PSO

**Area of Research:**

Fuel & Energy

**Duration:**

02 Years

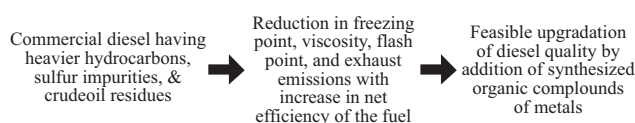
**Research Highlights:**

- Exploitation of different additives to blend with diesel fuel to achieve many advantages such as lower emissions and higher lubricity attributes.
- Upgradation of commercial grade diesel fuel.
- Trial batch production of the proposed fuel
- Quality control of blended fuel

**Funding Agency:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- Quality controlled Trial batch production of the blended fuel
- Increase the self-generated earning of FRC by sale out technology
- Publication in the form of patent and paper



## PCSIR Leather Research Centre, Karachi (LRC)

**Name of Laboratory/ Centre/ Unit:**

LRC/ PCSIR

**Title of Project: Natural Dyeing of Cotton & Wool Fibre Using Bio-Mordant for Sustainable Development**

**Project Leader:**

Dr. Muhammad Kashif Pervez, CSO

**Project Associate(s):**

Ms. Tahir Ayaz, SSO  
 Ms. Sarwat J. Mahboob, SSO  
 Dr. Rajkumar Dewani, SSO  
 Mr. Sikandar Ali Somroo, JTO

**Area of Research:**

Leather Auxiliaries

**Duration:**

02 Years

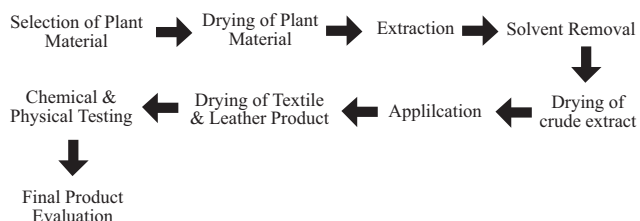
**Research Highlights:**

- To develop eco-friendly approach of dyeing for leather and textile.
- To modify the hue and shades by the mixing of natural extracted color from Indigenous sources with different bio-mordant.
- To increase the color fastness properties of the dyed matrixes i.e., leather and textile.
- Application of modified hues and shades on leather and textile as an eco-friendly approach.

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The synthetic dyes have been imported from other countries to Pakistan since long that is not only a burden on our economy but there is a great concern of associated toxic effects too.
- Most of the synthetic dyes and their metallic salts created toxicity in the environment, human and in animal.
- The proposed R&D project will be helpful to develop cost-effective and marketable dyes application utilizing indigenous natural resources with less or no toxic effects.
- Some natural dyes are identified which can be used as an alternative of synthetic dyes which is beneficial and utilization of indigenous sources.
- Domestic natural dyes from natural sources will be cost-effective and eco-friendly and as well as good dye stability.



**Name of Laboratory/ Centre/ Unit:**

LRC/ PCSIR

**Title of Project: Designing the Road Map Towards the Sustainability for Pakistan Leather Industries**

**Project Leader:**

Dr. Rajkumar Dewani, SSO

**Project Associate(s):**

Dr. M. Kashif Pervez, CSO  
 Ms. Tahira Ayaz, SSO  
 Ms. Sarwat J. Mahboob, SSO  
 Mr. Sikandar Ali Somroo, JTO

**Area of Research:**

Leather Industries

**Duration:**

02 Years

**Research Highlights:**

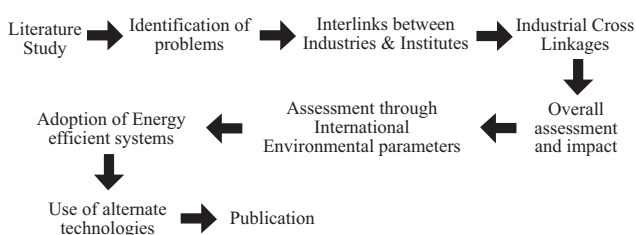
- Identification of issues confronted by Pakistani industrial sector.

- Interlinking of different industries through waste and by-product utilization principle.
- Addressing common issues related good industrial practices and energy efficiency.
- Suggestion of remedies and directions for sustainable industrial productions.
- Assessment of expected outcomes from important measures.

**Funding Agency:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- The synthetic dyes have been imported from other countries to Pakistan since long.
- The proposed R&D project will develop cost-effective and marketable dyes application utilizing indigenous natural resources with less or no toxic effects.
- Some natural dyes are identified that can possibly be used as an alternative of synthetic dyes which is beneficial and utilization of indigenous sources.
- Domestic natural dyes from natural sources will be cost-effective, and eco-friendly with good dye stability.



**Name of Laboratory/ Centre/ Unit:**

LRC/ PCSIR

**Title of Project: Special Anti-Microbial Tanning Agents Utilizing Indigenous Plant Resources**

**Project Leader:**

Mr. Barkat Ali Solangi, PSO



**Project Associate(s):**

- Dr. Hafiz Rub Nawaz, CSO
- Dr. M. Kashif Pervez, CSO
- Ms. Uzma Nadeem, SEO
- Dr. Beena Zehra, SSO
- Mr. Muhammad Zeeshan, PT

**Area of Research:**

Leather

**Duration:**

02 Years

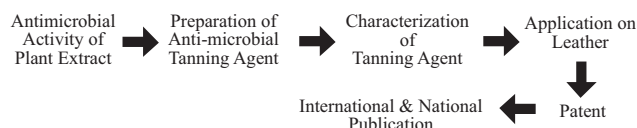
**Research Highlights:**

- Conversion of indigenous plant resource into tanning agent.
- Application of above tanning agent to prepare anti-microbial leather for multi-purpose usage.

**Funding Agency:**

PC SIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Tanning is a fundamental process for conversion of raw hide/skins into leather form that is an industrially demanded product which has numerous applications such as, in making of shoes, leather goods, furniture, aprons, hand bags, watches, decorative items, and many other daily use items.
- The current demands of leather industry are to minimize the pollutants and harmful chemicals from tannery processes towards green approach.
- The execution of the proposed project would be beneficial in for quality leather production at the cost of environmental remediation.

**Name of Laboratory/ Centre/ Unit:**

LRC/ PCSIR

**Title of Project: Preparation of UV-Resistant, Anti-Soiling Efficient Acrylic Polymer Binder for Leather Shoes**

**Project Leader:**

Dr. Beena Zehra, SSO

**Project Associate(s):**

Mr. Muhammad Zeeshan, PT

Mr. Raja Asad, S.T

**Area of Research**

Leather

**Duration:**

02 Years

**Research Highlights**

- Conversion of Cheap Acrylic Source into Efficient Polymer Binder
- Characterization and Application of Acrylic Polymer on Leather

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Leather Shoes require proper protection against various conditions such as, moisture, dust, and stability against cracking, etc.
- The leather binders/top coats are used to strengthen the leather which is being crack due to internal fibre changes.
- Traditional, poly-urethane based binders are very high cost and have natural toughness and low flexibility.

- The acrylic based binders have urgent need due to the fundamental anti-soiling effect and thermal and hydrolytic stability, ultraviolet resistance to degradation.
- Thus, the substitution of costly binders through the cheap and efficient binders will be very beneficial for the leather industries.



**Name of Laboratory/ Centre/ Unit:**

LRC/ PCSIR

**Title of Project: Production of Biological Based Fatliquor on Semi-Pilot Scale Level for Pakistan Leather Industry from Indigenous Sources**

**Project Leader:**

Dr. Muhammad Kashif Pervez, CSO

**Project Associate(s):**

Ms. Tahira Ayaz, SSO

Mr. Barkat Ali Solangi, PSO

Ms. Sarwat J. Mahboob, SSO

Dr. Rajkumar Dewani, SSO

Mr. Adeel Khalid Khan, Director, M/s. Hostachem Pvt. Ltd.

Mr. M. Imran, QAM, M/s. Hostachem (Pvt), Ltd.

**Area of Research:**

Leather Auxiliaries (Fatliquor)

**Duration:**

01 Year

**Research Highlights:**

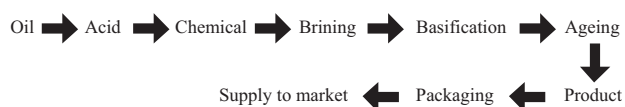
- Production of vegetable oil based fatliquor on semi-pilot scale from easily available raw materials (Vegetable Oils) in the local market of Pakistan.
- To provide the assistance to the Pakistani Chemical Manufacturing Industries in the manufacturing of leather chemicals (fatliquor) locally. It would be beneficial to leather and allied industries in Pakistan.
- To check the chemical properties of developed fatliquor and study the physical and chemical properties after application on leather.



- To study the effluent parameters i.e. COD, BOD<sub>5</sub>, TS, TDS, SS, P, N, Chloride, Alkalinity etc. after the application of fatliquor in the processing/ making of leather and finished leather products by qualitative and quantitative analysis as the guideline of international standards.

**Funding Agency:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Fatliquor is beneficial to oil base crops i.e., castor, sunflower, canola, hemp etc. and support the cultivation in agriculture field in Pakistan. This product (fatliquor) is an import substituted product.
- This successful completion of this project would provide the helping hand to save environment as well as, foreign exchange of Pakistan.
- The project concept is development, start-up, production, and marketing, in addition with the indirect provision of opportunity to small and medium entrepreneur to start their businesses in the field of textile and leather chemicals.



**Name of Laboratory/ Centre/ Unit:**  
LRC/ PCSIR

**Title of Project: Preparation of Retanning Material, Tend to Produce White Leather for Leather Industries**

**Project Leader:**  
Ms. Sarwat Jahan Mahboob, SSO

**Project Associate(s):**  
Ms. Tahira Ayaz, SSO  
Dr. Rajkumar Dewani, SSO  
Mr. Sikandar Ali, Soomro JTO

**Area of Research:**  
Leather

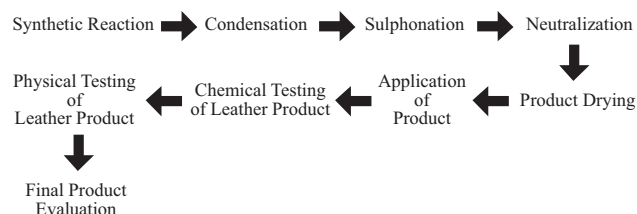
**Duration:**  
1.5 Years

**Research Highlights:**

- To synthesize retanning materials that could produce the dye free and highly resistant white leathers.
- To provide the leather have a unique property of quantitative reversible shrinkage in hot water, i.e., highly stable organic leather.
- To provide high grade leather bears excellent light fastness, softness and fullness appropriate for usage.
- To provide safe natural leather for consumer and manufacturers.

**Funding Agency:**  
PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of the Country:**

- The project will directly aid in achieving the export requirements of European Union and other international agencies to boost the economy of Pakistan.
- It would be Economic and Cheaper for Local Tanneries, Import Substitution, Saves Foreign Exchange and likely to yield pertinent scientific publications.



**Name of Laboratory/ Centre/ Unit:**  
LRC/ PCSIR

**Title of Project: Development of Low Cost Effective Dog Chew from Rawhide**

**Project Leader:**  
Mr. Barkat Ali Solangi, PSO

**Project Associate(s):**

Ms. Uzma Nadeem, SEO  
Dr. Muhammad Kashif Pervaz, CSO  
Dr. Beena Zehra, SSO  
Mr. Muhammad Zeeshan, PT

**Area of Research:**

Leather Industry

**Duration:**

01 Year

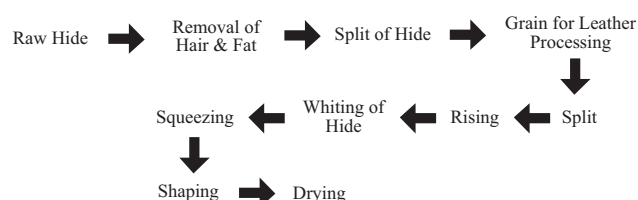
**Research Highlights:**

- To develop the low-cost white leather for dog chew from rawhide.
- To check the chemical and microbial properties of prepared leather.
- Patent
- Paper
- Technical Report

**Funding Agency:**

PCSIR In-house R&D

**Graphical Abstract:**



**Project Outcome w.r.t. Socio-economic Development of Country:**

- Pakistan leather industries are facing many challenges after Covid-19 mainly because chemical cost increased many folds due to restrictions on imports.
- Split leather goes on very cheap prices that cannot meet the cost of chemicals.
- LRC, PCSIR design a project for dog chew from rawhide product that has high demands in USA, Canada and European countries.
- Pakistan may earn and generate millions of dollars from export of dog chew after the development in Pakistan.



## PCSIR Laboratory, Skardu (SL)

**Name of Laboratory/ Centre/ Unit:**

SL/ PCSIR

**Title of Project: Development of Protein Enriched and Gluten Free Flour and other Therapeutic Food Products from Faba Beans**

**Project Leader:**

Mr. Faizullah Khan, SSO

**Project Associate(s):**

Mr. Tariq Umar Khan, CSO/Director

**Area(s) of Research:**

Food

**Duration:**

02 Years

**Research Highlights:**

- Faba beans being unidentified crop in Pakistan are emerging as sustainable quality plant protein sources & have shown antioxidant, antidiabetic, antihypertensive, cholesterol-lowering, and anti-inflammatory effects. Extensive research is required as this crop has potential to meet the growing global demand for more nutritious and healthy foods.
- Due to high protein content and well-balanced amino acid profile, low sodium amount & being gluten free, flour as well as other therapeutic food products will be developed form Faba beans.

**Source of Funding:**

PCSIR In-house R&D

**Graphical Abstract:**

