

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:

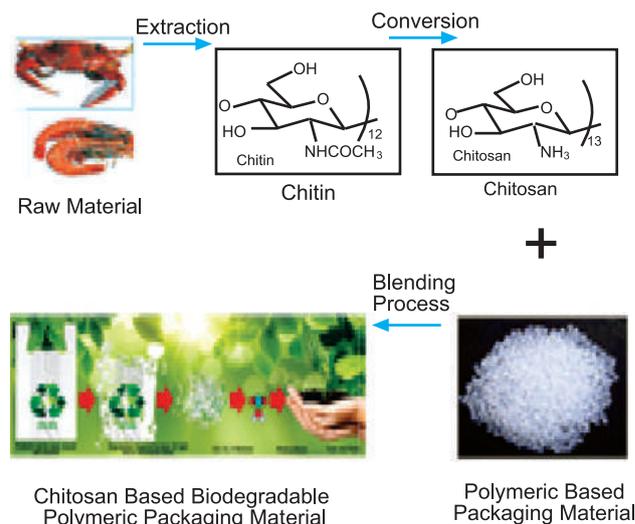
Chemical Sciences / Industrial Chemistry, Advance Materials / Polymeric Based Composites Materials

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

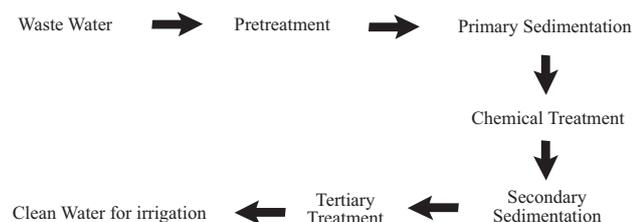
Research Highlights:

- 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

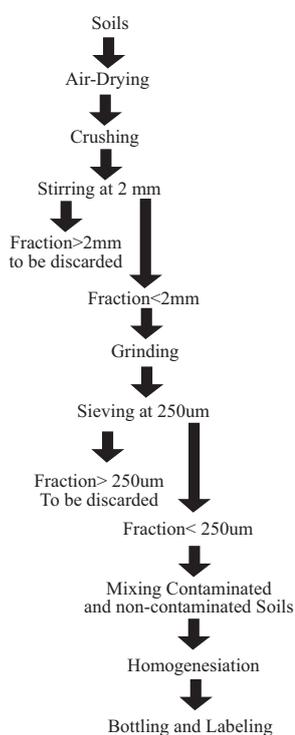
Research Highlights:

- 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 Abidin, EO

Area(s) of Research:

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

Duration:

03 Years

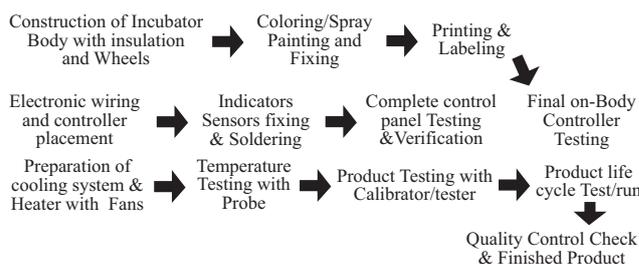
Research Highlights:

- 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:

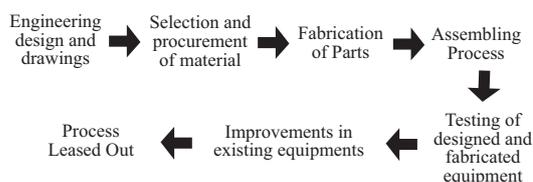
- LPG has come to play an innovative role as a refrigerant. It serves as the best contender to replace CFCs for domestic refrigerators and air conditioners.
- R-290 is the common name for high purity propane (C3H8) suitable for use in the refrigeration and air conditioning industry.
- The LPG is stored 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

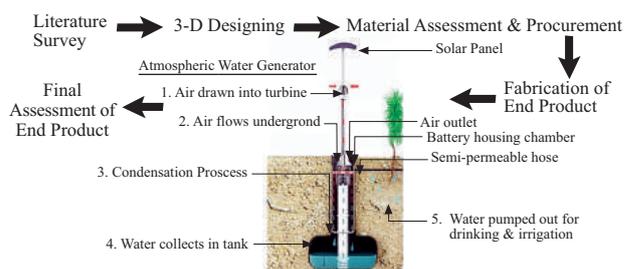
Area(s) of Research:
Environmental Science

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

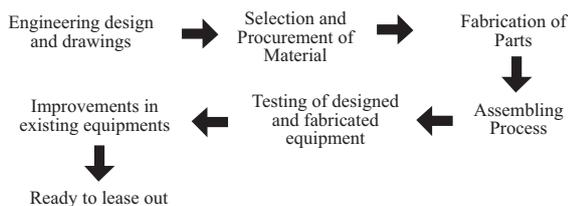
Research Highlights:

- 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

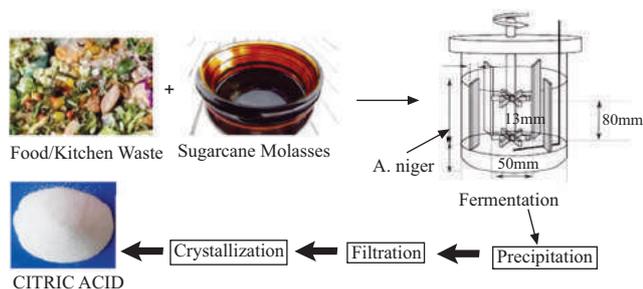
Research Highlights:

- 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

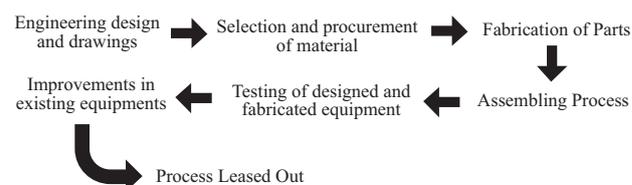
Research Highlights:

- 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

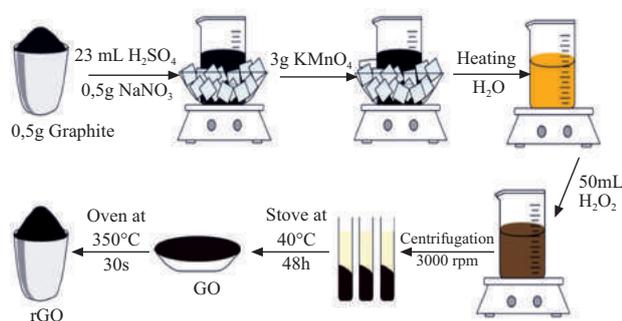
Research Highlights:

- 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

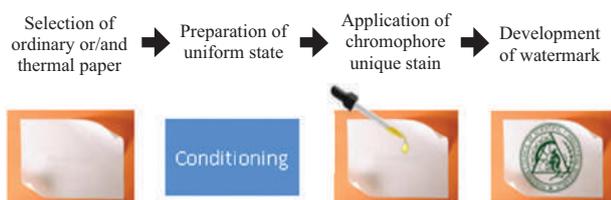
Research Highlights:

- 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

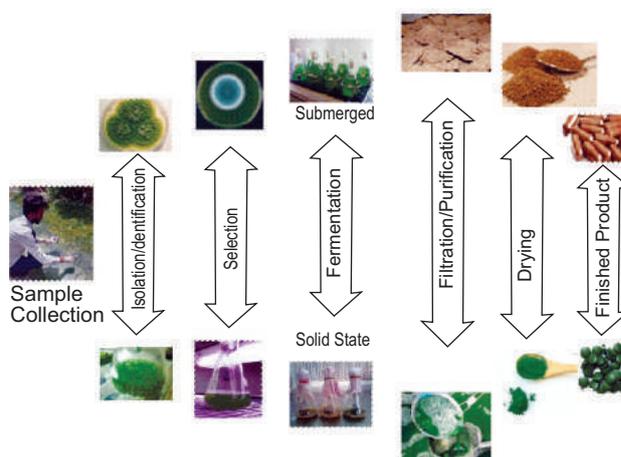
Research Highlights:

- 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

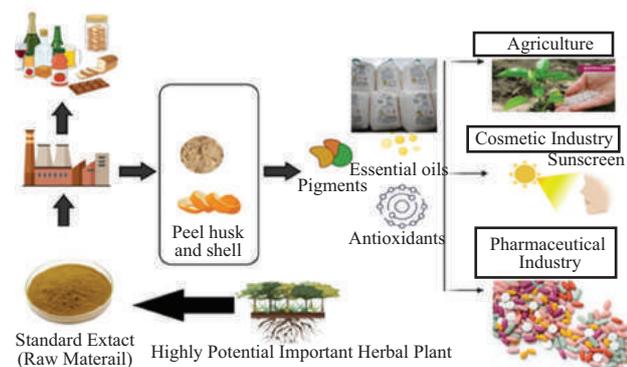
Research Highlights:

- 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

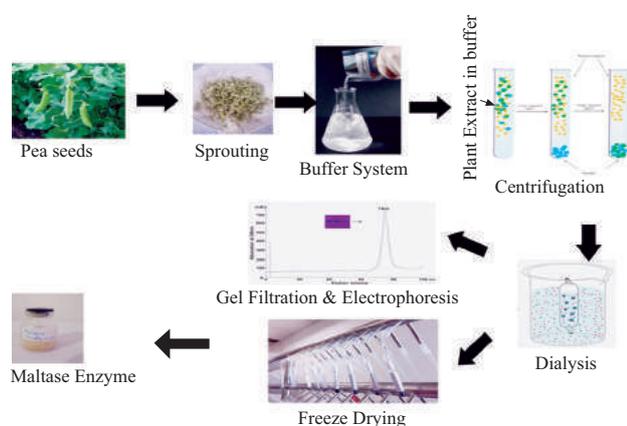
Research Highlights:

- Maltase or alpha glucosidase (EC 3.2.1.20) is an exo-glycosidase that catalyzes the release of α -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:
FMRRRC/ 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

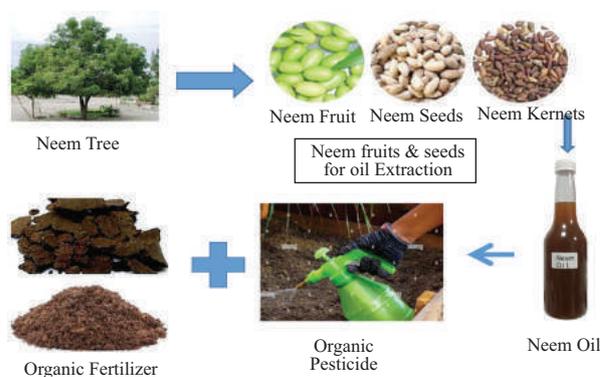
Area(s) of Research:
Agriculture

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

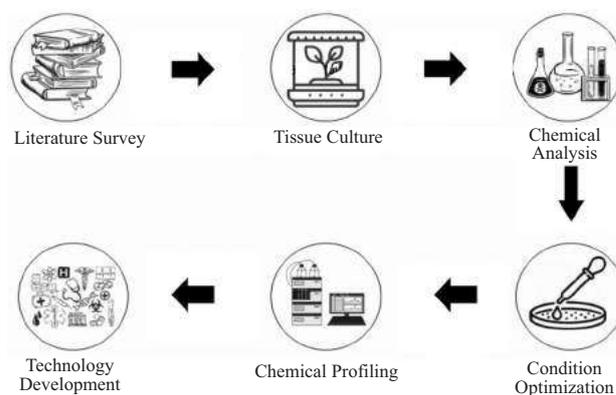
Duration:
02 Years

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

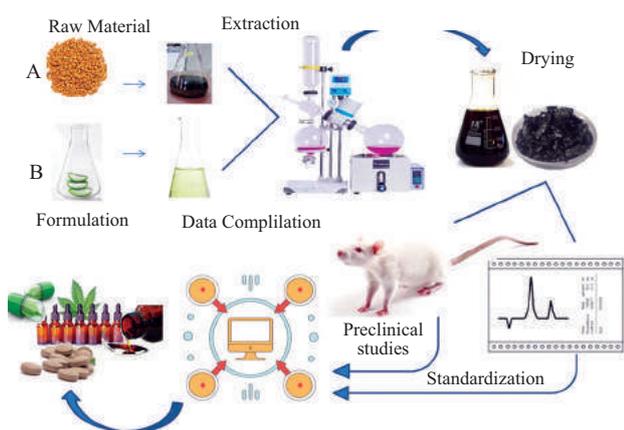
Research Highlights:

- 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:

PCSIR 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:

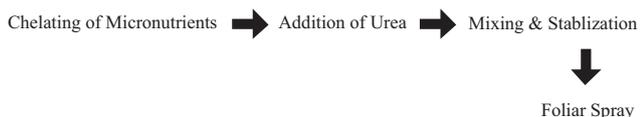
- Fertilizers supply elements needed for plant nutrition, with Nitrogen (N), Phosphorus (P) and Potassium (K) as principal components, nevertheless, micronutrients replenishment is seldom done.
- There is a need for new fertilizer formulations and new methods of fertilizer application that supply of 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

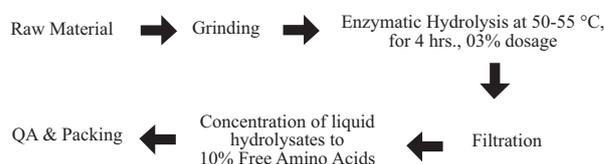
Research Highlights:

- 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

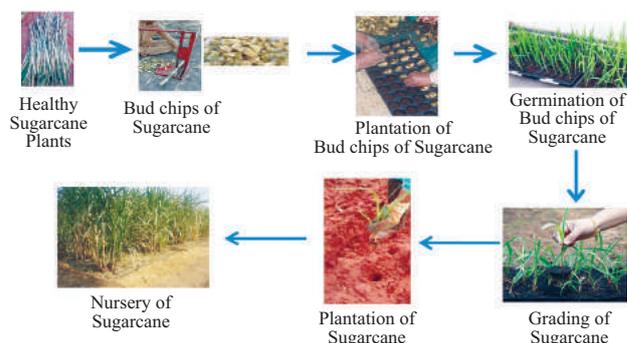
Research Highlights:

- 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

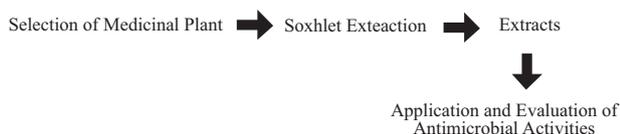
Research Highlights:

- 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:

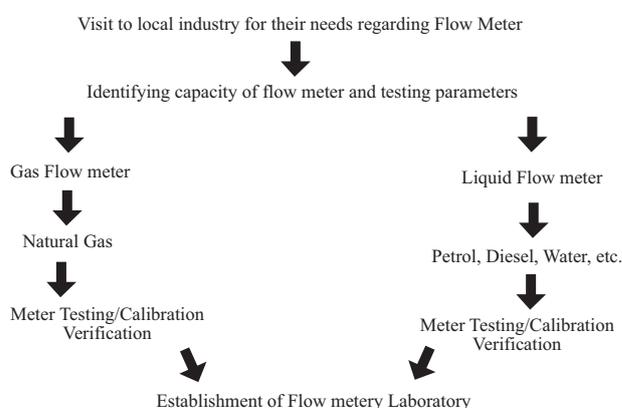
- To develop testing and calibration facility for gas and liquid flow meters.

- 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

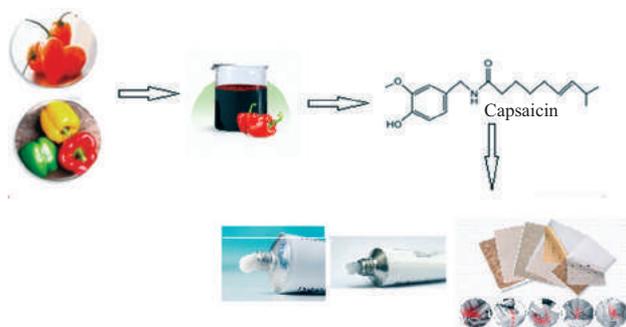
Research Highlights:

- 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:

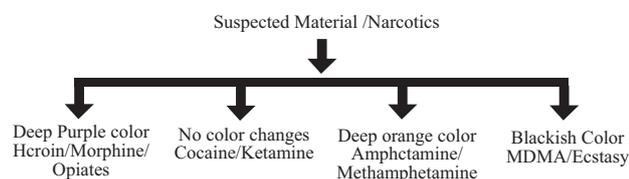
- The term amphetamine type stimulants (ATS) refer to a range of drugs mostly derived from the phenethylamines that are central nervous system (CNS) stimulants, and first synthesized more than a century ago for medical applications.

- 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:

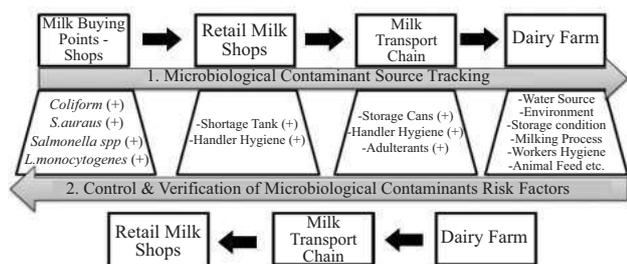
- Milk is a valuable and an absolute source of human diet because it constitutes all important nutrients, therefore its consumption increased globally.
- It is calculated that >95% milk is sold in market in raw form. Being a large population under poverty line could not afford to reliance on the processed 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:

FMRRRC/ 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

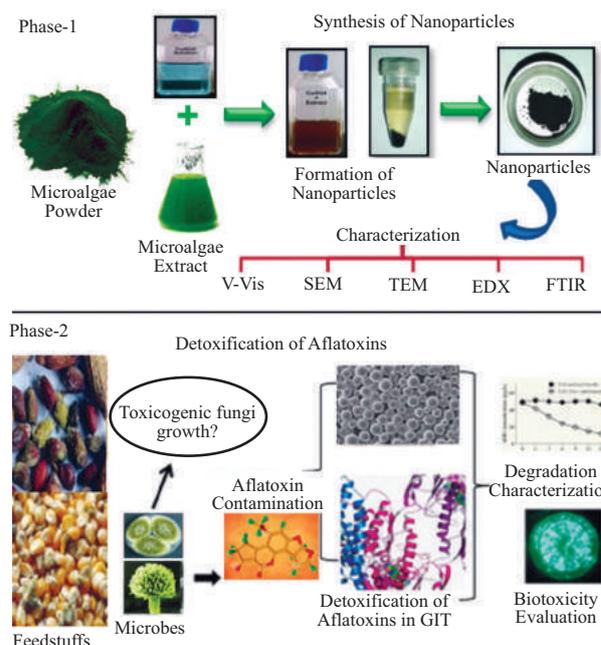
Research Highlights:

- 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:

FMRRRC/ 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:

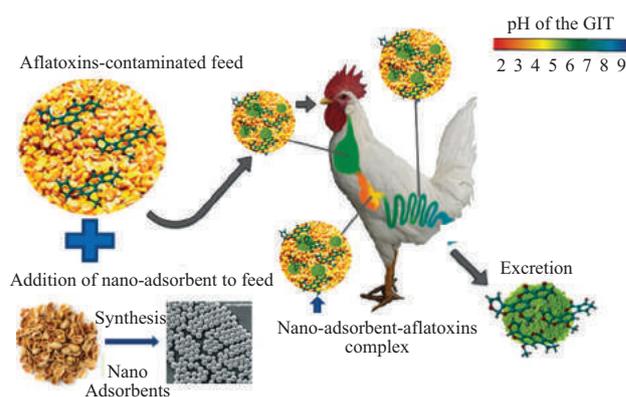
- A large quantity of edible nuts is consumed in Pakistan and generates a significant amount of waste material (Shells).

- 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

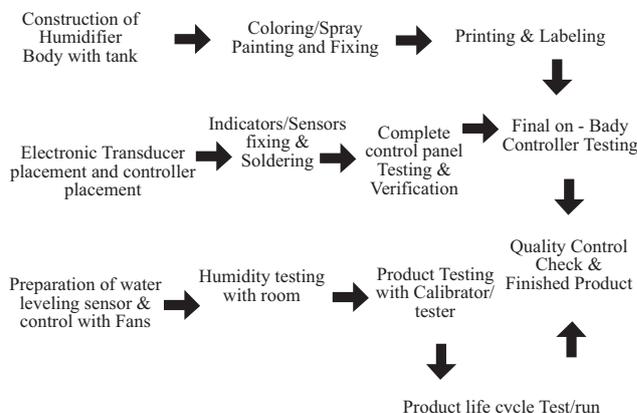
Research Highlights:

- 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:

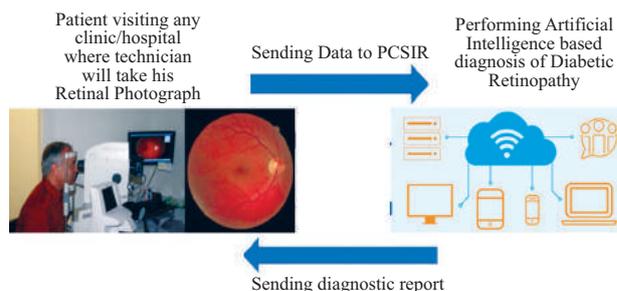
- Retina is the photosensitive layer present inside human eye which is responsible to receive photons and convert them into electrical signals. These electrical signals are carried to brain through optic nerve to convert them into meaningful information. Visual disorders like Age related Macular Degeneration, 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

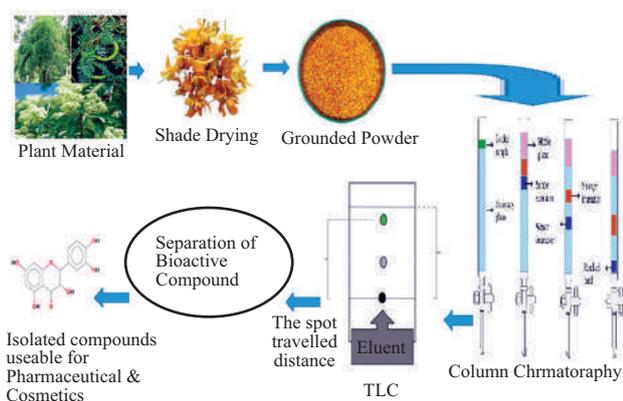
Research Highlights:

- 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:

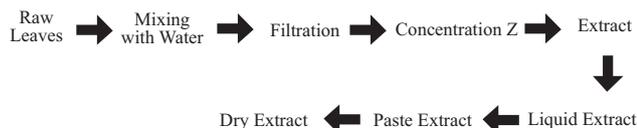
- To develop material & method for extract of *Ocimum tenuiflorum* leaves, material used (Aqua, Methyl alcohol, Ethyl alcohol, Acetone, Hexane & Chloroform)
- Tulsi having multiple therapeutic actions including adaptogenic, antimicrobial, anti-inflammatory, cardioprotective, and immunomodulatory effects, 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

Name of Laboratory/ Centre/ Unit:

ACRC/ LLC

Project Associate(s):

Dr. Shafaq Mubarak, SO

Title of Project: Development of Flavors and Fragrances

Area(s) of Research:

Agro-chemicals

Project Leader:

Ms. Asma Inayat, PSO

Duration:

01 Year

Project Associate(s):

Dr. Zahida Parveen, PSO

Dr. Saima Siddique, SSO

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

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

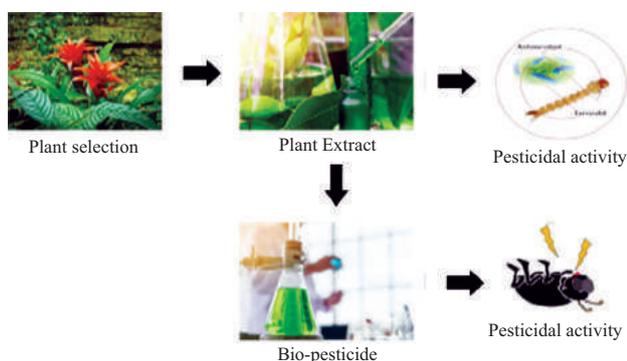
Source of Funding:

PCSIR In-house R&D

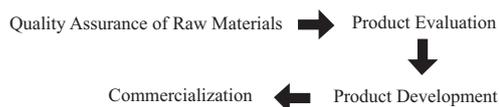
Source of Funding:

PCSIR In-house R&D

Graphical Abstract:



Graphical Abstract:



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

- Green synthesis of nano-pesticides

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

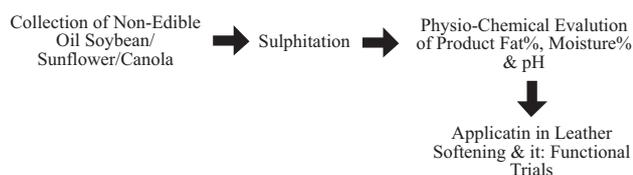
Research Highlights:

- 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

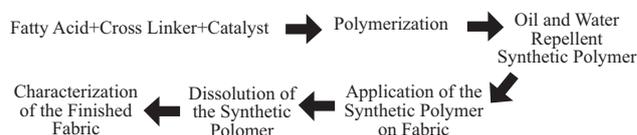
Research Highlights:

- 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

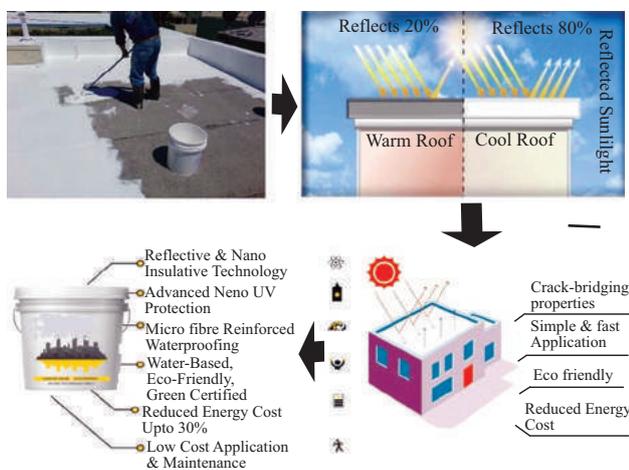
Research Highlights:

- 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:

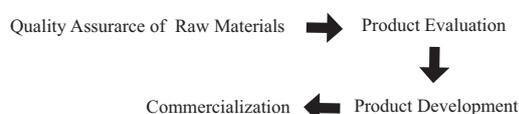
- Colored facial cosmetics are important part of the dermatologic armamentarium. They can camouflage contour and pigment abnormalities, provide moisturization, enhance oil control, add sun protection, deliver barrier-enhancing agents and create a sense of personal well-being. This variety of functions 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

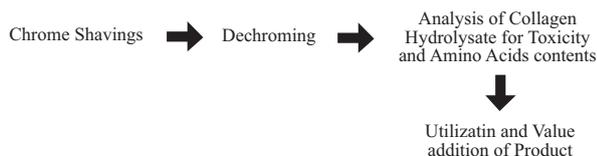
Research Highlights:

- 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

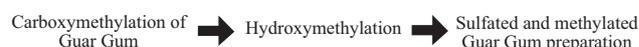
Research Highlights:

- 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

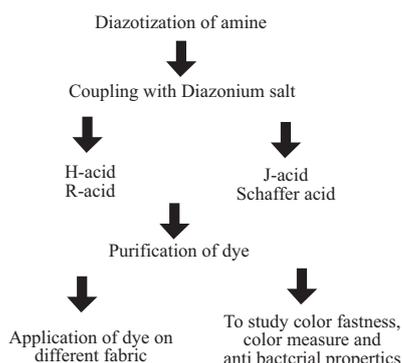
Research Highlights:

- 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

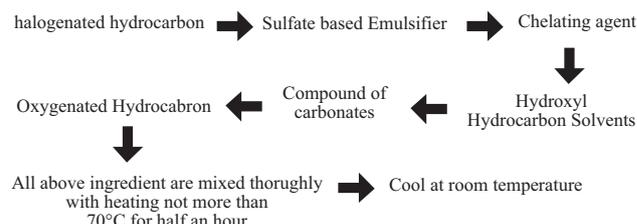
Research Highlights:

- 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

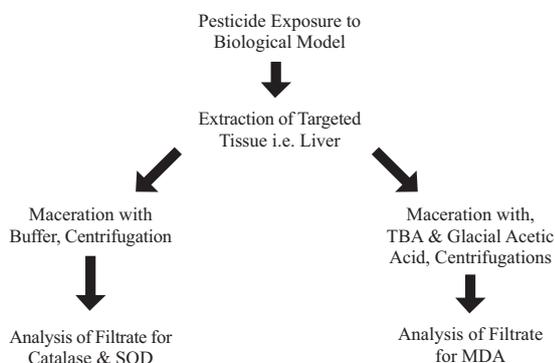
Research Highlights:

- 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

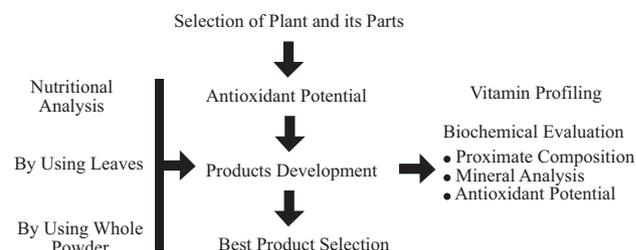
Area(s) of Research:
Food & Nutrition

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:



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 (Fe₂₁Mo₂Cm_n) 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

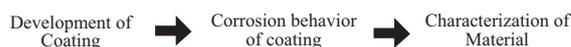
Research Highlights:

- 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

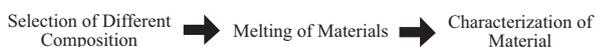
Research Highlights:

- 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

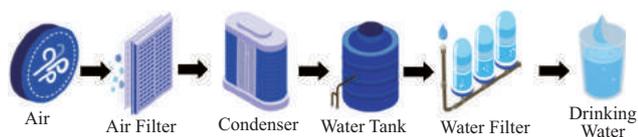
Research Highlights:

- 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

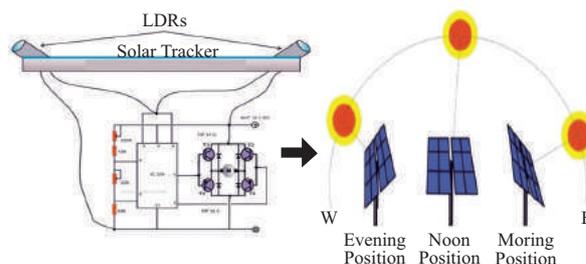
Research Highlights:

- 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

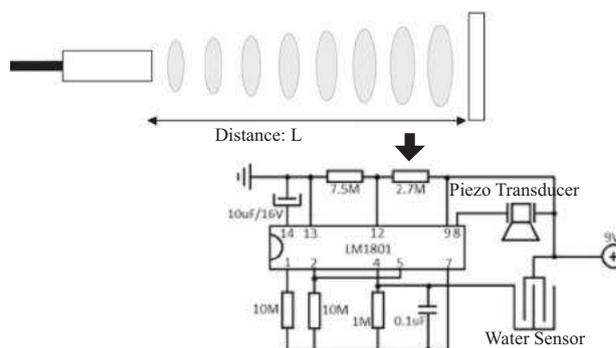
Research Highlights:

- 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:

PCSIR 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

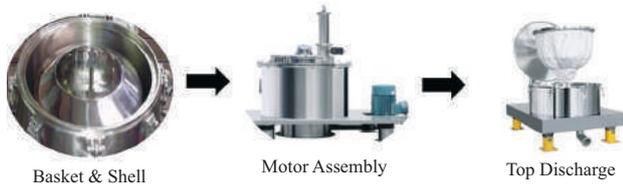
Research Highlights:

- 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

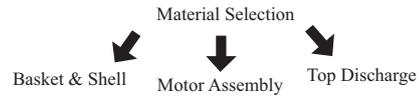
Research Highlights:

- 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

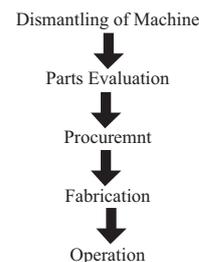
Research Highlights:

- 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 CO₂ to Value Added Chemicals by Following H₂ Route.

Project Leader:
Engr. Ali Imran, JE

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

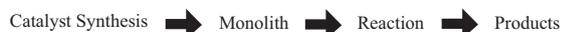
Area(s) of Research:
CO₂ utilization, catalytic conversion

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 CO₂ vs H₂ reaction and having experimental set up within PCSIR, it may pave way for reduction of CO₂ 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

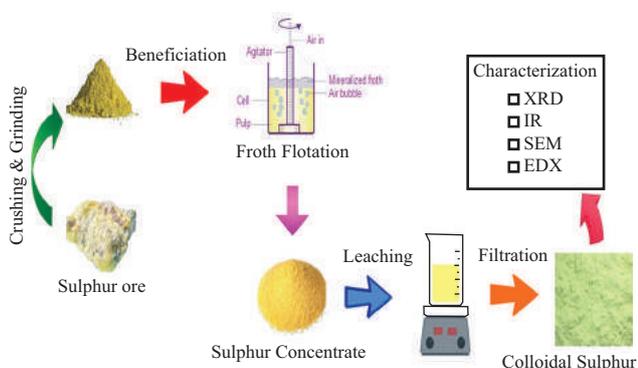
Research Highlights:

- 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:

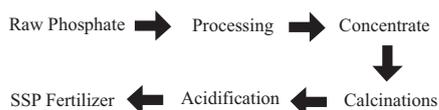
- Phosphorous, nitrogen and potassium are the three major plant nutrients of NPK fertilizers that are used to enhance the growth of food crops throughout the world.
- Phosphate compounds particularly superphosphates are used as fertilizers to make up its deficiency in the soil.
- Pakistan has limited 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

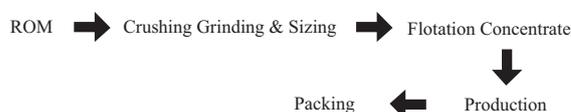
Research Highlights:

- 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

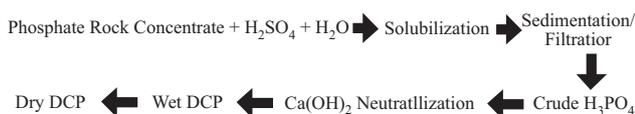
Research Highlights:

- 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% P₂O₅ 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

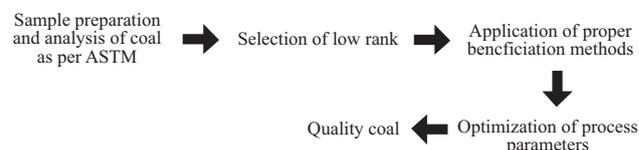
Research Highlights:

- 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

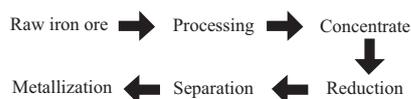
Research Highlights:

- 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

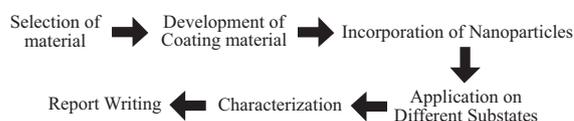
Research Highlights:

- 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

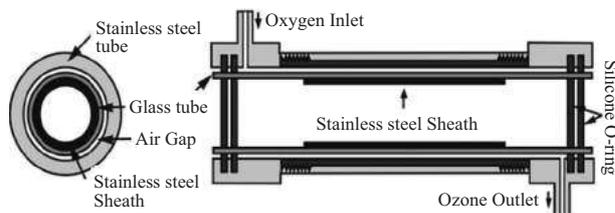
Area(s) of Research:
Design Development of Laboratory Equipment

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.

