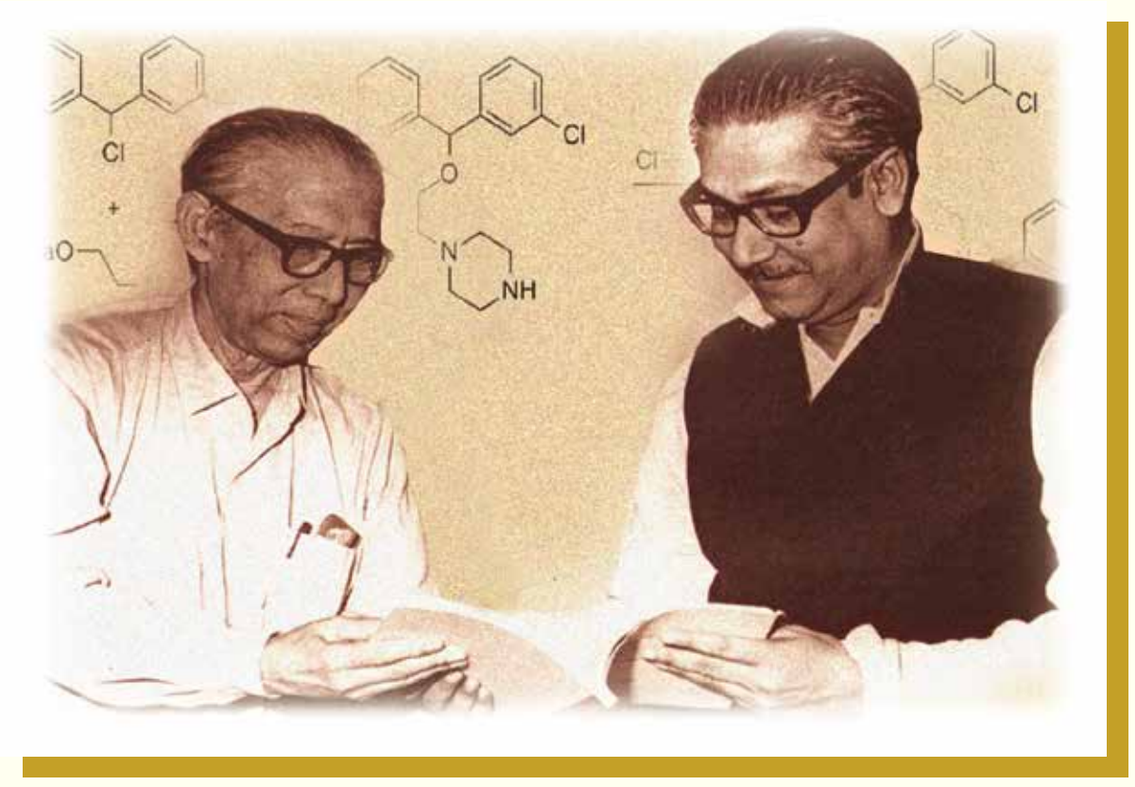
ANNUAL REPORT
2019-2020

BCSIR Laboratories, Dhaka
Bangladesh Council of Scientific and Industrial Research
Dr. Qudrat-i-Khuda Road, Dhanmondi, Dhaka-1205
Website: www.dhakalabs.bcsir.gov.bd

ANNUAL REPORT

2019-2020



BCSIR Laboratories, Dhaka
Bangladesh Council of Scientific and Industrial Research
Dr. Qudrat-i-Khuda Road, Dhanmondi, Dhaka-1205
Website: www.dhakalabs.bcsir.gov.bd

Message from the Chairman

It is my immense pleasure to note that BCSIR laboratories, Dhaka is going to publish annual report for the fiscal year 2019-2020, which records research and development activities (R&D) and achievements of this eminent multidisciplinary unit of BCSIR, especially in the 'Mujib Year', announced by the Government of the Peoples' Republic of Bangladesh to celebrate the birth centenary of the Father of the Nation, Bangabandhu Sheikh Mujibur Rahman, the Greatest Bangalee of all time.

BCSIR Laboratories, Dhaka covers research areas like biological research, chemical research, genomic research, fibre and polymer research, industrial physics, pharmaceutical sciences, physical instruments, pulp and paper research, soil, water and environment research and so on. Research activities of this institute is now not only confined to performing fundamental R&D activities, but also focused more on application based research, which enhances knowledge generation as well as technology based industrialization that is essential to sustain the economic growth. Furthermore, BCSIR Laboratories, Dhaka is offering analytical services to various public and private organisations, entrepreneurs and stake holders in their different field of research.

In developed countries doctoral and postdoctoral research mainly drives the research engine that creates wealth and fuels the national economy. I am delighted to know that scientist of BCSIR laboratories, Dhaka are trying to replicate this strategy by supervising the research works of a good number of MS, M.Phil, Ph.D level students of different universities in Bangladesh. Besides, researchers of this laboratory are continually arranging and participating different workshops, seminars, symposiums and training programmes in home and abroad to strengthen their skills and expertise. It has to be mentioned here that, our Government is providing us with enormous financial facilities to develop our research laboratories with state-of-the-art equipments and cutting edge technologies.

I am optimistic and confident enough that this report will provide a wealthy scenario of scientific activities and achievements of BCSIR Laboratories, Dhaka. I would like to express my heartiest congratulations to the director, scientists and all other working forces for their excellent contributions in bolstering this unit. I strongly believe that their dedication and hearty effort will make BCSIR a centre of excellence and thus contribute to our national economy.

I wish their overall success for the upcoming days.

(Professor Dr. Md. Aftab Ali Shaikh)
Chairman, BCSIR

Message from the Director

I feel profound happiness to present the Annual Report (2019-2020) of BCSIR Laboratories, Dhaka. As a director of one of these multi-disciplinary research centers, I am thrilled to read through the profusion of scientific research activities and achievements that have been conducted throughout the different divisions of BCSIR in the past year. This report will allow the BCSIR community to get a summarized view of all the various R&D activities, services to industries and skill enhancement training of scientists that had occurred for the all-around growth of this institute.

In spite of the unfavorable circumstances provided by the pandemic, BCSIR Laboratories, Dhaka ensured satisfactory R&D development through interaction with relevant industries to find prospects of new research, monthly seminars to exchange project progress and potential as well as intensive training sessions to develop the skills of its scientists. In addition to its regular activities, BCSIR laboratories, Dhaka, also contributed its own share of research results in combating this pandemic, through sequencing over 300 samples of SARS-CoV-2 from all around the country. BCSIR Laboratories, Dhaka has been continuously providing its in house hand sanitizers to different government organizations as well as analytical services to the different hand sanitizer producing companies.

I feel extremely honored for having the opportunity to celebrate the birth centenary of Bangabandhu, which began at the last quarter of the 2019-2020 fiscal year. It's a matter of great pride that BCSIR Laboratories, Dhaka has already undertaken different programs for the celebration of the 100th birth anniversary of the father of the Nation.

I am deeply grateful to inherit glorious legacy of these laboratories and my major goal is to keep the reputation as best as I can.

BCSIR Laboratories, Dhaka acknowledged the chairman of BCSIR for his generous support for qualitative changes in this institution. The dedication effort of scientists and stuffs of these laboratories are highly appreciated and acknowledged for publishing this report.

I look forward to the coming years and continued success of this Laboratories.

Dr. Md. Sarwar Jahan
Director, BCSIR Laboratories

Editorial Committee

Convener

Suravi Islam
Principal Scientific Officer

Member

Khaledun Nahar Babi
Senior Scientific Officer

Afroza Parvin
Senior Scientific Officer

Fatema Moni
Senior Scientific Officer

Jannatun Nayeem Rumee
Senior Scientific Officer

Lutfun Naher Hilary
Senior Scientific Officer

Khondoker Shahin Ahmed
Scientific Officer

Member Secretary

Dr. Md. Monarul Islam
Senior Scientific Officer

BCSIR Laboratories, Dhaka

BCSIR Laboratories, Dhaka commenced its magnificent journey as the 'East Regional Laboratories' of the Pakistan Council of Scientific and Industrial Research (PCSIR) in 1955. Dr. Muhammad Qudrat-i-Khuda, the eminent scientist and educationist, conceived the idea and took initiative for establishing such a laboratory in this part of the continent. Later, it expanded its domain to several full-fledged multi-disciplinary regional laboratories and institutes. BCSIR Laboratories, Dhaka focuses its research and development in the arenas of Biology, Chemistry, Fibre and Polymer, Genomics, Industrial Physics, Pulp and Paper, Physical Instrumentation, Pharmaceutical Sciences etc. In addition with R&D activities, this laboratories renders analytical and testing services to various public and private bodies, entrepreneurs and individuals. Our scientists also supervise a significant number of students of post-graduate, doctoral and post-doctoral level from different universities every year and give them scientific and technical support for their thesis work. BCSIR Laboratories, Dhaka is serving the nation dedicatedly for achieving our mandate of scientific and technological advancement, addressing national priorities and thus contributing to the economic vibrancy of the country.

Mission of BCSIR Laboratories, Dhaka

To carry out, promote and guide scientific, industrial and technological research on various fields of pure and applied sciences that optimizes the economic, environmental and societal benefits for the people of Bangladesh.

Vision of BCSIR

To be a center of excellence in science and technology.

BCSIR Laboratories, Dhaka At a Glance

Establishment	**: 1955**
Present director	**: Dr. Md. Sarwar Jahan**
Total number of research Divisions	**: 07**
Projects	
Total ongoing R&Ds	**: 35**
Number of ongoing ADPs	**: 02**
Achievements	
Number of published papers	**: 94**
Number of accepted processes	**: 03**
Number of patents	**: 02**
Services	
Analytical services	**: 3,706**
Student supervision	**: 93**
Dissemination of technology	**: 29**
Manpower	
Number of scientists	**: 73**
Number of officers	**: 07**
Number of staff	**: 50**

Special Contributions

- **Whole Genome Sequencing of Coronavirus (SARS-CoV-2): 263 (81% of total in Bangladesh);**
- **Preparation and distribution of hand sanitizer to prevent Covid-19;**
- **Quality analysis of hand sanitizer produced by different companies.**

Organizational Chart of BCSIR Laboratories, Dhaka

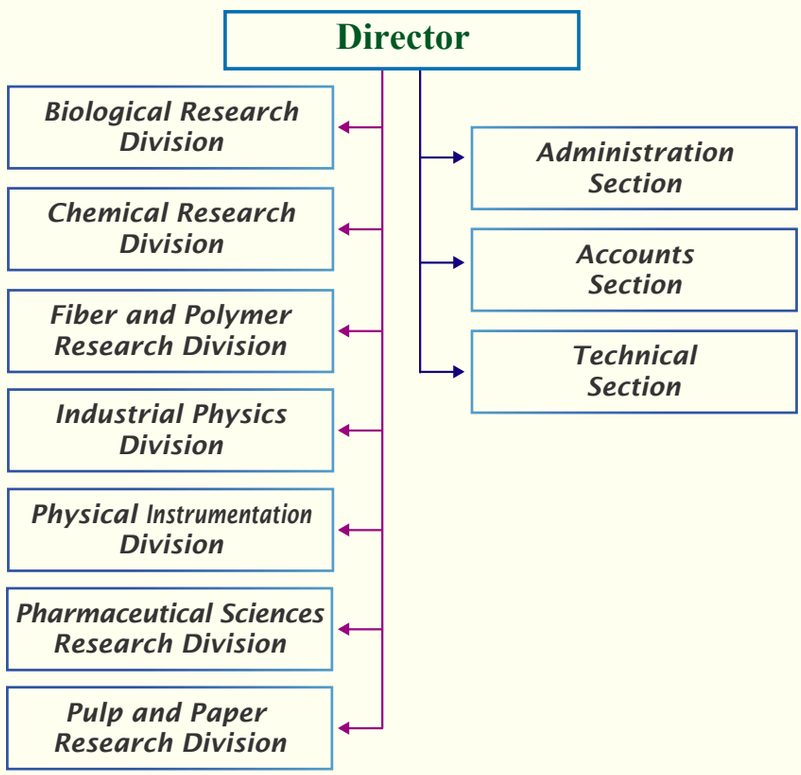


Table of Contents....

BIOLOGICAL RESEARCH DIVISION (BRD)

DECORATE YOUR LIFE WITH BIOTECHNOLOGY

Biological research division is the largest division in BCSIR laboratories, Dhaka which conducts research and development activities in six (06) different sections.

Different sections of BRD are

- Tissue Culture: *in vitro* plant regeneration and multiplication of important medicinal, natural dye producing and timber plants. To carry on genome & molecular research for disease free plants.
- Soil, Agronomy and Environment: to conduct research on soil health improvement, environment quality assessment through GIS technology.
- Applied Botany: research on economically important algae, medicinal, horticultural and flowering plants culture and producing and marketing *Spirulina.*
- Plant Pathology: to identify fungal and bacterial infection on plant and their remediation.
- Plant Physiology: conducts research on plant hormones and biochemical activities of different vegetables.
- Zoology: engaged research on applied entomology and fisheries.

R&D Projects

Qualitative and quantitative determination of bioactive metabolites in field grown plants, *in vitro* grown plants and callus tissues obtaining from *Rauwolfia Serpentina* L. and *Bacopa monnieri* L.

Dr. Md. Salim Khan (PL), Dr. Md. Ahashan Habib, Dr. Shahina Akter, Dr. Tanjina Akhtar Banu, Mousona Islam and Barna Goswami

Introduction

Natural products provide unlimited opportunities for new drug discoveries due to unmatched availability of chemical diversity. *Rauwolfia serpentine* L. and *Bacopa monnieri* L. were chosen because of their ability to naturally synthesize and accumulate important secondary metabolites. In recent years, plant cell, tissue and organ cultures have been developed as an important alternative source for the production of secondary metabolites compounds.

Objectives

- Establishment of suitable *in vitro* protocol and callus culture from various explants
- Estimation of alkaloid contents from field grown plants, *in vitro* grown plants and callus tissues of *Rauwolfia serpentina* L and *Bacopa monnieri* L.

Progress Achieved

- Huge callus was produced from *Bacopa* leaf
- HPLC analysis of two plants are going on against reserpine and bacoside standard from different explants sources

Various type of callus of *B. monnieri* plants

High efficiency regeneration of *Gynura procumbens* (Lour.) Merr. an important medicinal plant and identification of its active compounds through NMR profiling

Dr. Tanjina Akhtar Banu (PL), Dr. Md. Salim Khan, Dr. Md. Ahashan Habib, Dr. Shahina Akter, Mousona Islam and Barna Goswami

Introduction

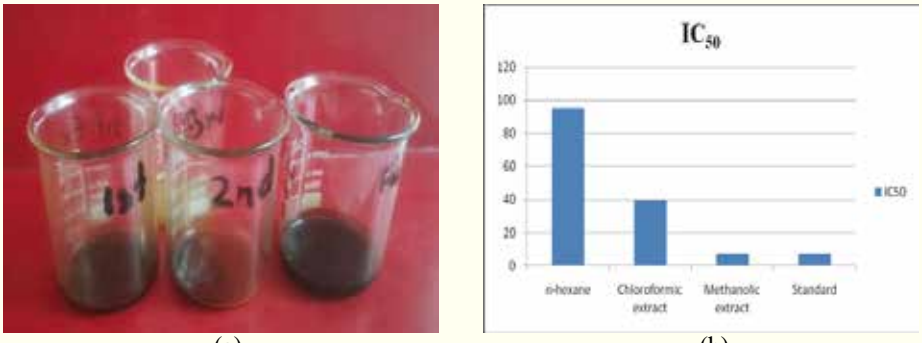
Gynura procumbens (Lour.) Merr. is an important medicinal plant in South East Asia. A number of studies of this plant should conduct for the investigation of different pharmacological activities. The regeneration protocol is useful for large-scale clonal multiplication as well as for transformation studies. Moreover *in vitro* cell and tissue cultures will be used for the production of secondary metabolites.

Objectives

- Development of an efficient system for the regeneration of *G. procumbens*
- Determination of chemical properties and comparative studies among various sources.

Progress Achieved

- Antioxidant and Antibacterial activity were studied using various leaf extracts of *Gynura procumbens.*
- Methanolic leaf callus extract was prepared from the callus and field grown leaf for HPLC and NMR analysis.



(a) (b)

a. Methanolic extract of *Gynura procumbens* b. Evaluation of antioxidant activity: methanolic extract showed the best result which is most close to value of standard

Transfer and expression of Alpha zein gene in some fruit plants

Dr. Shahina Akter (PL), Dr. Md. Salim Khan, Dr. Md. Ahashan Habib, Dr. Tanjina Akhtar Banu, Mousona Islam and Barna Goswami

Introduction

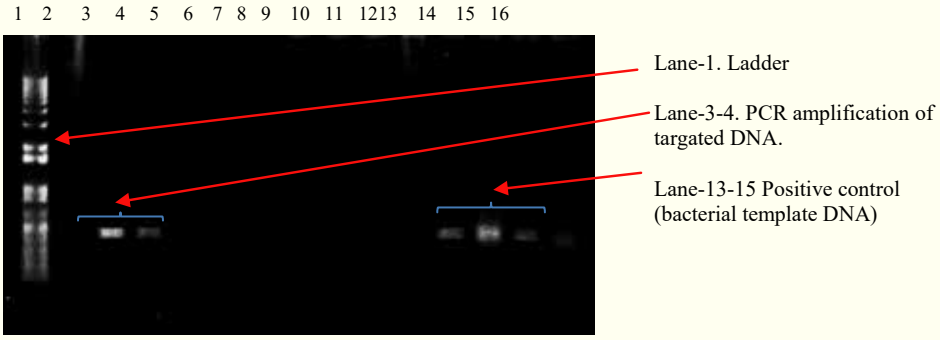
The plant system used to produce a plant-made vaccine is as important as the antigen itself. The cost of the vaccine is also influenced by the plant-production system, as it has direct impact on the time spent in development and the cost of containment and processing. This study will be an initiation for development of edible vaccine in Bangladesh.

Objectives

- To develop an effective *in vitro* regeneration protocol for some selected fruit plants
- To transfer alpha zein gene into targeted plant through genetic transformation
- Screening of putative transgenic plants through molecular technique

Progress Achieved

- Plant regeneration protocol has been established from different parts of *Rubus parvifolius*
- PCR amplification was performed to confirm the presence of plasmid along with Alphazein gene in *A. tumefaciens*



PCR confirmation of presence of Alpha-zein gene in A. tumefaciens

Development of an Easy to Use Arsenic Testing Kit for Spot Analysis of Arsenic Contaminated Water Sources

Dr. Md Kamal Hossain (PL), Afroza Parvin, Dr. Mohammad Moniruzzaman, Badhan Saha and Dr. Samina Ahmed

Introduction

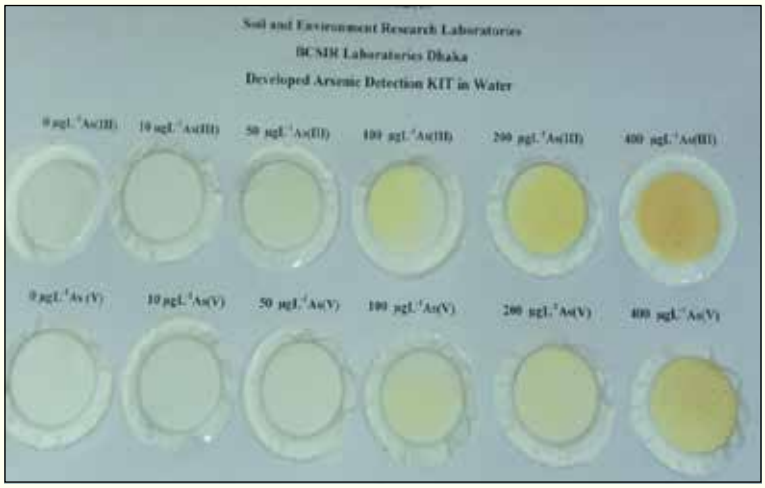
Ground water contamination with arsenic has become a major global issue. Millions of people worldwide are exposed to this pollutant at concentrations above current drinking water standards. The situation is especially worrisome in Bangladesh, where 35 – 77 million people have been estimated to be chronically exposed to arsenic contaminated drinking water. Arsenic in Tube well water was first identified in 1993. At Present Prevalence of Arsenic in Drinking Water has been identified in 61 out of 64 Districts of the country (Except Hilly Districts). At present 271 out of 463 upazilas As problem identified from the Survey of DPHE-UNICEF & DPHE-BGS.

Objectives

- To develop an easy to use/ instant Arsenic (As) detection kit of As contaminated water.

Progress Achieved

- From July –December 2019- Literature survey and study the limitation of existing one.
- January –June 2020-Sample Collection, chemical purchase and Proposed kit Trial in Lab.



Lab Scale development of As detection Kit of contaminated water - in trial basis (Color developed using various known concentration of $As^{3+}$and As^{5+} salts)

Effect of Arsenic-Selenium interaction on some food crops and its possible relevance to arsenicosis disease

Badhan Saha (PL), Dr. Mohammad Moniruzzaman, Dr. Md Kamal Hossain, Afroza Parvin, Dr. Shahina Akter and Dipa Islam

Introduction

Contamination of groundwater by arsenic in Bangladesh is considered as one of the most important natural calamities. In Bangladesh there are many areas which are affected by arsenic and a number of arsenicosis patients have been identified while in some arsenic affected areas no arsenicosis patients have been identified yet. The present work is to examine any relevance to the selenium (Se) content in soil, water and in an edible plant to the incidence of arsenicosis in some arsenic hotspots of the country where arsenicosis patients have been identified and where no arsenicosis patients have yet been reported.

Objectives

- To find out any interaction between arsenic and selenium.
- To find out possible relevance of arsenic-selenium interaction to arsenicosis disease.

Progress Achieved

- Pot experiment has been successfully completed with Ipomoea aquatic (Kalmi) to study the arsenic-selenium interaction.
- Analysis of samples (Soil, edible plants and water) collected from different arsenic hot spot areas of Manikganj, Sonargaon and Chapainawabganj of Bangladesh as well as from pot experiment is going on.

Application of different doses of arsenic and selenium as treatments in soils.

Pot experiment with Kalmi (*Ipomoea aquatica*) to study the interaction between arsenic and selenium.

Collection of water samples from arsenic affected areas.

Collection of soil and plant samples from arsenic affected areas.

Formulation of Humic Acid Based Composite Fertilizer from Quality Assessment of Market Available Fertilizer

Afroza Parvin (PL), Dr. Mohammad Moniruzzaman, Dr. Md Kamal Hossain, Badhan Saha, Hemayet Hossain, Abdullah Al Mansur, Afsana Parvin and Nasima Momotaz

Introduction

Fertilizer is the most critical and costly input for sustaining agricultural production. Now-a-days, harmful heavy metals may be introduced into the soil along with the fertilizer, which are then absorbed by growing crop plants causing significant health related issues. Humic acids are biodegradable, ubiquitous in the environment and comprise the most abundant pool of non-living organic matter. Humic acids improve soil structure by increasing microbial activities and reduce metal mobility in soil and therefore, uptake by plants. The research work has been conducted to formulate humic acid based composite fertilizer for food security and safety.

Objectives

- Quality assessment of the nutrient elements and heavy metal contents in market available fertilizer (chemical, organic and mixed fertilizer)
- Formulate new fertilizer by mixing humic acid and chemical fertilizer
- Examine the effectiveness of the fertilizer and cost benefit analysis of the formulated fertilizer with others

Progress Achieved

- Nutrient and Heavy metals (Pb, Cr, Cd, Ni, As) content of commercial fertilizer was analyzed
- Complex formation of trace metals (Pb, Cr, Cd, Ni) with humic acid was quantified
- Formulation of humic acid based composite fertilizer is going on.

Development of Culture Technology for Insect larvae as Live Fish Feed

Lailatul Ferdousi (PL), Nahid Sultana and Md. Rakibul Hasan

Introduction

As fly larvae is a natural component of the diet of fish, chicken and pig, the proposed research is focusing on rearing two species of fly (for example, house fly and black soldier fly) and conducting feeding trials with their larvae or maggots. Fly larvae grown on a range of organic wastes have the ability to reduce the volume of that waste by up to 60%, providing an additional benefit to waste management and the environment.

Objectives

- To develop mass culture method for insect larvae (i.e. Diptera larvae) as live fish feed
- Developing culture method of insect larvae through organic waste management system
- To investigate high yielding varieties of insect as fish and poultry diet for commercial culture

Progress Achieved

- High antimicrobial activities of black soldier fly prepupae oil against bacteria, fungus and yeast was observed

Culture tanks

Larvae of black soldier fly

Economic importance of Insect in Agar formation within Agarwood tree: It's identification, biology & technique developed for rearing the insects

Nahid Sultana (PL), Md. Rakibul Hasan and Lailatul Ferdousi

Introduction

Aquilaria malaccensis commonly known as agar wood has aromatic and medicinal values. Generally it takes 4 or 5 years to accumulate resin as agar. The quality of nailing agar does not match with the naturally infested product which is mainly caused due to the infection of wood boring insect. The present research is to study the biology of the insects associated with the production of agar within agar wood tree.

Objectives

- Collection of insects from Agar plants and their taxonomic identification
- Studying the life-cycle of insects in laboratory scale
- Techniques developed for rearing the larvae and also continuous propagation

Progress Achieved

- Larval samples from Agar tree were collected from Moulovibazar forest area and set them in the laboratory for rearing
- Morphological Identification of the Insects was performed up to the pupal stage

A B C

Figure: Related pictures of the experiment in the laboratory. **A.** Larva selected a suitable place to bore within a piece of agar wood **B**. Attachment of larva to the wood piece cutting it with their strong mandible and **C**. Entering the larva within the wood piece.

ADP (Annual Development Project)

Establishment of Genomics Research Laboratory

Genomics Research Laboratory has been established in BCSIR under an annual development project (ADP) financed by Ministry of Science and Technology, Government of Bangladesh**.** The objective of the project is to establish a Genomic Laboratory for the use of Next Generation Sequencing (NGS) with the help of whole genome DNA sequencer by increasing the capability of genomics research.

Project Implementation period: July 2018-June 2020.

Project Cost: 4855.20 lakh taka

Architect Yeafesh Osman, Honorable Minister, Ministry of Science and Technology started the first run of Human Whole Genome Sequencing through NGS NovaSeq 6000 that was a historical event for Bangladesh

Objectives

- Establishing a Genomics Laboratory for the use of Next Generation Sequencing (NGS)
- Developing and implementing genome-based technologies
- Creating skilled manpower through seminars, symposiums, conferences, workshops and training programs.

Progress Achieved

- **C**ompleted whole genome sequencing of one hundred patient sample using NGS NovaSeq 6000 machine
- Sequenced 312 whole-genomes of SARS-CoV-2 strains collected from different divisions of Bangladesh
- Started collaborative research Project with University of Nottingham, UK and University of Melbourne, Australia
- Sequenced 128 bacterial whole genome with NextSeq 550 and MiniSeq machine.
- Already arranged more than ten seminar on Genomic Research

NGS Machine room (NovaSeq 6000, NextSeq 500, MiniSeq
Microarray Iscan hybridization station)

Research Papers

1. Mohammad Moniruzzaman, Badhan Saha, Afroza Parvin, Priyanka Dey Suchi, Md. Kamal Hossain and Sirajul Hoque, "Comparative Characterization of Humic Substances Extracted from Peat Soils of Gopalgong and Khulna Regions of Bangladesh", *International Journal of Recent Advances in Multidisciplinary Research*, **2019**, 6(6), 5023-5028.
2. Afroza Parvin, Md Kamal Hossain, Shabiha Islam, Saborni Swarna Das, John LitonMunshi, Priyanka Dey Suchi, Mohammad Moniruzzaman, Badhan Saha and M Golam Mustafa, "Bioaccumulation of heavy metals in different tissues of Nile tilapia (*Oreochromis niloticus*) in Bangladesh", *Malaysian Journal of Nutrition*, **2019**, 25(2), 237-246.
3. Md. Mostakim Billah, Tanjina Akhtar Banu, Mousona Islam, Nilufa Akhter Banu, Salim Khan, Shahina Akter and Ahashan Habib. "*In vitro* regeneration and molecular characterization of some varieties of *Lycopersicon esculentum* Mill. in Bangladesh", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54(2), 117-124.

4. Salim Khan, Barna Goswami, Shahina Akter, Mousona Islam, Afsana Huq Noon, Ahashan Habib and Tanjina Akhtar Banu, '*In Vitro* Mass Propagation of Piper Betle L', *Bangladesh Journal of Botany*, **2019**, 48(3), 559-566.
5. M. Naimur Rahman Sumon,Tanjina Akhtar Banu, Sanjida Rahman Mollika, Barna Goswami, Mousona Islam, Shahina Akter, Ripa Akter Sharmin and M. Salim Khan, "*In vitro* Regeneration of Ginger (*Zingiber officinale Roscoe*)", *Plant Tissue Cult. & Biotech*, **2019**, 29(2), 151-159.
6. Mostafiz Farhana, Md Monirul Islam, Badhan Saha, Md. Kamal Hossain, Mohammad Moniruzzamanand Md. Habibullah-Al-Mamun, "Bioaccumulation of trace metals in freshwater prawn, Macrobrachium rosenbergii from farmed and wild sources and human health risk assessment in Bangladesh", *Environmental Science and Pollution Research,* **2020**, 27, 16426-16438.
7. Aby Syed Md Saiful Isalm, Md Belal Hossain, Sanjida Afrin Semme, Babu, Md. Kamal Hossain and Mohammad Moniruzzaman, "Accumulation of trace elements in selected fish and shellfish species from the largest natural carp fish breeding basin in Asia: a probabilistic human health risk implication", *Environmental Science and Pollution Research*, **2020**. https://doi.org/10.1007/s11356-020-09766-1.
8. Kaniz Fatema, Md. Nazmus Sakib, Md. Al Zahid, Nahid Sultana and Md. Rakibul Hasan,"Growth performance and bioaccumulation of heavy metals in *Anabas testudineus* (Bloch, 1792) cultured using different market feeds" *Bangladesh J. of Zool*. **2019**, 47(1), 77-88.
9. Mousona Islam, Ahsan Habib, Salim Khan, Shahina Akter, Barna Goswami, Hyalles Khan and Tanjina Akhtar Banu,"Molecular characterization of oil seed Brassica using RAPD markers", *Bangladesh Journal of Scientific and Industrial Research*, **2020**, 55(1),1-8.
10. Md. Adnan Rahe, Sanjida Rahman Mollika, M. Salim Khan, Tanjina Akhtar Banu, G. M. Al Amin, Md. Ahsan Habib, Shahina Akter, Mousona Islam and Ripa Akter Sharmin, *In vitro* "Micropropagation of *Bacopa monnieri* (L.) Penn. - An Important Medicinal Plant", *Plant Tissue Cult. & Biotech*., **2020**, 30(1), 57-63.

Reseach Abstracts

1. Mohammad Moniruzzaman, Gafur M.A., Badhan Saha, and Qadir M.R., "Promoting sustainable technology to reduce emission load from brick kilns in Bangladesh", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 69.
2. Md. Kamal Hossain, Afroza Parvin, Badhan Saha, Mohammad Moniruzzaman, Samina Ahmed, Chen M., Haque N., and W. Bruckard W, "Current scenario of arsenic in ground water of Bangladesh", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 70.
3. Badhan Saha, Mohammad Moniruzzaman, Priyanka Dey Suchi, Md. Kamal Hossain, Shahid Akhtar Hossain, Afroza Parvin, and Md. Kamal Hossain , "Arsenic and selenium content in some arsenic affected areas of Bangladesh and its possible relevance to arsenicosis disease", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 71.
4. Afroza Parvin, Mohammad Moniruzzaman, Md. Kamal Hossain, Badhan Saha, Priyanka Dey Suchi, Afsana Parvin and Sirajul Hoque, "Efficacy of humic substances of indigenous sources for heavy metal removal from aqueous solution", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 72.
5. Mohammad Moniruzzaman, Badhan Saha, Md. Kamal Hossain, Afroza Parvin, Afsana Parvin and Sirajul Hoque, "Chemical technology approaches to remediate metal contaminated soil in Bangladesh using humic substances in combination with synthetic extractant", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 72.

6. Afsana Parvin, Mohammad Moniruzzaman, Md. Kamal Hossain, Badhan Saha, Priyanka Dey Suchi, Afroza Parvin and Sirajul Hoque, "Transformation of Lead and Cadmium in contaminated surface soil as affected by applied organic matter", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 73.

7. Sanjida Afrin Semme, Afroza Parvin, Mohammad Moniruzzaman, Badhan Saha, Uddin M.J., Moniruzzaman M., Ahmed A.S.A., and Md. Kamal Hossain, "Monitoring the metal contamination in the sediment and Bivalves from part of the Bay of Bengal and its environmental impacts", *Bangladesh Journal of Scientific and Industrial Research*, **2019**, 54 (Special Issue), 74.

Scientist pursuing M.S/M.Phil/Ph.D courses in home or abroad

1. Mousona Islam, Scientific Officer, pursuing Ph.D Saitama University, Japan.

Industrial Tours/Dissemination

Name of the Scientists, Technician	Place	Date
Jonh Liton Munshi, PSO Md. Majidur Rahaman, Sr. Gar.	Atgharia, Pabna	20-21 October 2019
Natasha Nafisa Huque, RC Abdullah Al Mamun, Sr. Lab. Attn.	Saturia, Manikgonj	27-28 October 2019
Jonh Liton Munshi, PSO Md. Majidur Rahaman, Sr. Gar.	NaraiSadar, Narail	27-28 October 2019
Jonh Liton Munshi, PSO Md.Modon Miah, Jr. Tech	Jaldhaka, Nilfamari	03-04 November 2019
Natasha Nafisa Huque, RC Md. Majidur Rahaman, Sr. Gar.	Shribordi, Sherpur	07-08 November 2019
Md. Mohi Uddin, RC Md. Majidur Rahaman, Sr. Gar.	Chagolnaiya, Feni	11-12 November 2019
Jonh Liton Munshi, PSO Md. Modon Miah, Jr. Tech	Panchbibi, Joypurhat	26-27 November 2019
Jonh Liton Munshi, PSO Md. Majidur Rahaman, Sr. Gar.	Daulatpur, Kushtia	08-09 December 2019
Dr. Md. Ahsan Habib. PSO Tapan Ch. Mollick, Jr. Tech.	Motbaria, Pirojpur	19-20 December 2019
Jonh Liton Munshi, PSO Md. Modon Miah, Jr. Tech	Alamdanga, Chuadanga	29-30 December 2019
Jonh Liton Munshi, PSO Abdullah Al Mamun, Sr. Lab. Attn.	Begumgonj, Nowkhali	05-06 January 2020
Natasha Nafisa Huque, RC Md. Majidur Rahaman, Sr. Gar.	Kaligonj, Gazipur	05-06 January 2020
Jonh Liton Munshi, PSO Dr. Md. Ahsan Habib. PSO Tapan Ch. Mollick, Jr. Tech. Abdullah Al Mamun, Sr. Lab. Attn.	Potuakhali Sadar, Potuakhali	12-13 January 2020

Name of the Scientists, Technician	Place	Date
Natasha Nafisa Huque, RC Md. Modon Miah, Jr. Tech	Sonargaon, Narayangonj	19-20 January 2020
Jonh Liton Munshi, PSO Md. Majidur Rahaman, Sr. Gar.	Kaptai, Rangamati	19-20 January 2020
Jonh Liton Munshi, PSO Abdullah Al Mamun, Sr. Lab. Attn.	Potnitola, Noaogaon	26-27 January 2020
Natasha NafisaHuque, RC Md. Majidur Rahaman, Sr. Gar.	Gajaria, Munshigonj	02-03 February 2020
Jonh Liton Munshi, PSO Md. Modon Miah, Jr. Tech	Burichong, Camilla	05-06 February 2020
Jonh Liton Munshi, PSO Abdullah Al Mamun, Sr. Lab. Attn.	Luxmichori, Khagrachori	11-12 February 2020
Nasima Momtaz, RC Abdullah Al Mamun, Sr. Lab. Attn.	Mirpur, Kustia	23-24 February 2020
Jonh Liton Munshi, PSO Dr. Md. Ahsan Habib, PSO Md. Monirul Islam, Lab. Attn. Md. Majidur Rahaman, Sr. Gar.	Chirirbandar, Dinajpur	27-28 February 2020
Mst. Elina Akhter Zenat, SSO Abdullah Al Mamun, Sr. Lab. Attn.	Kotalipara, Gopalgonj	01-02 March 2020
Jonh Liton Munshi, PSO Dr. Md. Salim Khan, PSO Tapan Ch. Mollick, Jr. Tech. Md. Modon Miah, Jr. Tech	Lama, Bandarban	01-02 March 2020
Jonh Liton Munshi, PSO Md. Modon Miah, Jr. Tech	Gangni, Meherpur	08-09 March 2020
Jonh Liton Munshi, PSO Md. Majidur Rahaman, Sr. Gar.	Goshaerhat, Shoriotpur	08-09 March 2020
Jonh Liton Munshi, PSO Abdullah Al Mamun, Sr. Lab. Attn.	Sharsa, Jessore	12-13 March 2020

Guidance to research Work (phD/M.Phill/M.S/ NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory (Ph.D, M.Phil/ M.S)	Name of Student	Name of academic Institute	Name of Supervisors in BCSIR
01	Assessment of heavy metal concentration in water, sediment and bivalves collected from the coast of bay of Bengal, Bangladesh	MS	Sanjida Afrin Semme	Bangladesh Agricultural University	Dr. Mohammad Moniruzzaman, PSO and Dr. Md Kamal Hossain, PSO
02	Concentrations of trace metals in different organs of Labeocalbasu, L. gonis and L. bata from Mymensingh fish firms in Bangladesh	MS	Saika Sawkat	University of Dhaka	Dr. Mohammad Moniruzzaman, PSO and Afroza Parvin, SO
03	Molification of Cadmium (Cd) toxicity potato tuber by using Moringa seed extract and silicon	MS	Sharmin Akhtar	Sher-e-Bangla Agricultural University	Dr. Mohammad Moniruzzaman, PSO and Afroza Parvin, SO
04	Mitigation of Lead (Pb) toxicity in rice by using Biochar	MS	Sabrina Habib	Sher-e-Bangla Agricultural University	Dr. Md. Kamal Hossain, PSO and Afroza Parvin, SO
05	Heavy metal analysis of fish and sediment in mangroves areas of Coastal region (Swandwip, Sitakundo, nijhumdwip)	MS	Md. Shafiur Rahman	Noakhali Science and Technology University	Dr. Md. Kamal Hossain, PSO and Afroza Parvin, SO
06	Amelioration of Cadmium (Cd) toxicity in rice by using organic manure	MS	Nafis Nauwal	Sher-e-Bangla Agricultural University	Badhan Saha, SSO and Afroza Parvin, SO
07	Evaluation of surface water quality & status of heavy metal in sediment and fish samples collected from part of the Dhaleshwari river alongside the tannery estate, savar, Dhaka.	MS	Shaila Rahman Ema	Jahangirnagar University	Badhan Saha, SSO
08	Spatial Distribution of organic carbon in the active Jamuna floodplain: A case study on Ariche-Shibalya.	MS	Kamrunnahar	Jahangirnagar University	Badhan Saha, SSO
09	Pathogenic bacteria and heavy metals in the inlet and outlet water of shrimp PL nurseries in South-west region of Bangladesh	MS	Abdullah Yeasin	University of Dhaka	Badhan Saha, SSO
10	A comprehensive assessment of trace metals contamination in water, sediment and fish species of various habitat preferences and trophic guides from the Brahmaputra river.	MS	Sabikunnahar Shorna	University of Dhaka	Badhan Saha, SSO and Dr. Md. Kamal Hossain, PSO

Sl. No.	Title of research	Research Catagory (Ph.D, M.Phil/ M.S)	Name of Student	Name of academic Institute	Name of Supervisors in BCSIR
11	Assessment of trace metals in fisheries species from two sources (fame and wild) in Bangladesh.	MS	Nahida Akhter	University of Dhaka.	Badhan Saha, SSO
12	*In vitro* regeneration and *Agrobacterium* mediated genetic transformation of *Rubussp.*	MS	Asma Khatun	Islamic University Kustia.	Dr. Shahina Akter, PSO
13	Development of Somaclonal Variation in Gerbera Varieties (Red Variety of *Gerbera jamesonii* Bolus. and White variety of *Gerbera viridifolia* (DC) Sch. Bip.) Using Micropropagation and Mutation.	MS	Munmun Zahan	Jaganath University	Dr. Tanjina khtar, Banu, PSO
14	Insect larvae and blood meals asprotein sources in diet and growth performance of juvenile climbing perch *Anabas testudineus*"	MS	Shekrite Bardhan	Department of Zoology, Jagannath University.	Lailatul Ferdousi, SO

Participation in training/seminar/Symposium/Workshop/Conference

Training

1. **Dr. Mohammad Moniruzzaman (PSO)** participated in training on operation, multiple application and routine maintenance of Raman Spectroscopy in Horiba Scientific Company, Piscataway, New Jersey, USA from 17 to 23 July, **2019**.
2. **Dr. Md. Salim Khan (PSO)** participated in training on International Training Course on Industrial Synthetic Biotechnology held on October 14-November 2, **2019**, Tianjin, China, organized by Tianjin Institute of Industrial Biotechnology, Chinese Academy of Sciences(CAS).
3. **Badhan Saha (SSO)** participated in training program on "R&D Management for BCSIR Scientists" held on 14 &16 November, **2019** at BCSIR Laboratories Dhaka.
4. **Afroza Parvin (SO)** participated in training program on "Public Procurement Management" held on 14 &16 November, **2019** at BCSIR Laboratories Dhaka.
5. **Dr. Md. Salim Khan (PSO)** participated in training program on "Introductory course in applied microbial genomics for public health and antimicrobial resistance" held on 2-6 December, **2019** organized by The Peter Doherty Institute for Infection and Immunity, University of Melbourne, Australia.
6. **Barna Goswami (SO)** participated in training program on "Introductory course in applied microbial genomics for public health and antimicrobial resistance" held on 2-6 December, **2019** organized by The Peter Doherty Institute for Infection and Immunity, University of Melbourne, Australia.
7. **Iffat Jahan (SO)** participated in training program on "Introductory course in applied microbial genomics for public health and antimicrobial resistance" held on 2-6 December, **2019** organized by The Peter Doherty Institute for Infection and Immunity, University of Melbourne, Australia.

8. **Dr. Mohammad Moniruzzaman (PSO)** participated in training program on "ISO 17025 for Accreditation of Testing Parameter" held on 02-04 February, **2020** at BCSIR Laboratories Dhaka.
9. **Dr. Md. Kamal Hossain (PSO)** participated in training program on "ISO 17025 for Accreditation of Testing Parameter" held on 02-04 February, **2020** at BCSIR Laboratories Dhaka.
10. **Badhan Saha (SSO)** participated in training program on "ISO 17025 for Accreditation of Testing Parameter" held on 02-04 February, **2020** at BCSIR Laboratories Dhaka.
11. **Afroza Parvin (SO)** participated in training program on "ISO 17025 for Accreditation of Testing Parameter" held on 02-04 February, **2020** at BCSIR Laboratories Dhaka.
12. **Afsana Parvin (SO)** participated in training program on "ISO 17025 for Accreditation of Testing Parameter" held on 02-04 February, **2020** at BCSIR Laboratories Dhaka.
13. **Dr. Mohammad Moniruzzaman (PSO)** provided in training on Raman Spectroscopy in BCSIR from 9-13 February, **2020**.
14. **Dr. Md. Kamal Hossain (PSO)** participated in training on Arsenic mitigation in ground water From19 August to 19 November, **2019** Commonwealth Scientific and Industrial Research Organization (CSIRO), Melbourne, Australia.
15. **Dr. Md. Kamal Hossain (PSO)** participated by Starting with Your safety 21 August, **2019** Commonwealth Scientific and Industrial Research Organization (CSIRO), Melbourne, Australia.
16. **Dr. Md. Kamal Hossain (PSO)** participated in The Work Health and safety Act: Your legal duties 10 October, **2019** Commonwealth Scientific and Industrial Research Organization (CSIRO), Melbourne, Australia.
17. **Dr. Md. Kamal Hossain (PSO)** participated in training on 3 policy instruments (NIS, GRS, RTI) to establish good governance, 1 March, **2020**, BCSIR Laboratories Dhaka.
18. **Afsana Parvin (SO)** participated in training on 3 policy instruments (NIS, GRS, RTI) to establish good governance, 1 March, **2020** BCSIR Laboratories Dhaka.
19. **Badhan Saha (SSO)** participated in training program on "R&D Management for BCSIR Scientists" held on 17-21 February, **2020** at CSIR-Human resource development centre, Ghaziabad, Uttar Pradesh, India.
20. **Iffat Jahan (SO)** participated in training program on "R&D Management for BCSIR Scientists" held on 17-21 February, **2020** at CSIR-Human resource development centre, Ghaziabad, Uttar Pradesh, India.
21. **Dr. Shahina Akter (PSO)** participated in training on Epidemiology and Biostatistics held on January 6-8, **2020** at Global Public Health Research Foundation, Dhaka, 2020.
22. **Dr. Tanjina Akhtar Banu (PSO)** participated in training on Epidemiology and Biostatistics held on January 6-8, **2020** at Global Public Health Research Foundation, Dhaka, 2020.

Conference

1. **Md. Salim Khan (PSO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Introduction of Human Whole Genome Sequenced-based Research in Bangladesh"
2. **Dr. Mohammad Moniruzzaman (PSO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Promoting sustainable technology to reduce emission load from brick kilns in Bangladesh".

3. **Dr. Mohammad Moniruzzaman (PSO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Chemical technology approaches to remediate metal contaminated soil in Bangladesh using humic substances in combination with synthetic extractant".

4. **Dr. Md. Kamal Hossain (PSO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Current scenario of arsenic in ground water of Bangladesh".

5. **Badhan Saha (SSO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Arsenic and selenium content in some arsenic affected areas of Bangladesh and its possible relevance to arsenicosis disease".

6. **Afroza Parvin (SO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Efficacy of humic substances of indigenous sources for heavy metal removal from aqueous solution".

7. **Afsana Parvin (SO)** participated in BCSIR Congress on Science and Technology for Sustainable Development organized by BCSIR, 12-14 December, **2019** and presented an oral presentation entitled "Transformation of Lead and Cadmium in contaminated surface soil as affected by applied organic matter",

8. **Dr. Md. Salim Khan (PSO)** participated in 9th International Plant Tissue Culture & Biotechnology Conference 2019 organized by Bangladesh Association for Plant Tissue Culture & Biotechnology, Department of Botany, University of Dhaka. February 08-10, **2020** and presentedan oral presentation entitled "Introduction of Human Whole Genome Sequenced-based Research in Bangladesh"

9. **Dr. Tanjina Akhtar Banu (PSO)** participated in 9th International Plant Tissue Culture & Biotechnology Conference 2019 organized by Bangladesh Association for Plant Tissue Culture & Biotechnology, Department of Botany, University of Dhaka. February 08-10, **2020** and presented an oral presentation entitled "*In vitro* regeneration of Gerbera varieties from different explants"

10. **Barna Goswami (SO)** participated in 9th International Plant Tissue Culture & Biotechnology Conference 2019 organized by Bangladesh Association for Plant Tissue Culture & Biotechnology, Department of Botany, University of Dhaka. February 08-10, **2020** and presented two oral presentations entitled "Indirect organogenesis and somatic embryogenesis for regeneration of *Rauvolfia serpentina* L. from the root explants." And "*In vitro* mass propagation of *Withania somnifera* (L.) Dunal an important medicinal plant of Bangladesh"

Award

1. Dr. Tanjina Akhtar Banu (PSO) has been awarded as the best presenter in the session "*In vitro* Regeneration and Micropropagation of Economically Important Crops, Ornamental and Medicinal Plants" of the 9th International Plant Tissue Culture & Biotechnology Conference 2019.

Number of Analytical (Ad-Hoc) Problem Solved

Name of the Division	Routine type	Research Type	Total
Biological Research Division	1487	167	1654

Special Contribution to the Nation

1) Sequencing of more than 300 whole-genomes of SARS-CoV-2 strains

In May 2020, according to the instructions of honourable minister of Science & Technology, Arch. Yeafesh Osman, BCSIR has undertaken a project, to sequence 300 SARS-COV-2 samples from eight divisions of Bangladesh. To investigate the genetic diversity, a total of 312 whole genomes of SARS-CoV-2 strains were sequenced by Genomic Research Lab, BCSIR under the leadership of Dr. Salim Khan. Very good quality 263 sequencing data was submitted in GISAID (Global Initiative on Sharing All Influenza Data) which comprises 81% of all sequenced data generated in Bangladesh.

Scientists working on whole-genome sequencing of SARS-CoV-2

Press briefing chaired by honorable minister of Science & Technology,
Arch. Yeafesh Osman, to inform the status of 300 whole-genomes of SARS-CoV-2 strains

2) Environment monitoring activities on metro-rail (DMRT) and other projects

Soil and Environment Research section is closely work with Government mega projects. This section is always very conscious to full-fill the dream of government election manifesto. This section assess the in-situ air quality as an independent monitoring team (IMG) of Dhaka Mass Rapid Transport (DMRT) projects and another preferential mega project of Government extension of 3rd Terminal of Dhaka International airport.

Monitoring of air at different construction site of Metro-rail Project

3) Dissemination of Appropriate Technology

Seminar & Exhibition on "Application & Expansion of Appropriate Technology (***Spirulina***)" – Organized by the Ministry of Science and Technology, Bangladesh. To popularize & adoption and dissemination programme of Appropriate Technology of BCSIR to rural mass people. Attended about 26 Upazilas in various places all over the country from **2019-2020**.

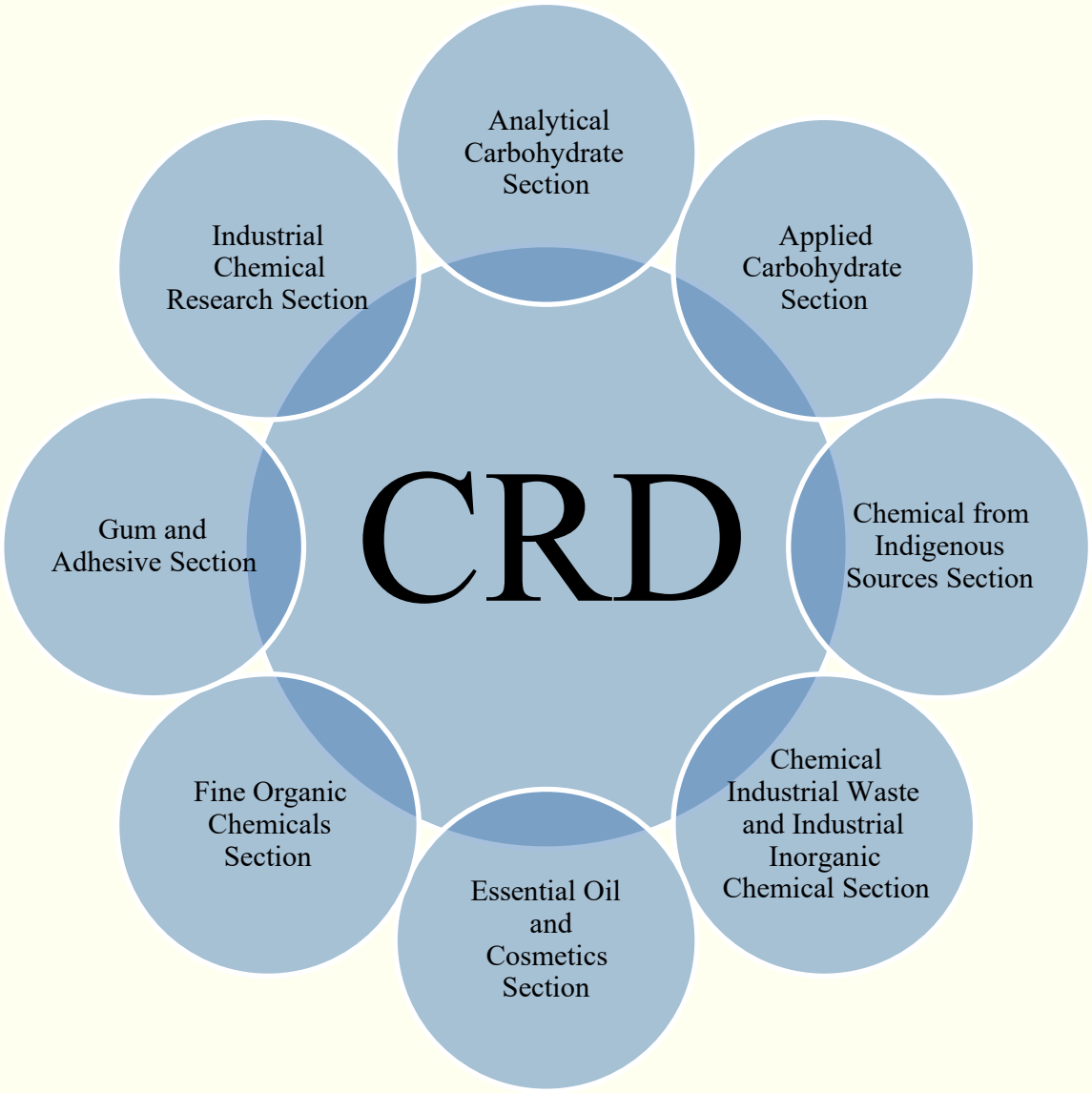
Dissemination of Appropriate Technology at Atghoria, Pabna

Major Instruments

Automatic Air Quality Monitoring System

NovaSeq 6000 NextSeq 550 MiniSeq

Chemical Research Division (CRD)



Chemical Research Division is one of the largest research divisions of BCSIR Laboratories, Dhaka. The main objective of this division is to explore the natural resources of the country, production of chemicals, both organic & inorganic, organic & inorganic synthesis, herbs processing's & herbal products, waste management from chemical and other industries as well as development of process for products from industrial wastes, production of different kinds of gum and adhesives from locally available raw materials are also the objectives of this division.

Research Areas & Short Description on R&D

The R&D activities of CRD are being carried out on production of chemicals from indigenous natural sources, industrial chemicals, gum and adhesives, production of sugars from various natural resources, production of various industry essentials through organic synthesis. Important methods development from this category such as: phosphate and carbonate based fire extinguishing powder, production of chitin and chitosan from shrimp waste shell, production of curcumin from turmeric, methyl and ethyl salicylate, liquid detergent, liquid hand wash, ultrasound gel, zinc acetate, lead acetate etc.

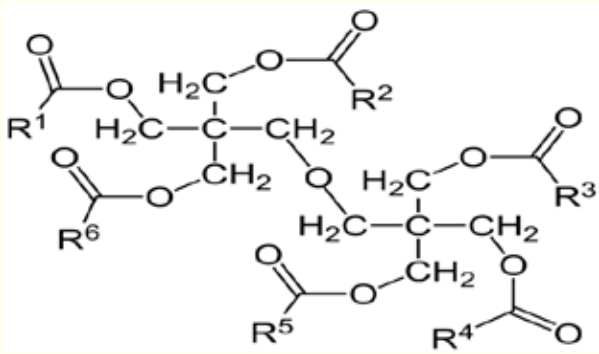
R&D Projects

Process for the production of esters and its derivatives from locally available chemicals and their bioactivity observations

Dr. Shahin Aziz (PL), FatemaTuz Zohra, Dr. Most. Hosney Ara Begum and Dr. Shahana Parveen

Introduction

Esters are widespread in nature. Ester group can be synthesized in a number of different ways. The esters occur both in plants and in animals. In general esters have many uses in both living world and industries such as fragrances in foods, for insect communication, in transparent plastics, in cosmetic formulations, nail polish remover, plasticizer, in glues as solvents.



Polyol ester

Objectives

- To synthesize different esters and its derivatives from locally available chemical with using low cost easy available techniques.
- These will cut down foreign currency.

Work Progress

- Two esters (pineapple flavored and banana flavored) were done.
- The prepared esters was characterized as per standard method.

Prepared Ethyl butyrate ester (Pine apple flavor)

Prepared Amyl Acetate ester (Banana flavor)

Achievements

- One process submitted.
- Another One process is going to submit.

Production of Graphene from Graphite and/or Carbon

Md. Amirul Hoque (PL), Dr. Syed Farid Uddin Forhad and Muhammad Shahriar Bashar

Introduction

Graphene is sudden and revolutionary invention of modern science. It shows extremely high tensile strength and it is 300 times stronger than Steel. It shows extremely high electrical conductivity so that it is called super conductive material. It is 1300 times conductive than cupper. It is very light weight and 1000 times lesser weight than a thin paper. It is single layer carbon atom and almost opaque. Due to its properties a huge number of chemicals, apparatus, equipment, are possible to develop with this material. It is being using for water purification, chemical synthesis, electronic circuit designing, environmental pollution control etc. But the processing technique of Graphene is somewhat expensive and so the material is still expensive.

Objectives

- Preparation of Graphene Oxide from Graphite and its Characterization
- Preparation of Graphene from Graphene Oxide and its Characterization
- Preparation of Graphite from Carbon and its Characterization

Work Progress

a) Literature survey and data collection for the synthesis of Graphene have been done and continuing for further updates.

b) Collections of chemicals, raw materials, glassware, and some equipment have been done and collections of some others are in progress.

c) Establishment of the synthesis procedure of Graphene Oxides and facilities have been set up and some reaction have been conducted and some other steps are in progress.

d) Five batches of Graphene Oxides have been synthesized from Graphite and their purification and characterization works are in progress.

Data and pictures of respective R&D activities

Reaction No.	Wt. of Graphite (g)	Temp. (°C)	Time (Hr.)	Wt. of Graphene Oxide (g)
01.	10.0125	60-65»95	16	16.1250
02.	10.0042	90-95»95	10	14.1326
03.	10.0028	80-85»95	12	14.8974
04.	10.0054	70-75»95	14	15.4252
05.	10.0012	55-60»95	20	17.5638

Formulation, evaluation and comparative study of herbal skin care cosmetics from indigenous sources

Ferdoushi Jahan (SSO) (PL), Md. Abdul Momen, S. M. Mahmudul Hassan, Badhan Saha, Khondoker Shahin Ahmed, Dr. Sahana Parveen, Md. Ahedul Akbor and Rasheda Akter

Introduction

Nature is recognized as the most valuable blessing to the human being, since all one needed to exist in this universe is provided in nature. Hence, from the ancient time, human beings used typical natural ingredients for their daily requirements. Nowadays men and women are very much willing to look them beautiful. Hence, these conscious people show much interest on skin care activities. They have a tendency to use beauty products that includes herbs to look younger and more charming. Recently, herbal cosmetics have gained more popularity and more acceptability among the people than synthetic ones due to their lesser or almost nil side effects.

Objectives

- To develop cost effective and quality herbal skin care cosmetics from indigenous sources.
- Successful completion and industrialization of this project to reduce dependency on imported cosmetics items.

Work Progress

- Collection of herbal ingredientsis completed.
- Herbal ingredients preparation and analysis are going on.
- Formulation of cosmetics products are going on.

Development of method for cost effective and quality upgradation of phosphate based dry fire extinguishing agent.

Nushrat Jahan Ethane (PL), Md. Hemayet Hossain, Khondoker Shahin Ahmed and Dr. Pizush Kanti Biswas

Introduction

Dry Chemical fire extinguishers extinguish the fire primarily by interrupting the chemical reaction of the fire triangle. The multipurpose dry powder works by creating a barrier between the oxygen element and the fuel element on Class A, B & C fires. It is monoammonium phosphate based containing chemical additives, and produced by an exclusive chemical process. The resultant agent is free-flowing, water repellant, non-abrasive, and when used as a fire suppressing agent will produce no toxic effects. In this project, we will produce an advanced multipurpose fire extinguishing agent.

Objective

- To develop a process for the production of high efficiency and cost effective advanced and modified form of phosphate based fire extinguishing agent from locally available chemicals for multipurpose fire extinguisher.
- Successful completion and industrialization of this project generate employment for unemployed men & women.

Work progress

- Five different fire extinguishing agent were produced from the said chemicals in different proportion, analytical work of these product are going on.
- Application of these prepared modified forms of phosphate based fire extinguishing agent and compare with the marketed fire extinguisher powder.

Production of useful Laboratory Chemicals as $(NH_4)_2C_2O_4$, $Ca(C_2H_3O_2)_2$, Na_2MoO_4, $NH_4CH_3CO_2$, NH_4Cl, for Research & Industrial use

Nushrat Jahan Ethane (PL), Md. Hemayet Hossain, Khondoker Shahin Ahmed and Dr. Pizush Kanti Biswas

Introduction

Research organizations, Pharmaceuticals, Industries and Educational Institutes in our country spend a lot of foreign currencies to get proper laboratory grade chemicals. It is our view to develop the process for the production of most essentially chemicals like as $(NH_4)_2C_2O_4$, $Ca(C_2H_3O_2)_2$, Na_2MoO_4, $NH_4CH_3CO_2$, NH_4Cl using local raw materials as well as industrial wastes. Development of the process will help us to make the chemicals available not only in proper grade but also in very reasonable price.

Objective

- The main object of this project is to develop the process for the production of laboratory chemicals like $(NH_4)_2C_2O_4$, $Ca(C_2H_3O_2)_2$, Na_2MoO_4, $NH_4CH_3CO_2$, NH_4Cl using locally available raw materials.
- This will reduce the dependency on foreign countries for those imported items and save millions of foreign currency.
- Contribute in poverty alleviation in our unemployed men and women.

Work progress

- Raw material have been collected and purified them well.
- Literature survey of this project has been completed.
- Production of $(NH_4)_2C_2O_4$ and $Ca(C_2H_3O_2)_2$ were carried out in laboratory scale. Analytical works of these products are going on.
- Lab scale production of $(NH_4)_2C_2O_4$ and $Ca(C_2H_3O_2)_2$ has been successfully completed. Semi large scale production of $(NH_4)_2C_2O_4$ and $Ca(C_2H_3O_2)_2$ is going on.

Achievements and Activities

Scientific paper

1. Sharika Farhana, **Shahin Aziz**, Shirin Akhter Banu, Sharif Al-Reza, "UV & FT-IR Spectroscopic analysis of *Andrographis Paniculata* Ethanolic Leaf Extract",*Research Journal of Life Sciences, Bioinformatics, Pharmaceutical and Chemical Sciences*, *RJLBPS*, **2019**, 5 (4), 12.
2. Shirin Akhter Banu, **Shahin Aziz**, Sharika Farhana, Sharif Al-Reza, "Spectroscopic profiling of *EcliptaProstrata*Ethanolic Leaf Extract by UV and FT-IR". *GSC Biological And Pharmaceutical Sciences,* **2019**, 08(1), 029-034.
3. Tahmina Khondokar Mitu**, Shahin Aziz**, Sharif Al-Reza, "Spectroscopic Analysis o*f Abroma Augusta* Ethanolic Leaf Extract by UV & FT-IR", *International Journal of Pharma Research and Health Sciences*, **2019**, 7 (3), 2974-76.
4. Sharika Farhana, Shirin Akhter Banu, Tahmina Khondkar Mitu, **Shahin Aziz** and Sharif Md. Al-Reza, "Phytochemical Screening and chemical composition of Fixed oil from Stems of *Andrographis Paniculata*" *World Journal of Pharmaceutical Research*, **2019**, 8(9), 186-194.
5. Shirin Akhter Banu, Sharika Farhana, Md. Shadiqul Islam, **Shahin Aziz** and Sharif Md. Al-Reza, "Determination of physicochemical analysis and chemical constituents of fixed oil from leaves of *Eclipta Prostrata*" *World Journal of Pharmaceutical Research*, **2019**, 8(10), 35-41.

6. S M Neamul Kabir Zihad, Yashu Gupt, Shaikh Jamal Uddin, Muhammad Torequl Islam, Md. Rabiul Alam, **Shahin Aziz**, Mahmood Hossain, Jamil Ahmad Shilpi, LutfunNahar, Satyajit D. Sarker, "Nutritional value, micronutrient and antioxidant capacity of some green leafy vegetables commonly used by Southern Coastal people of Bangladesh", *Heliyon*, **2019**, 5, e02768.
7. Tahmina Khondokar Mitu**,** Sharika farhana, Shirin Akhter Banu, **Shahin Aziz**, Sharif Al-Reza, Phytochemical screening and chemical composition of fixed oil from seed of *Abroma augusta*, *International Research Journal of Biological Sciences*, **2019**, 8 (11), 29-32.
8. Fariha Mamuna, Md. Mizanur Rahmana, Mushfera Zamila, Nusrat Subhana, **Hemayet Hossain**, S.M. Raquibul Hasan, MdAshraful Alam, Md. Areeful Haque, "Polyphenolic compounds of litchi leaf augment kidney and heart functionsin 2K1C rats", *Journal of Functional Foods*, 2019.
9. **Ferdoushi Jahan**, Afroza Akter Happy, Mohammad Moynul Hasan Chowdhury, Mohammad Arif Hossain,"Natural Herbs and Spices: A Great Resource for Skin Care Cosmetics", *Journal of Plant Sciences*, **2019**, 7(4), 86-99.
10. Mizanur Rahman, Ismet Ara Jahan, **Khondoker Shahin Ahmed**, Wahiduz Zaman, Iftekhar Ahmad and Shah Ahmed, "Comparison of proximate composition and antioxidant tactivity of black and green tea available in Bangladesh", *SUST J Sci Tech*, **2019**, 29(2), 52-57.
11. Kamrun Nahar, **Shahin Aziz**, Muhammad Shariar Bashar, M. AhsanulHaque, "Synthesis and characterization of silver nanoparticles from Cinnamomum tamala leaf extract and its antibacterial potential", *Int. J. Nano. Dimenns*, **2020**, 11(1), 88-98.
12. **Ferdoushi Jahan,** Md. Abdul Momen, Afroza Akter Happy, **Md. Hemayet Hossain,** Md. Ahedul Akbor, Sharmin Ahmed, "Formulation and Evaluation of Herbal Ultrasound Gel for Ultrasonography", *Journal of Diseases and Medicinal Plants*, **2020**, 6(1), 11-15.
13. **Md. Monarul Islam**, Xing Feng, Chuan-Zeng Wang, Shofiur Rahman, Abdullah Alodhayb, Paris E. Georghiou,Taisuke Matsumoto, Junji Tanaka, Carl Redshawand Takehiko Yamato, "Studies on Lewis-Acid Induced Reactions of 8-Methoxy [2.2] metacyclophanes: A New Synthetic Route to Alkylated Pyrenes", *Chemistry Select*, **2020**, 5, 1269-1274.
14. Zhen Hu, Haoke Zhang, Yan Chen, Qingsong Wang, Mark R. J. Elsegood, Simon J. Teat, Xing Feng, **Md. Monarul Islam**, FugenWu and Ben Zhong Tang, "Tetraphenylethylene-Based Color-Tunable AIE-ESIPT Chromophores", *Dyes and Pigments*, **2020**, *175*, 108175.
15. Zhen Hu, Ying Li, Miaomiao Kang, **Md. Monarul Islam**, Mengsi Chen, Jun Zhang, Ye Xiao, Xing Feng, Carl Redshaw, Menglong Zhang, Qing Chen, Sheng Xie, Jacky W. Y. Lam and Ben Zhong Tang, "Aggregation-induced emission luminogen: A new perspective in the photo-degradation of organic pollutants", *EcoMat.* **2020**, 1-12

Process accepted

Nushrat Jahan Ethane, Md. Hemayet Hossain, Dr. Pizush Kanti Biswas, Dr. Ismet Ara Jahan, "Production of Aluminum Sulfate (anhydrous) from scrap Aluminum" accepted by the office, Member Development, BCSIR, Dhaka. Ref. No.:39.02.0000.043.37.103.17/829 Date: 12.12.2019.

Guidance to research Work (PhD/M.Phil/MS/NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
01.	Studies on *Baccaurearamiflora* seeds for its fatty oil, minerals and proximate analysis.	M.S thesis	Mst. Jebunnahar	Islamic University Kushtia	Dr. Shahin Aziz, PSO
02.	Bio concentration of Cr, Cd, Ni, Pb and As in some fresh and dried fishes collected from south east coast of Bangladesh with health risk assessment.	M.S thesis	Tamanna Sharmin	Dhaka University	Dr. Shahin Aziz, PSO
03.	Evaluation of heavy metal concentration in canned fish and health risk analysis.	M.S thesis	Jannatul Aynaum Mimi	Dhaka University	Dr. Shahin Aziz, PSO
04.	Chemical and Biological Investigation on different Plant parts of *Abroma Augusta* (L.) .	M.Phill Research	Tahmina Khondkar Mitu	Islamic University, Kushtia	Dr. Shahin Aziz, PSO
05.	Chemical and Biological Investigation on different Plant parts of *Andrographis Paniculata* (Burm. F.) Wall. Ex Nees	M.Phill Research	Tahmina Khondkar Mitu	Islamic University, Kushtia	Dr. Shahin Aziz, PSO
06.	Chemical and Biological Investigation on different Plant parts of *Eclipta Alba* (Linn.) Hassk	M.Phill Research	Sharika Farhana	Islamic University, Kushtia	Dr. Shahin Aziz, PSO
07.	Chemical and Biological Investigation on different Plant parts of *Adiantum Flabellulatum* Linn.	M.Phill Research	Taslima Akhter	Khulna University, Kushtia	Dr. Shahin Aziz, PSO
08.	Eco–Friendly Synthesis of Silver nanoparticles using plant extract and evaluation of their anti microbial activities.	Ph.D Research	Kamrun Nahar	Islamic University, Kushtia	Dr. Shahin Aziz, PSO
09.	HPLC-DAD profiles and pharmacological insights of *Costusspeciosus* extract	M. Pharm thesis	Md. Abdul Barek	Noakhali Science and Technology University	Md. Hemayet Hossain, PSO
10.	HPLC-DAD profiles and pharmacological insights of *Musa acuminate* extract	M. Pharm thesis	Muhammad Amanat	Noakhali Science and Technology University	Md. Hemayet Hossain, PSO
11.	Effects of processing treatments on phenolic compounds of rice	M.S thesis	Md. Kawser Alam Kanan	Hajee Mohammad Danesh Science & Technology University, Dinajpur	Md. Hemayet Hossain, PSO and Khondoker Shahin Ahmed, SO

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
12.	Effects of processing treatments on phenolic compounds of black berry leaves and fruits	M.S thesis	Towrin Nahar	Hajee Mohammad Danesh Science & Technology University, Dinajpur	Md. Hemayet Hossain, PSO and Khondoker Shahin Ahmed, SO
13.	HPLC profiling and antioxidant activities of ethanol of arial part of *Aervasanguilenta* grown in Bangladesh	M.S thesis	Zoy Sharker	Rajshahi University	Md. Hemayet Hossain, PSO
14.	Preparation of chitosan based combination product which can used as natural food preservative	Research Fellow	Nadia Sultana	BCSIR Laboratories, Dhaka.	Md. Hemayet Hossain, PSO
15.	Formulation, evaluation and comparative study of herbal skin care cosmetics from indigenous sources.	Research Fellow	Afroza Akter Happy	BCSIR Laboratories, Dhaka.	Ferdoushi Jahan, SSO

Participation in training / Seminar/ Symposium/ Workshop/ Conference

Training

1. **Md. Abdul Momen** (RC) participated in training programme on "Wavelength Dispersive X-ray Fluorescence (WDXRF)" organized by IMMM, BCSIR, Joypurhat, 23-27 February, 2020.
2. **Nushrat Jahan Ethane**, SSO, has participated training on “ISO 17025 For Accreditation of Testing Parameter” held 0n 02-04 February 2020 at BCSIR Laboratories, Dhaka, Bangladesh Council of scientific and Industrial research (BCSIR).
3. **Khondoker Shahin Ahmed**, SO, has participated training on “ISO 17025 For Accreditation of Testing Parameter” held 0n 02-04 February 2020 at BCSIR Laboratories, Dhaka, Bangladesh Council of scientific and Industrial research (BCSIR).
4. **Khondoker Shahin Ahmed**, SO, has participated training on “Raman Spectroscopy: Principles, Operation and Data Analysis” held 0n 09-13 February 2020 at Bangladesh Council of scientific and Industrial research (BCSIR), Dhaka-1205.
5. **Dr. Md. Monarul Islam**, SSO, participated in an evening training program entitle “Financial Management for Executives” organised by Bangladesh Institute of Management at Dhaka held on 8-12 February, 2020.
6. **Ferdousi Jahan,** SSO, has participated in a training on “Liquid Chromatography-Mass-Mass Spectrometer (LC-MS-MS): Principles, Operation and Data Analysis” held 0n 16-20 February 2020 at BCSIR Laboratories, Dhaka, Bangladesh Council of scientific and Industrial research (BCSIR).

Conference Proceedings

1. **Dr. Md. Monarul Islam** delivered an Invited Lecture on "Pyrene-based Aggregation-induced Emission (AIE) Luminogens" organized by Institute of Biomedical and Health Engineering and IEEE Engineering in Medicine and Biology Society Shenzhen Chapter 16 July, 2019, SIAT-CAS, Shenzhen.

2. **Dr. Shahin Aziz**, presented oral presentation, "Phytochemical screening and antibacterial activity of various extracts from different parts of *Cassia sophera* Linn" in BCSIR Congress, an international conference organized by BCSIR, Dhaka, at 12-14 Dec., 2019. (Oral presentation).
3. **Dr. Shahin Aziz**, presented orally, "Utilization of Spilanthesacmella leaf oil cake as Biofertilizer" with abstract no. OP-C01in Conference on Environmental Solutions for sustainable development: towards development Bangladesh (CESSD 2019) an international conference organized by Forest and Environmental Affairs Sub-committee Bangladesh Awami league at 27-28 Dec., 2019. (Oral presentation)
4. **Khondoker Shahin Ahmed**, Qualitative Assessment of Water and Sediment of Dhaleshwari River in Savar, Dhaka, Bangladesh, (Oral Presentation), A Future Earth Conference as well as Water Future Conference, Devecha Centre for Climate Change, Indian Institute of Science (IISc), Bengalure, India from 24-27 September, 2019.
5. **Khondoker Shahin Ahmed**, Simultaneous HPLC-DAD Profiling of Polyphenolic Compounds from *Moringa oleifera* Lam. Leaves Grown in Bangladesh, (Poster Presentation, NP-PP-08, p-143), Bangladesh Chemical Society Conference, Department of Chemistry, Rajshahi University, Rajshahi, Bangladesh from 9-10 November, 2019.
6. **Ferdoushi Jahan** (SSO) participated in "1st International Conference on Planning and Development" organized by National Academy for Planning and Development (NAPD), 23-24 November, 2019.
7. **Shahin Aziz**, Sarzana Rahman, Tahmina Khondkar Mitu presented "Analysis of fatty acids, total protein and selected phytochemical content in *cassia sophera Linn* leaves, stem, flowers and seeds" in PSE-NPS 2020, an international Summit organized Pharmacy discipline, Khulna University at 16-18 January, 2020 with id : PSE-NPS 2020 Summit /pp/A059 with page no. 110. (Poster presentation)
8. Sharika Farhana**, Shahin Aziz**, Md. Sharif Al-Reza presented oral presentation, "Chemical and biological investigation on different parts of *Andrographis paniculata* (Burm f.) Wall .ex. Nees." in PSE-NPS 2020, an international Summit organized Pharmacy discipline, Khulna University at 16-18 January, 2020 with id : PSE-NPS 2020 Summit /pp/A034 with page no. 84. (Oral presentation)
9. **Shahin Aziz**, Md. Morshed Alam, Md. Zahangir Alam presented, "Utilization of *Spilanthes acmella* leaf oil cake as Biofertilizer" in ICRAC, an international conference organized Department of Chemistry, Jagannath University at 7-8 February, 2020 with id: pp-E-14 with id poster presentation 202. (Poster presentation)
10. Sharika Farhana, **Shahin Aziz**, Md. Sharif Al-Reza presented, "Antimicrobial activity of different plant parts of *Androgra phispaniculata* (Burm f.) Wall .ex. Nees." in International conference on recent advances in chemistry organized Department of Chemistry, Jagannath University at 07-08February, 2020 with id: Op-C-07 with page no.42. (Oral presentation).
11. **Khondoker Shahin Ahmed**, Anti-Inflammatory, antioxidant activities and quantification of major polyphenols of *Viscum monoicum* by HPLC, (Poster Presentation, PSE-NPS2020Summit/PP/A075, p-116), PSE-NPS 2020 Summit on Natural Products for Healthy Living, Pharmacy Dicipline, Khulna University, Khulna, Bangladesh from 16-18 January 2020.
12. **Khondoker Shahin Ahmed**, Antioxidant activities and polyphenolic compounds analysis of different parts of *Moringa oleifera* grown in Bangladesh, (Poster Presentation, PP-B-06, p-137-138), International Conference on Recent Advances in Chemistry, Department of Chemistry, Jagannath University, Dhaka, Bangladesh from 07-08 February, 2020.

Award

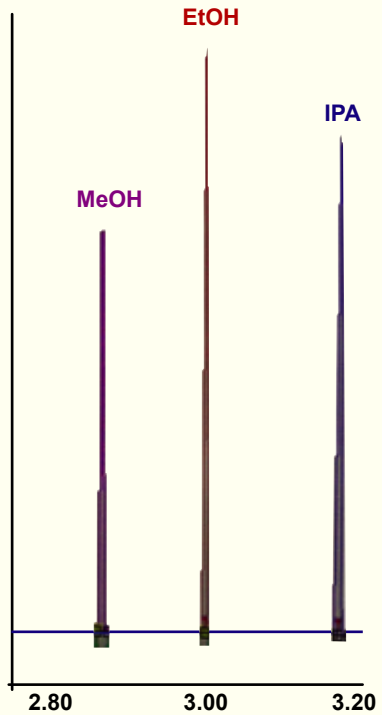
Khondoker Shahin Ahmed, SO, Chemical Research Division, got Integrity award 2019-2020 from BCSIR Laboratories, Dhaka.

Number of Analytical (Ad-Hoc) Problem Solved

Name of the Division	Routine type	Research Type	Total
Chemical Research Division (CRD)	350	100	450

Special Contribution to the Nation

Chemical Research Division of BCSIR Laboratories, Dhaka is currently providing analysis services to different industries by determining the specific standards of Hand Sanitizer, Gel, and Hand Rub etc by the GC machine from April 2020. It is to be noted that Corona virus (COVID-19) has now become pandemic all over the world and many companies in Bangladesh are currently producing Hand Sanitizer, Gel, and Hand Rub etc. As a result, it is important to continue the analysis service at CRD, BCSIR.



Products

Phosphate Based Fire extinguishing powder

Carbonate Based Fire extinguishing powder

Ultrasound Gel

Aloe Gel

Neem Based Cream

Herbal Hand Wash

Baby Liquid Laundry Detergent

Hearbal Shaving Foam

Activated Carbon

Chitosan

Lead Acetate

Pectin from Mango Peel

Carcumin

Mouth Wash

Starch from Mango Seed

Zinc Acetate

Sophisticated Equipments/Machineries:

FTIR

HPLC

GC

Fibre & Polymer Research Division (F&PRD)

Fibre & Polymer Research Division is one of the largest divisions of BCSIR Laboratories, Dhaka. It is a highly specialized research laboratory conducting R&D works on different branches of Polymer Chemistry and providing services to the large scale polymer-based industries of Bangladesh by developing knowledge-based analytical methods. R&D activities of the division are mainly focused on Plastic, Textiles, Jute, Wood, Rubber, Bitumen, Paint, Dyes and Pigments, Plastic and Rubber Waste Management and Utilization System, Textile Effluent Treatment etc. This division is gradually increasing its capability to reduce the dependency on foreign laboratories in the field of polymer analyses. The ultimate objective is to ensure sustainable development of the country applying Polymer Science & Technology. This division has seven fields of research/sections-

- Cellulosic Fibre Research Section
- Plastic Research Section
- Rubber Research Section
- Dyes & Pigment Research Section
- Resin Research Section
- Paint-Varnish-Lacquer Research Section and
- Fibre & Polymer Testing Section

R&D Projects

Development and application of industrially important cellulose derivatives (HPMC, MC, CMC, Celluloseacetate etc.) from lignocellulosic biomass (Jute etc.)

Md. Mahbubur Rahman (PL), Zahidul Islam, Muhammad Saiful Islam, Swapan Kuner Ray, Md. Abdullah Al Mansur, Dipa Islam, Dr. Toufic Ahmed and Dr. M. Sarwar Jahan

Introduction

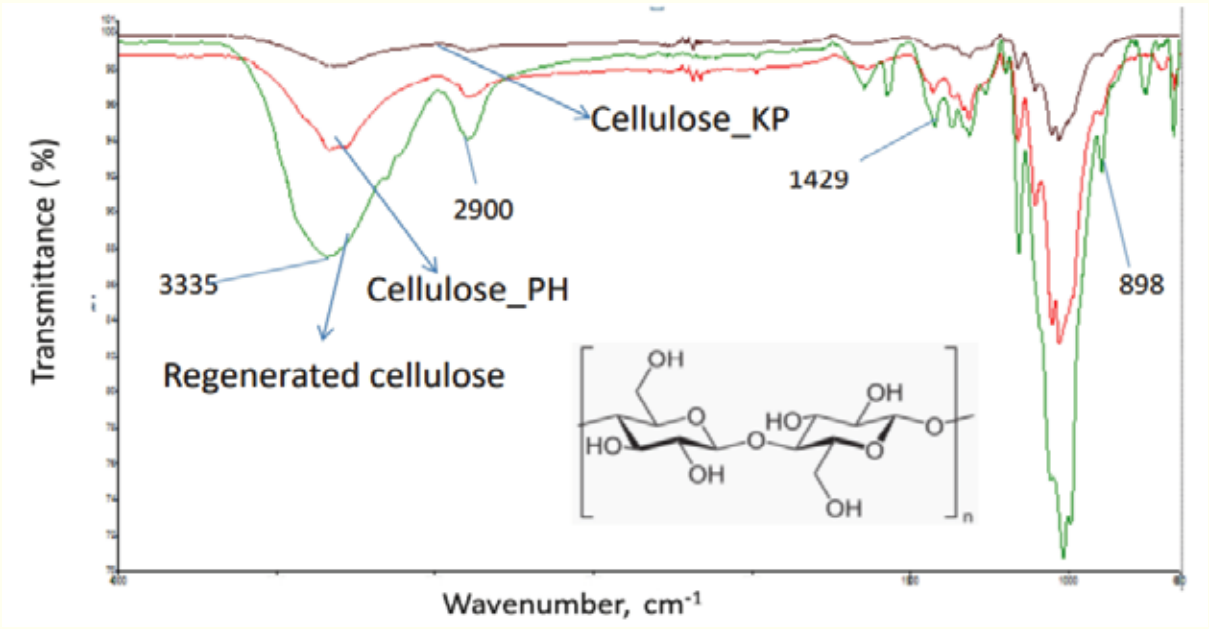
Cellulose, a well-known fascinating biopolymer is the naturally most abundant biorenewable and biodegradable resource on the earth. In this project our aim is to synthesize industrially important cellulose derivatives hydroxypropyl methylcellulose (HPMC), methyl cellulose (MC), carboxymethyl cellulose (CMC) and cellulose acetate from lignocellulosic biomass considering its applications in construction, food, pharmaceutical and personal care industries. In this project we will also use ionic liquids (ILs) and their double salts (DSILs) for dissolution and modification of cellulose. ILs provides an attractive alternative to traditional solvents for both industrial and laboratory purpose on account of their potential as 'green' solvents.

Objectives

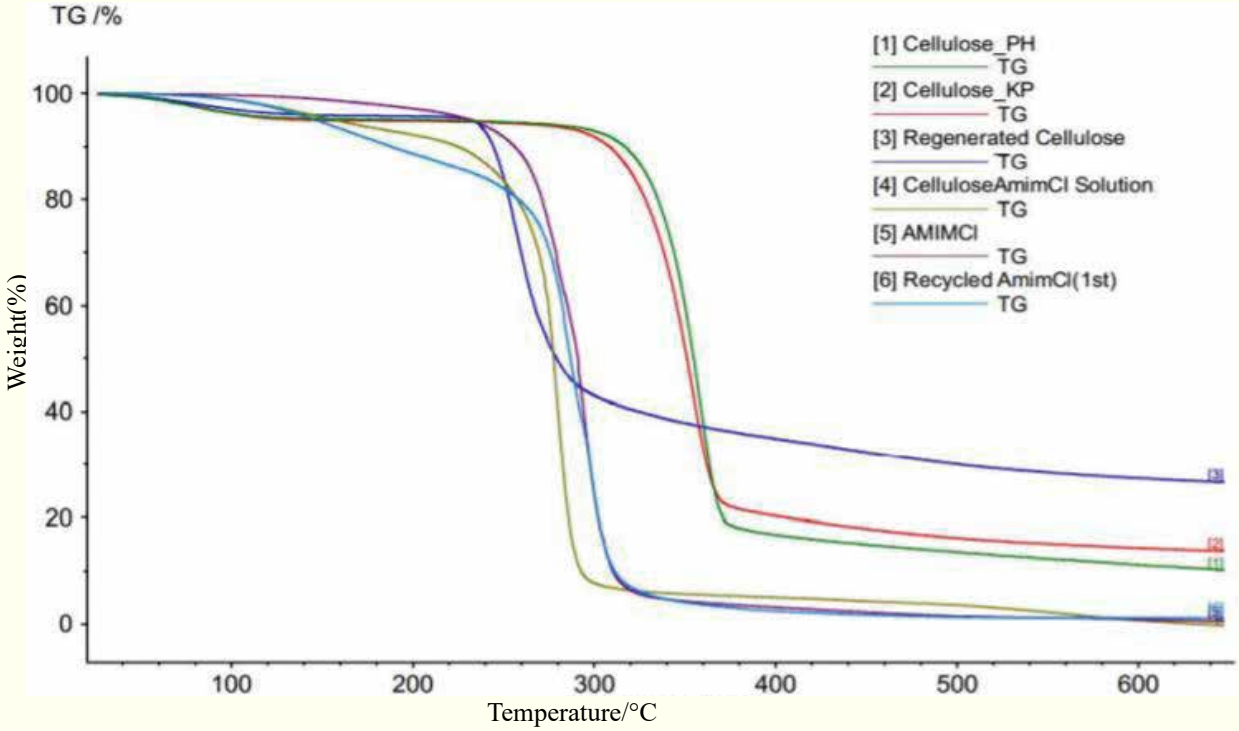
- Isolation and purification of cellulose from jute fiber etc.
- Synthesis of cellulose derivatives HPMC, MC, CMC, Cellulose acetate, etc. from Jute fiber etc.
- Application of cellulose derivatives in the field of food, pharmaceutical, cosmetic and textile industries
- Introduction in a green approach Ionic liquids (ILs) and their double salts for dissolution and modification of cellulose

Work Progress

- Isolation and purification of cellulose from jute fibre is completed
- Preparation of methyl cellulose from jute cellulose is completed and its characterization is going on
- Determination of physical properties of ILs & DSILs is going on



FT-IR spectra of 1-Allayl-3-methylimidazolium chloride and recyled 1-Allayl-3-methylimidazolium chloride



TGA thermograms of jute cellulose & regenerated jute cellulose, jute cellulose in ionic liquid and recycled ionic liquid

Synthesis of thermoplastic modified thermosetting polymers, composites and nanocomposties

Shahin Sultana (PL), Lutfun Naher Hilary, Zahidul Islam and Md. Rashed Hasan

Introduction

Thermosetting polymer networks tend to have a characteristic low resistance to brittle fracture.To increase toughness, some research works have been found in literature on the modification reaction of thermosetting polymer.In this research works, the prepared thermoplastic modified thermosetting polymers, composites and nanocomposites might be used in adhesive industry, packaging industry, and plastic industry, automobile and other industrial applications respectively.

Objectives

- To synthesize thermoplastic modified thermosetting polymer.
- To prepare composites/ nanocomposites using these synthesized modified thermosetting polymers with treated and untreated natural fibers.

Work Progress

- PVA modified urea formaldehyde resin has been synthesized and characterized.
- PVA modified resorcinol formaldehyde resin has been synthesized and characterized.
- Preparation of composites and nanocomposites using these materials is going on.
- One patent has been submitted on PVA modified resorcinol formaldehyde resin.

Development of Polyaluminum Chloride to be used as coagulant for textile waste water treatment

Shamima Akther Eti (PL), Swapan Rumer Ray, Md. Jyanal Abedin and Riyadh Hossain Bhuiyan

Introduction

Wastewater treatment technologies are cost prohibitive. Application of effective coagulant seems to have the most potential for treatment of waste water because coagulation and filtration are the heart of conventional water treatment plants. Polyaluminum chloride (PAC) is a pre-polymerized coagulant which has been used extensively in recent years in such that it has become one of the most common coagulants in different water and waste water treatment plants.

Objectives

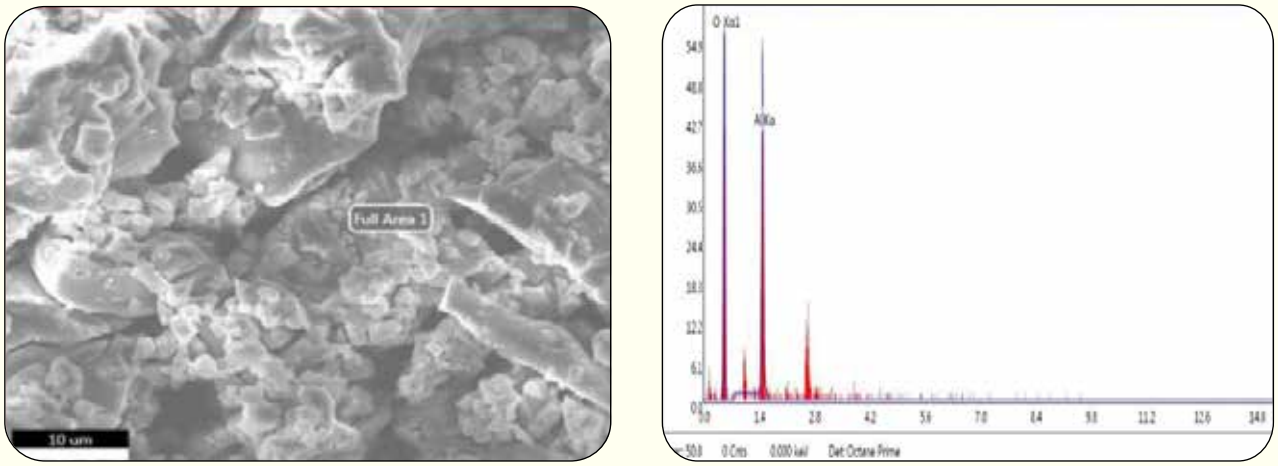
- To develop an appropriate technology for the preparation of Polyaluminum Chloride (PAC) coagulant for waste water treatment.
- Utilization of available scrap /waste aluminum and other low cost chemicals.

Progress Achieved

- Synthesis of Polyaluminum Chloride (PAC) : Some batches are prepared
- Characterization of laboratory prepared PAC is in progress

Synthesis of PAC in the laboratory

Synthesized Polyaluminum chloride



Morphology of the synthesized product

Production of polyvinyl chloride (PVC) solvent cement and composite materials using waste PVC and acrylic polymers

Shahin Sultana (PL), Zahidul Islam, Md. Jaynal Abedin, Lutfun Naher Hilary and Md. Khabiruddin Sarker

Introduction

Waste PVC polymers are available from power plant of Bangladesh. These are used as filler materials in the cooling system of power plant and rejected as waste PVC after four years. These are rigid PVC films and these waste PVC can be utilize to make value added products such as composite materials and PVC solvent cement. With the help of this project we want to utilize waste PVC to make value added products to reduce import of such products and to meet our local demand.

Objectives

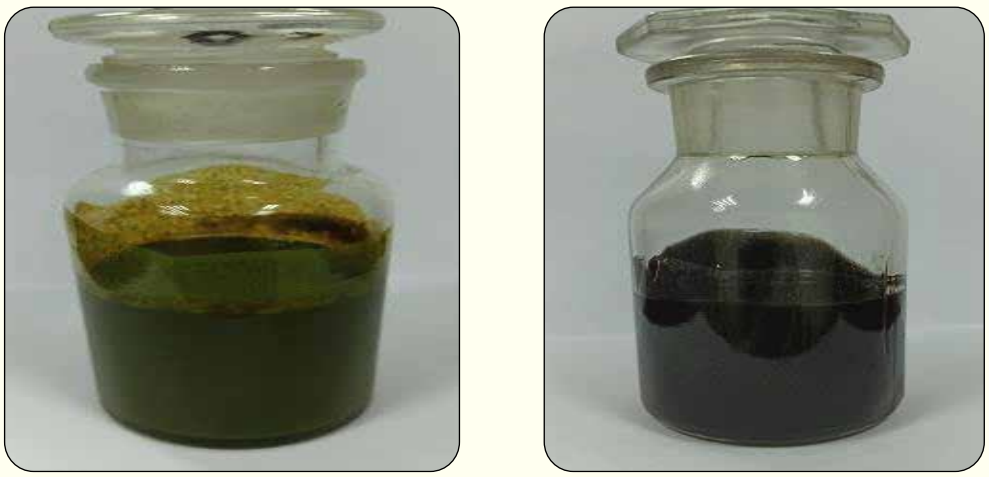
- To produce PVC solvent cement for PVC pipes jointing and fittings.
- To produce natural fibers reinforced composite materials using waste PVC and acrylic polymers.

Waste PVC from power plant

Progress Achieved

- Waste PVC materials have been collected and analyzed.
- Production of PVC solvent cement for PVC pipes jointing and fittings is in progress.

PVC Solvent Cement



Waste PVC based fabric marker

PVC pipe jointing by waste PVC based solvent cement

Achievements and Activities

Paper Published

1. Md Lukman Hakim, Nazmun Nahar, Mithun Saha, Muhammad Saiful Islam, Hasan Mahmud Reza and Shazid Md Sharker, "Local drug delivery from surgical thread for area-specific anesthesia", *Biomedical Physics & Engineering Express,* **2020***,* 6(1), 015028.
2. Imana Shahrin Tania, Mohammad Ali, and Riyadh Hossen Bhuiyan. "Experimental Study on Dyeing Performance and Antibacterial Activity of Silver Nanoparticle-Immobilized Cotton Woven Fabric." *Autex Research Journal,* **2020**, 1.
3. Mohammad Nashir Uddin, Taslima Ferdous, Zahidul Islam, M. Sarwar Jahan, M. A. Quaiyyum "Development of Chemometric Model for Characterization of Non-wood by FT-NIR Data", *Journal of Bioresources and Bioproducts*, **2020**, 5(3): 205–212.
4. Swapan Kumer Ray, Riyadh H. Bhuiyan, M. Saiful. Islam, M. Jaynal. Abedin, Pranab. K. Nandy, Zahidul Islam, M. Rashed Hasan and Husna P. Nu**r "**Modification of 80-100 penetration grade bitumen", *Bangladesh J. Sci. Ind. Res.,* **2019**, 54(4), 307-320.
5. M. A. Hossain, M. M. Elias, M. Mahbubur Rahman, M. M. Rahman, M. S. Ali, and M. A. Razzak, "Multi-phenyl structured aromatic hydrocarbon polymer", *Bangladesh J. Sci. Ind. Res,.* **2020**, 55 (2), 139-146.

6. N. J. Ara, M. F. Rahman, Z. Hasan, M. Saiful Islam and M. M. Rahman, "Development of the N-doped Cu- carbon composite as a novel catalyst for the removal reactive black 5", *Open Journal of Applied Sciences*, **2020**, 10, 432-443.
7. Tanvir Sultana, Shahin Sultana, Husna P. Nur and Md. Wahab Khan, "Impact on morphological, physicomechanical and thermal properties of polypropylene composites reinforced with chemically modified betel nut husk fiber", *Int. J. Adv. Res*., **2019**, 7(2), 1111-1119.
8. Afroza Khatun, Shahin Sultana, H. Parvin Nur and AM Sarwaruddin Chowdhury, "Physical, mechanical, thermal and morphological analysis of date palm mat (DPM) and palmyra palm fruit (PPF) fiber reinforced high density polyethylene hybrid composites", *Adv. Mater Sci.*, **2019**, 4, 1-6.
9. Mohammad Majedul Haque, Md. Rashed Hasan, Shakila Akter, Md. Khabir Uddin Sarker, Shamima Akther Eti and Shahin Sultana, "Phytochemical screening, proximate composition and heavy metals of camellia sinensis leaves", *Int. J. Adv. Res.*, **2019**, 7(7), 195-201.
10. M. Mazedul Haque, N. Sultana, S. M. T. Abedin and S. E. Kabir, "Stigmasterol, rengyolone, 2-phenylethyl β-D-glucopyranoside and n-tetradecyl-β-D-glucopyranoside from the flowers of Nyctanthes arbor-tristis Linn", *Bangladesh J. Sci. Ind. Res.,* **2019**, 54(3), 275-282.
11. M. Mazedul Haque, N. Sultana, S. M. T. Abedin and S. E. Kabir, "Phytochemical screening and determination of minerals and heavy metals in the flowers of Nyctanthes arbor-tristis L.", *Bangladesh J. Sci. Ind. Res.,* **2019**, 54(4), 321-328.
12. M. Saiful Islam, B. K. Ray, Zahidul Islam, M. Rashed Hasan, M. Jaynal Abedin, M. Mahbubur Rahman, Swapan K. Ray, Shahin Sultana, "Preparation and characterization of glycerol-plasticized PVA-chitosan blend film", *Bangladesh J. Sci. Ind. Res.,* **2019**, 54 (Special Issue-BCSIR Congress 2019-Abstract).
13. M. Ripaz Uddin, Riyadh H. Bhuyain, S. Yeasmin, M. A. Ahsan, M. E. Ali, **"**Characterize of some physic-chemical parameters and status of Escherichia coli of Karnaphuli River in Bangladesh", *Journal of Environmental Science, Computer Science and Engineering & Technology*, **2019**, A-8(4), 343-357.
14. Md. Ripaj Uddin, Riyadh Hossen Bhuyain, Muhammad Edris Ali, Md. Aminul Ahsan. **"**Pollution and ecological risk evaluate for the environmentally impact on Karnaphuli river, Bangladesh". *International Journal of Fisheries and Aquatic Research*, **2019**, 4(3), 38-48.
15. M. Nashir Uddin, Sohan Ahmed, Swapan Kumer Ray, M. Saiful Islam, Ariful Hai Quadery and M. Sarwar Jahan; Method for predicting lignocellulose components in jute by transformed FT-NIR spectroscopic data and chemometrics; *Nordic Pulp & Paper Research Journal* **2019**.

Patents Submitted

1. Shahin Sultana, Zahidul Islam, Md. Rashed Hasan, Md. Jaynal Abedin and Lutfun Naher Hilary, "A process for the production of polyvinyl alcohol modified resorcinol formaldehyde resin" submitted to the office of the Patents and Design and Trademarks, Motijheel, Dhaka. Date: 21.06.2020
2. Swapan K Ray, M Saiful Islam, Pranab K Nandy, Md. Amirul Hoque, Md. Mahbubur Rahman and Husna P Nur, "Natural rubber-bitumen-lignin binder for sustainable pavement construction with waste thermoplastic-coated aggregates", submitted Patent to Development office, BCSIR, Dhaka. Date: 29.06.2019.

Process Submitted

Swapan K Ray, M Saiful Islam, Pranab K Nandy, Md. Amirul Hoque, Md. Mahbubur Rahman and Husna P Nur, “"Natural rubber-bitumen-lignin binder for sustainable pavement construction with waste thermoplastic-coated aggregates", submitted to Development office, BCSIR; 29.06.2019.

Scientists pursuing M.S/M.Phil/PhD Courses in home or abroad

Name and Designation	Name of the Institute	Date
Shahin Sultana, PSO	PhD, Department of Theoretical and Computational Chemistry, University of Dhaka, Bangladesh	2016-2017 session
Swapon Kumar Ray, PSO	PhD, Department of Chemistry, University of Dhaka, Bangladesh	2018-2019 session
Md. Mahbubur Rahman, SSO	PhD, Department of Chemistry, University of Dhaka, Bangladesh	2017-2018 session
Shamima Akther Eti, SSO	PhD, Department of Soil, Water & Environment, University of Dhaka, Bangladesh	2017-2018 session
Pranab Kumar Nandy, SO	MS, University of South Dakota, USA	2019-2020 session

Industrial Tours/Dissemination

Name and Designation	Name of the Institute	Date
Md. Khabir Uddin Sarker, SSO Md. Jaynal Abedin, SSO Zahidul Islam, RC	Bangladesh Forest Industries Development Corporation, Shreemangal, Moulovibazar.	15.07.2019 - 18.07.2019
Md. Khabir Uddin Sarker, SSO Md. Jaynal Abedin, SSO Riyadh Hossen Bhuiyan, RC	BRB Cables Ltd., Kushtia	02.03.2020 – 05.03.2020

Guidance to research Work (PhD/M.Phill/M.S/NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
1	Agro-fiber reinforced polymer matrix based composite: Its prospects in Bangladesh	M.S thesis	Mr. Pinku Poddar	Department of Applied Chemistry and Chemical Engineering, University of Dhaka	Dr. Husna Parvin Nur, Director and Dr. A. M. Sarwaruddin Chowdhury, Professor
2	Fabrication and characterization of betel nut husks fiber and metal nanoparticles reinforced thermoplastic nanocomposites	M.S thesis	Mustari Rahman	Department of Chemistry, BUET, Dhaka	Shahin Sultana, PSO and Dr. Md. Wahab Khan, Professor

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
3	Synthesis and characterization of methyl cellulose from jute cellulose	M.S thesis	Md. Abu Zafor	Department of chemistry, University of Dhaka	Mohammad Mahbubur Rahman, SSO and Dr. Tanvir muslim, professor
4	Preparation and characterization of glycerol-plasticized 4and unplasticized PVA-chitosan blend film	M.S thesis	Bikash Kumar Ray	Department of Chemistry, Dhaka College, affiliated to the University of Dhaka	Muhammad Saiful Islam, SSO
5	Syntheses of lignin derivatives and their utilization in paint and adhesive.	M.S thesis	Md. Saddam Hossain	Department of Chemistry, University of Dhaka	Swapan Kumer Ray, PSO
6	Syntheses of lignin derivatives and their utilization in cosmetic industries	M.S thesis	Sayed Rashedul Islam	Department of Chemistry, University of Dhaka	Swapan Kumer Ray, PSO
7	Polyaluminum chloride based coagulants for removal of dye from industrial wastewater.	M.S thesis	Tarek Ahsan	Department of Soil, water and Environment, University of Dhaka	Shamima Akther Eti, SSO, Dr. Muhammad Enayet Hossain, Assistant Professor
8	Characterization and Ecological risk Assessment of Trace Metals and PAHs in coastal sediment of South-center Region in Bangladesh	M.S thesis	Nigar Sultana	Department of Environmental Science, Noakhali Science and Technology University	Shamima Akther Eti, SSO, Dr. Mohammad Abdus Salam, Assistant Professor
9	Study on aesthetic properties of finished pigment printed woven fabric	M.S thesis	Meharun Nessa	Faculty of Textile Chemical Engineering, Bangladesh University of textiles, Dhaka	Swapan Kumer Ray, PSO
10	Determination of methoxyl content of lignin isolated from baggasse	M.S thesis	Md. Rifat Islam	Department of Chemistry, University of Dhaka	Swapan Kumer Ray, PSO
11	Determination of hydroxyl content of lignin isolated from coconut fibre	M.S thesis	Seikhh Moyeen Md. Mustakim	Department of Chemistry, University of Dhaka	Swapan Kumer Ray, PSO

Participation in Training/Seminar/Symposium/Workshop/Conference

1. **Lutfun Naher Hilary (SSO)** has participated in training on "WD-XRF" organized by P&D, BCSIR, held in IMMM, BCSIR, Joypurhat, in 23-27 February, **2020**.
2. **Swapan Kumar Ray (PSO), Md. Mahbubur Rahman (SSO), Shamima Akther Eti (SSO),** and **Muhammad Saiful Islam (SSO)** have participated in BCSIR Congress-2019, held at BCSIR Campus Dhaka, 12-14 December, **2019**.
3. **Swapan Kumar Ray (SSO), Md. Mahbubur Rahman (SSO), Shamima Akther Eti (SSO)** and **Lutfun Naher Hilary (SSO)** have participated in "The Conference on Environmental Solutions for Sustainable Development: Towards Developed Bangladesh (CESSD)", at CIRDAP, Dhaka, 27-28 November, **2019**.
4. **Zahidul Islam (RC)** has participated in training on "GC-MS" organized by P&D, BCSIR, held in BCSIR Laboratories, Rajshahi, in 27-31 October, **2019**.
5. **Zahidul Islam (RC)** and **Riyad Hossain Bhuiyan (RC)** participated in training workshop on "Pulping and paper making technologies of non-wood fibre" organized by China National Pulp & Paper Research Institute (CNPPRI) in Beijing, China 12-31 August, **2019.**
6. **Zahidul Islam (RC)** has participated in training on "Conduct and Discipline Course" organized by BPATC, held in RPATC, Dhaka, in 4-8 August, **2019**.
7. **Lutfun Naher Hilary** (SSO) has participated in the 'Symposium on Women in Chemistry' organized by the Organization for Prohibition of Chemical Weapons (OPCW), held in The Hague, The Netherlands, on 24 June, **2019**.
8. **Zahidul Islam (RC)** has participated in training on "Photo Luminescence (PL)" organized by P&D, BCSIR, held in Central Lab, BCSIR Dhaka, in 19-23 May, **2019**.
9. **Swapan Kumer Ray (PSO)** has participated in International Workshop on "Sustainable Management of Plastic to Leverage Circular Economy and Achieve SDGs in Bangladesh", organized by Department of Environment, World Bank and Others, held at Pan Pacific Sonargoan, Dhaka, on 13 February, **2019**.

Number of Analytical (Ad-Hoc) Problem Solved

Name of the Division	Routine type	Research Type	Total
Fibre and Polymer Research Division	991	76	1067

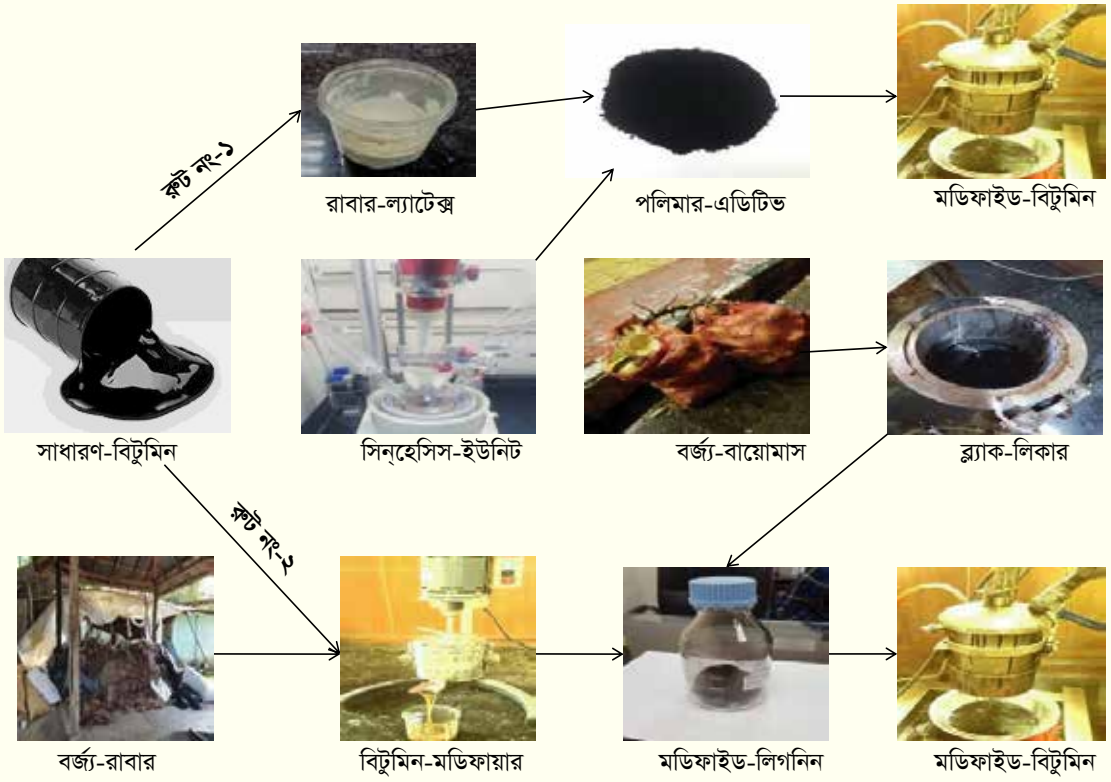
Products

Natural Dyed Jute Bag


Modified RF Resin


Polymer Modified Bitumen

উদ্ভাবিত বিটুমিন মডিফিকেশন পদ্ধতি



প্লাস্টিক-বর্জ্য ব্যবস্থাপনা ও বিকল্প ব্যবহার

Major Instruments

HS-GC-FID/ECD system

UPLC-PDA/RI Instrument

Simultaneous Thermal Analyzer

Gel Permeation/Size Exclusion Chromatograph

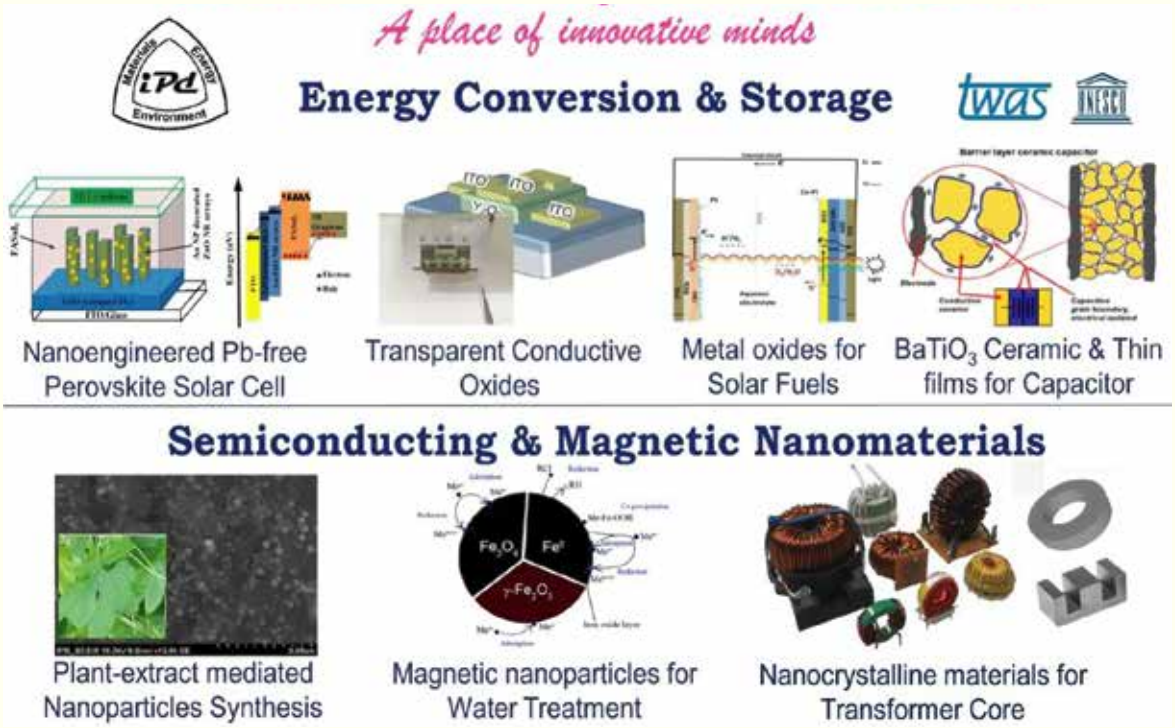
Universal Strength Tester

Reaction Calorimeter

Solution of industrial problems

Scientists working at Fibre and Polymer Lab

Industrial Physics Division (IPD)



Physicists in industry and academia have been a prime mover of industrial development as well as technological advances of modern products by translating fundamental discoveries into viable commodities and state-of-the-art tools that improve our way of life. In this era of fast-changing technology, materials and device physicists/engineers experience immense challenges globally to reduce the time and expense required to bring products and services to the end users. With this challenge in mind, Industrial Physics Division (IPD) has been engaged in the cutting-edge R&D activities in the field of materials and energy for sustainable development. Scientists and researchers of this division play a pivotal role to solve problems in a wide range of academic and industrial areas, devising custom-made tools and using unconventional techniques for better understanding the synthesized as well as imported products. Tailoring material properties at the nanoscale as well as adopting advanced and high-precision measurements techniques are the core of IPD activities to fulfill the needs of diverse stakeholders as well as for upholding the country's scientific development strategy.

R&D Projects

Low cost and Environment friendly semiconducting materials synthesize and property optimization for solar cell applications

Dr. Syed Farid Uddin Farhad (PL), Nazia Khatun, Mohammad Sajjad Hossain, Nazmul Islam Tanvir, Mohammad Shariar Bashar and Dr. Mohammad Abdul Gafur

Introduction

The current technology behind the production of solar cell modules is very expensive because of the scarcity of raw materials and sophisticated manufacturing technique. This R&D project focuses mainly on synthesis

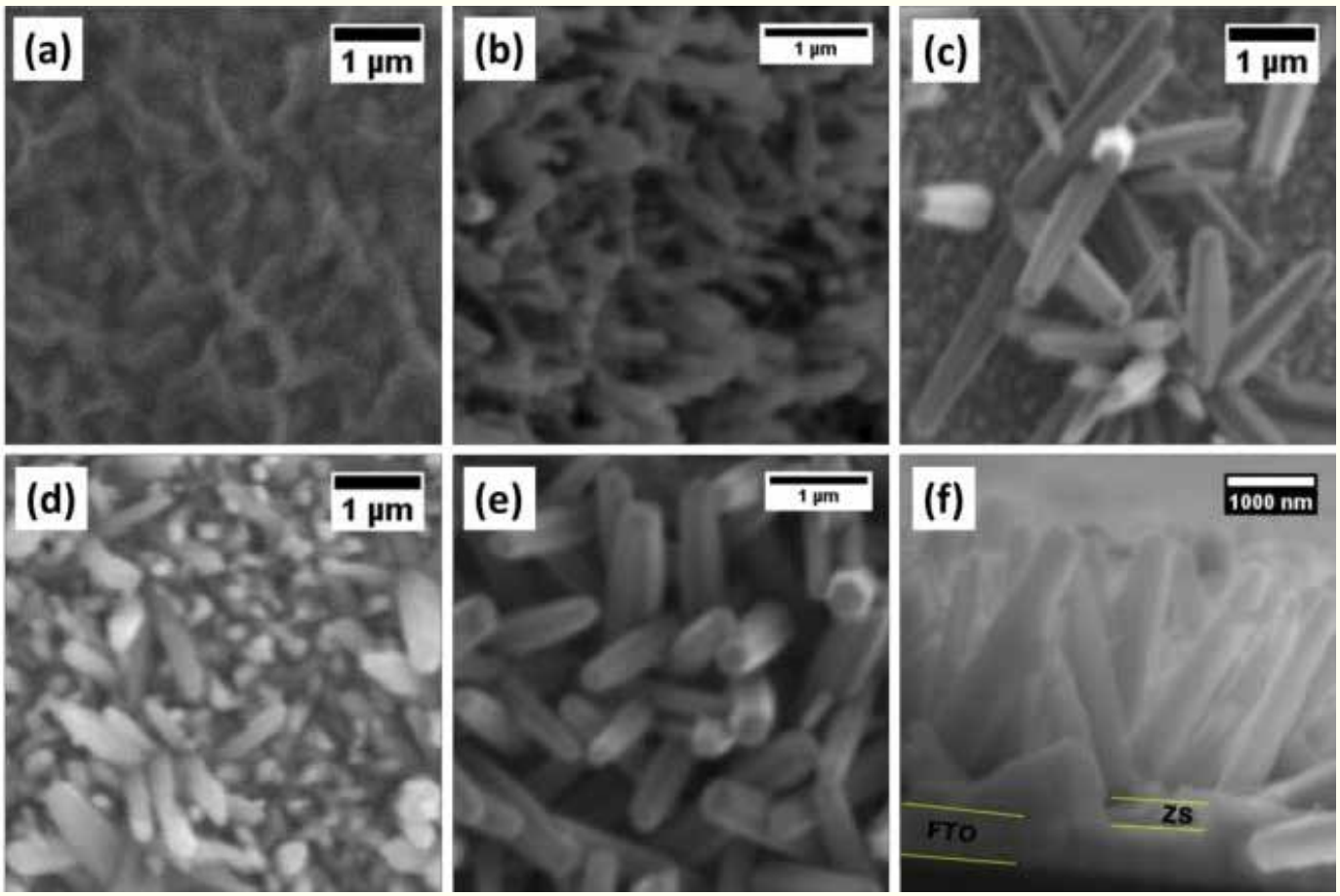
and property optimization of earth abundant materials for solar cell and other optoelectronic applications.This project accomplished in June, 2018 and the research findings of this project have been utilized to formulate external founding (for example, TWAS/UNESCO etc.) projectsrelated to Nanoengineered lead (Pb)-free perovskite solar cells and Bismuth based metal oxide photocathodes for Solar Fuels (H_2).

Objectives

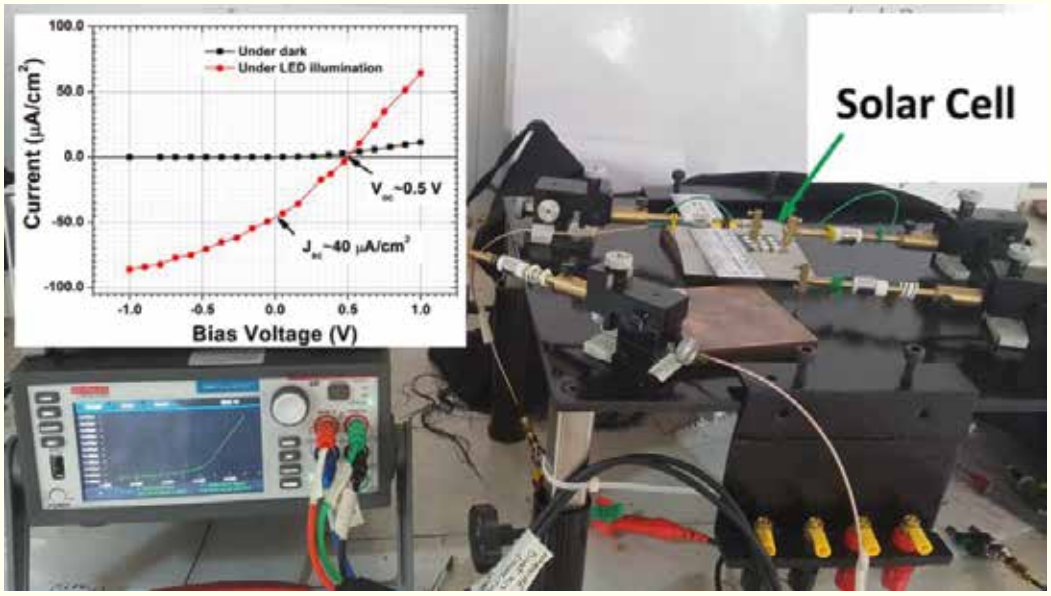
- To synthesize low and intermediate band gap (E_g< 2.5 eV) hole conducting (p-Type) as well as absorbing layers.
- To characterize deposited n- and p-type layers and their property optimization for integrating them into solar PV devices.

Work Progress

Zinc oxide (ZnO) and Al-doped ZnO (AZO) thin films have been grown on both amorphous glass and FTO substrates using variety of deposition techniques including drop casting (DC), dip coating (DPC), ball mill derived (BMD) spin coating, and SILAR techniques etc. for subsequent hydrothermal growth of ZnONanorods (see figure 4.11) were characterized by SEM, XRD , UV-VIS-NIR and RT-PL spectroscopy for property optimization for realization of 'Eco-friendly and high performance Solar Cells'. A home-built multi-probe workstation has been developed for investigating the performance of proto-type solar cell.



SEM micrographs of ZnO(DPC)/SLG (a), ZnO NR/ZnO(DPC)/SLG (b), ZnO NR/FTO (c); ZnO NR/ZnO(BMD)/FTO (d), ZnO NR/ZS(DC)/FTO (e) and ZnO NR/ZS(DP)/FTO (f). (a) – (e) are plane view images and (f) is the cross-sectional view image.



A home-built multi-probe workstation equipped with a precision source measurement unit (Keithley 2450-EC) for characterizing various optoelectronic devices including solar cells and LEDs.

Under the scope of this project, 4 M.Sc. students accomplished their research works and 2 M.Phil. and 3 M.Sc. students conducted their thesis works. Five research papers have been published in reputed peer review journals.

Future Plan

The property optimized p- and n- type materials will be used for devising prototype solar cells with rational design for performance enhancement.

Construction of Low cost equipment for developing Standard Test Methods for measuring Electrical Conductivity of Liquid and Solid Materials

Dr. Syed Farid Uddin Farhad (PL), Dr. Most. Hosney Ara Begum, Abu Kowsar and Nazmul Islam Tanvir

Introduction

Electrical conductivity is one of the inherent properties of any substance based on which they are classified as metal, semiconductor, insulator as well as dielectric materials. The conductance measurement spans many different ranges which require the different probing techniques of the test sample as well as sensitive equipment to reduce error and measurement accuracy. Therefore, this project mainly deals with design, construction and development of low-cost equipment as well as development of standard testing methods (STMs) for measuring conductivity of diverse materials using our homemade equipment.

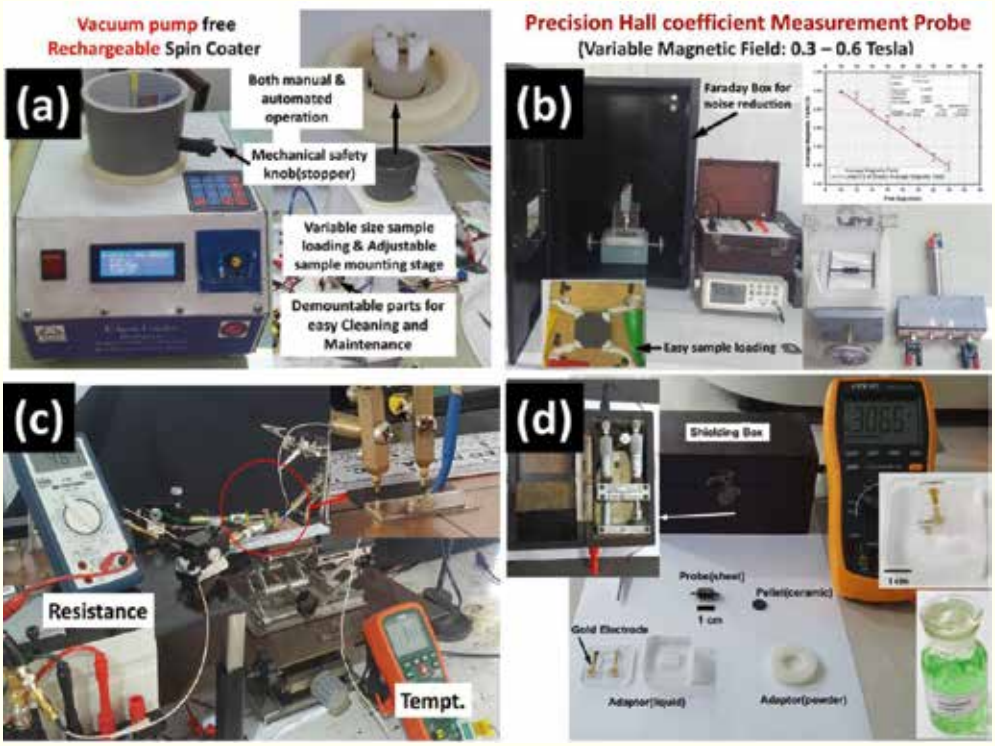
Objectives

- To develop STMs for measuring electrical conductivity of solid and semi-solid samples.
- To validate the testing methods using home-built equipment that 'fit-for-purpose' of different stakeholders.
- To locally construct/fabricate custom made affordable test equipment for research institutes as well as for college/university science laboratories.

Work Progress

Primary design and construction of some prototype equipment and probing accessories are shown in Figure 4.21below.

- A couple of equipment and sensitive probing accessories are locally designed and indigenously developed.
- STMs are developed for Ultra-high and ultra-low resistivity (conductivity) of diverse solid samples has been accomplished.
- A patent (spin- coater) application has been submitted and a process is ready for lease out.



(a) A portable (vacuum pump free) spin-coater for depositing conducting thin films, (b) Hall Effect measurement setup, (c) Temperature dependent resistivity measurement setup for thin and thick films, and (d) Test Jigs and adaptors for liquid, powder, and pellet samples.

Future Plan

The homemade prototype instruments will be used for the development of the proposed STMs and will further be upgraded for developing affordable test equipment.

Fabrication of highly Transparent and Conducting Substrate (TCS) of using low cost and environment friendly materials for consumer electronics

Dr. Syed Farid Uddin Farhad (PL), Suravi Islam, Abu Kowsar and Nazmul Islam Tanvir

Introduction

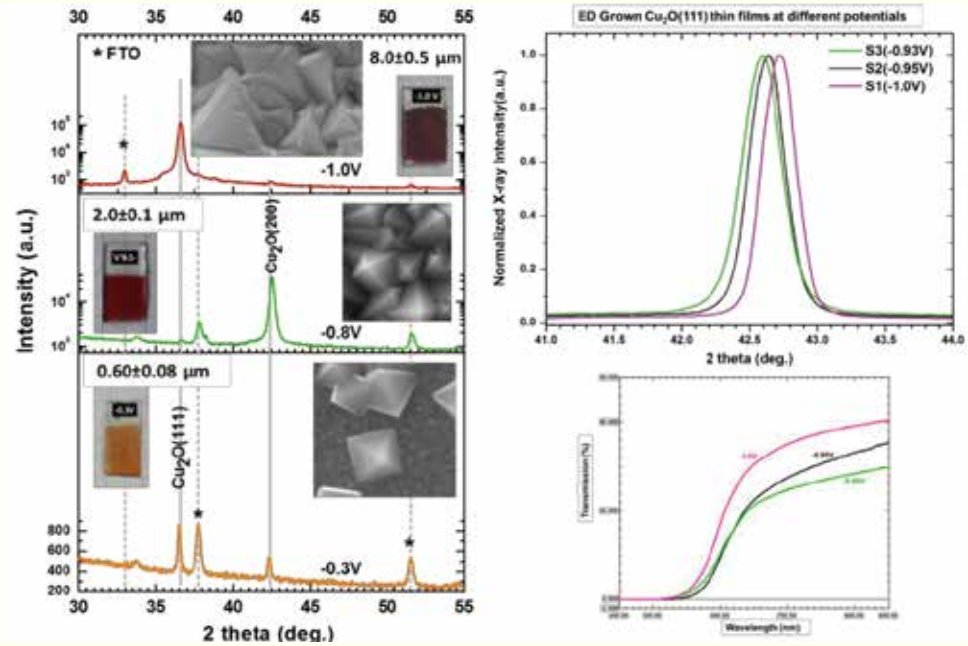
Transparent and Conducting Substrates (TCS) is one of the major components for consumer electronics such as flat panel displays, smart phone, touch screen, low-emissivity energy-conserving windows, photo-electrochemical device and more importantly in solar cells. This project focuses on the use of low cost and environment friendly materials for the facile fabrication of highly transparent and conducting substrates/electrodes for optoelectronic and solar cell industry.

Objectives

- To synthesis Binary/Ternary copper oxide, AZO, FTO, NiO and Graphene (reduced Graphene oxide (rGO)).
- Optimization of physical and chemical properties of synthesized TCS and study of their performance compared to the commercial TCS.

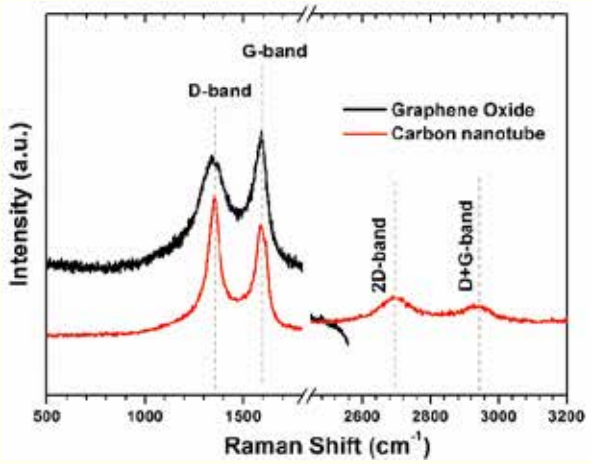
Work Progress

Highly crystalline with controlled orientation and solar cell grade copper oxides have been grown by a facile 2-electrode Electrodeposition technique. The initial characterization results of the deposited products are shown in below.



Left: Potentiostatic Electrodeposition (ED) of Cu2O at different cathodic potential to control orientation (111 & 200) of the deposit (SEM and Optical image and thickness of the films are shown in the inset) using home-built setup; Right: 111 oriented Cu2O thin film (Top) and their transmission spectrum (Bottom) at different cathodic potentials.

Apart from metal oxide based TCS materials, state-of-the-art carbon materials such as Graphene, Graphene oxide etc. have been synthesized by facile chemical methods.



Raman spectra of Graphene oxide and Carbon nanotube (CNT) showing characteristic bands.

Under the scope of this project three M.Sc. (thesis) students accomplished their research works. Further analyses of the characterization results of the deposited product are going on and at least two research publications are expected in the peer reviewed journals.

Future Plan

FTO and NiO will be synthesized low-cost solution processable techniques and carbon based TCS materials will be characterized and optimized for potential device applications. The duration of this R&D project will end in June, 2020 and efforts will be made for extension of this project to accomplish desired targets.

Synthesis and characterization of co-doped dielectric material for ceramic capacitor

Suravi Islam (PL), Dr. Syed Farid Uddin Farhad, Nazia Khatun, Mohammad Sajjad Hossain and Ayesha Siddika

Introduction

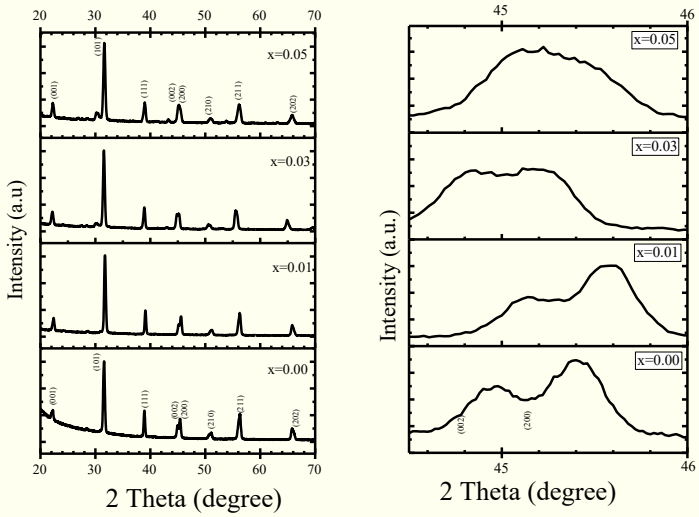
A ceramic capacitor is a fixed value capacitor in which ceramic material acts as dielectric. Different compositions of the ceramic material have different applications. Use of high-performance dielectric materials for ceramic capacitor is increasing day by day. On the basis of analysis and results of the prepared samples, developed materials will be employed for practical use for ceramic capacitor. This project accomplished in June, 2020.

Objectives

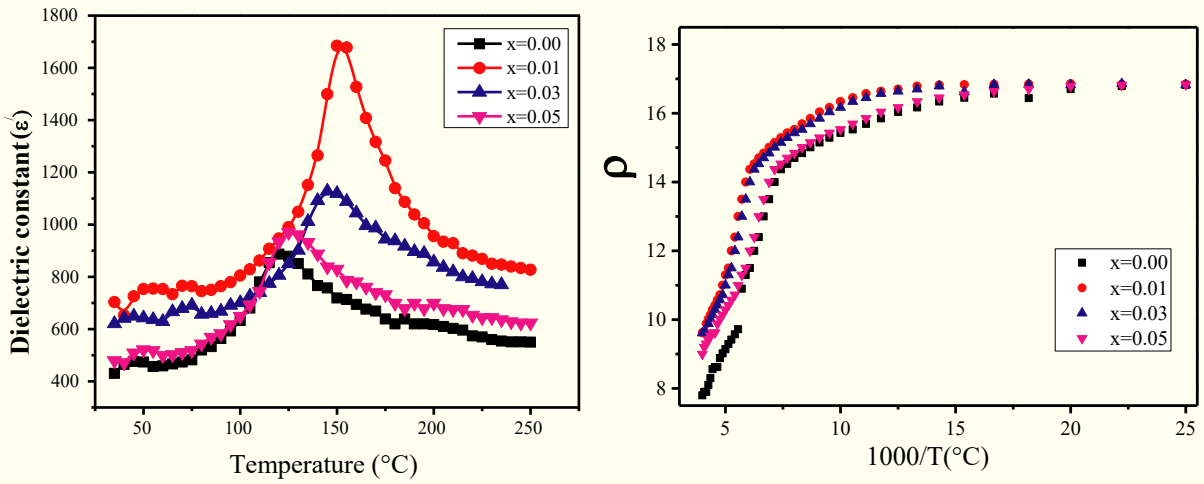
- To prepare high performance dielectric material as import substitute.
- To characterize the samples by XRD, SEM
- To study the physical, electrical and dielectric properties of the samples.

Work Progress

- Bi and Y co-doped BaTiO3 have been synthesized. Characterization of samples has been done by XRD and SEM, chemical analysis by EDS, Electrical and dielectric analysis by Impedance analyzer.
- Two M.Sc students completed their thesis under this project.
- Two research papers have been published.



Powder X- ray diffraction pattern and Gaussian fitting of the peaks in the vicinity of 44.5-460 for $(Ba_{1-x}BiX)(Y_xTi_{1-x})O_3$, (where x=0.00,0.01,0.03,0.05) ceramic samples



Temperature dependence of dielectric constant for $(Ba_{1-x}BiX)(Y_xTi_{1-x})O_3$Ceramics measured at 50 Hz and Temperature dependence resistivity of $(Ba_{1-x}BiX)(Y_xTi_{1-x})O_3$ samples

Development of magnetic material for sensor

Nazia Khatun (PL), Dr. Most. Hosney Ara Begum, Suravi Islam and Dr. Syed Farid Uddin Farhad

Introduction

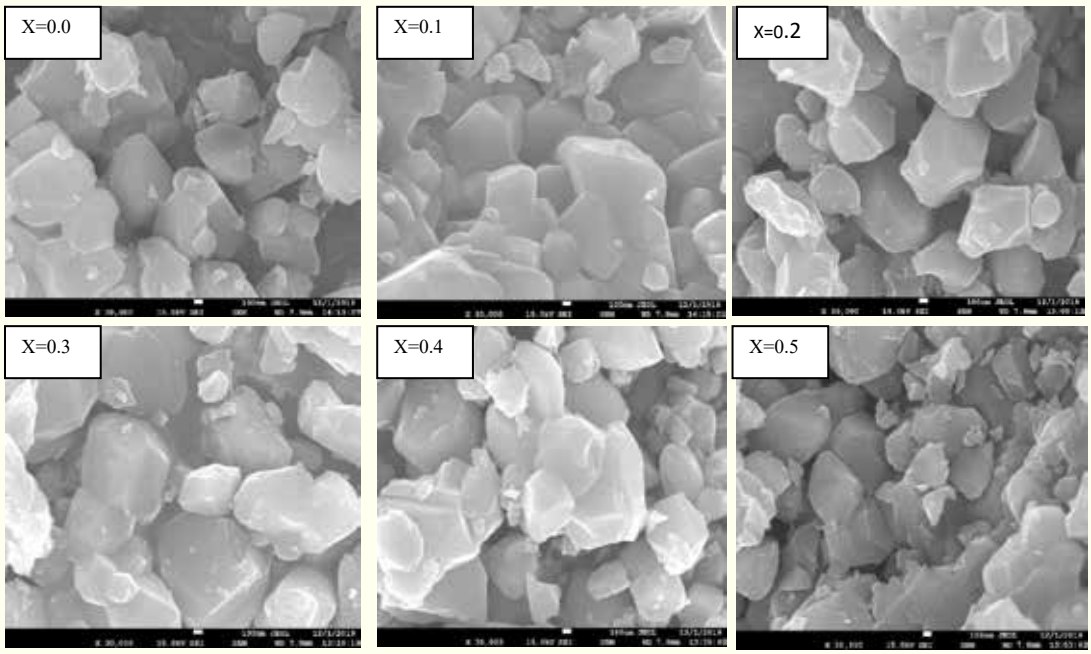
The term ferrite is commonly used to describe a class of magnetic Oxide compounds that contain iron oxide as a principal compound. A large number of metal Oxides, mixed metal Oxides and ferrites have shown better sensitivity to certain gas and humidity. A great advantage of ferrites is their porosity, which is necessary for sensor. These pores serve as humidity or gass adsorption sites and the sensitivity of sensor depends on the size of these pores. Application of humidity sensors and its use in electronic industries is increasing in our country day by day. On the basis of analysis and results of the prepared samples, developed materials will be employed for practical use for humidity sensors.

Objective

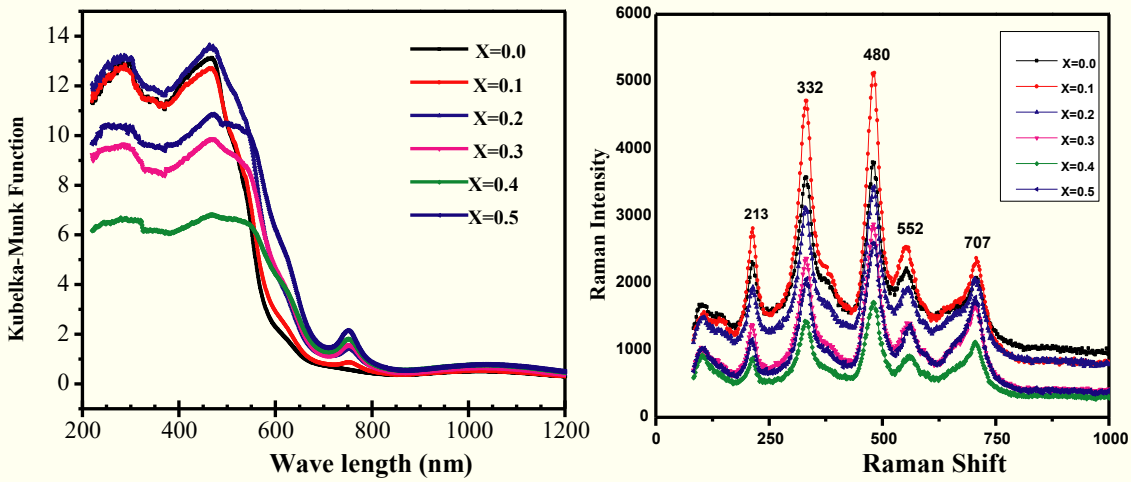
- To synthesize magnetic material for humidity sensor.
- To characterize this material to find optimum conditions in terms of performance.
- To fabricate humidity sensor in laboratory ambient.

Work Progress

- $Ni_xMg_{1-x}Fe_2O_4$ ferrites have been synthesized with different composition through a conventional ceramic technique.
- Characterization of samples have been done by SEM, chemical analysis by EDS, Electrical and dielectric analysis by Impedance analyzer, Absorption spectra and Optical band gap analysis by UV-Vis spectrophoto meter and Raman Spectrum analysis by Raman spectroscopy.
- Another two set of samples preparation with different additives is going on.
- One manuscript has been written for publication.
- Two MSc Thesis Students are working in this project.



FE-SEM micrographsof $Ni_xMg_{1-x}Fe_2O_4$ ferrites sintered at 1100 °C for 5 hours.



The Kubelka-Munk function spectrum and Raman Spectrum of $Ni_xMg_{1-x}Fe_2O_4$ ferrites sintered at 1100 °C for 5 hours.

Synthesis and property optimization of wide bandgap semiconducting materials through cost effective- ease technique

Mohammad Sajjad Hossain (PL), Dr. Syed Farid Uddin Farhad and Nazmul Islam Tanvir

Introduction

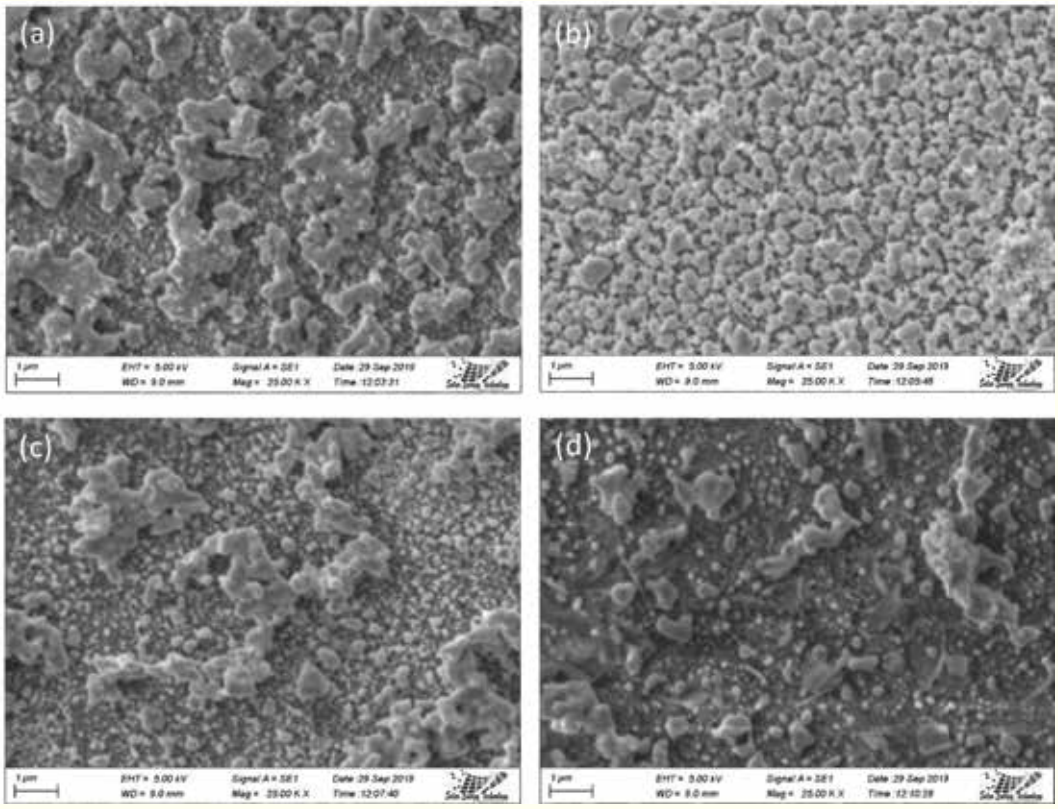
The technology and understanding of films less than 1 micron thick have made tremendous advances in last 50 to 60 years, primarily because of industrial demand for reliable thin film microelectronics devices to fulfill the needs of the sputnik era. This progress has brought maturity and much scientific confidence in the use of thin films for basic and applied research. In addition to major contributions to a variety of new and future scientifically based technology, thin films studies have directly and indirectly advanced many new areas of research in solid state physics and chemistry which are based on phenomena uniquely characteristic of thickness, geometry and structure of films. The thin films have mechanical, electrical, magnetic and optical properties which may differ from those of the bulk material. ZnS thin films have been found useful in various devices.

Objective

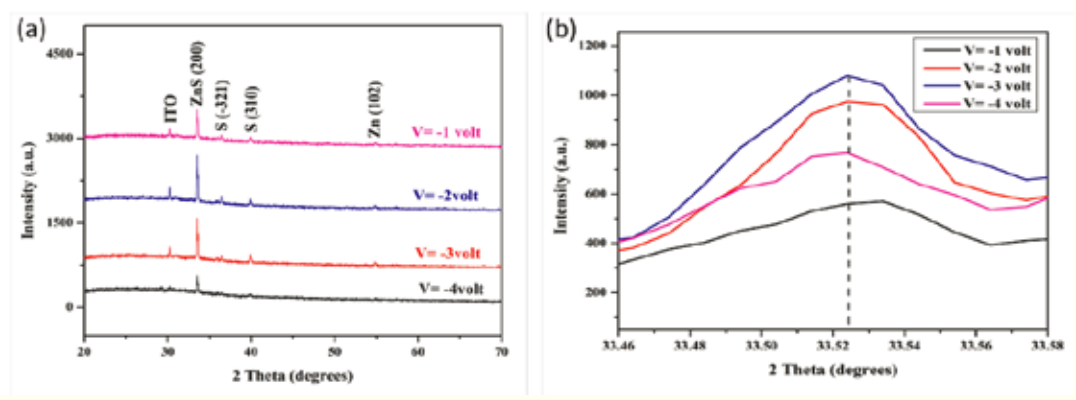
- To develop pure and doped ZnS semiconductor materials using different simple techniques such as Electro deposition (home-made), Spin coating and hydrothermal methods.
- Compare and contrast the as-made and annealed products synthesized by different techniques (one of the objectives is to assess the performance of our recently developed home-built deposition setups)
- Optimization of optical and electrical properties of synthesized ZnS thin film.

Work Progress

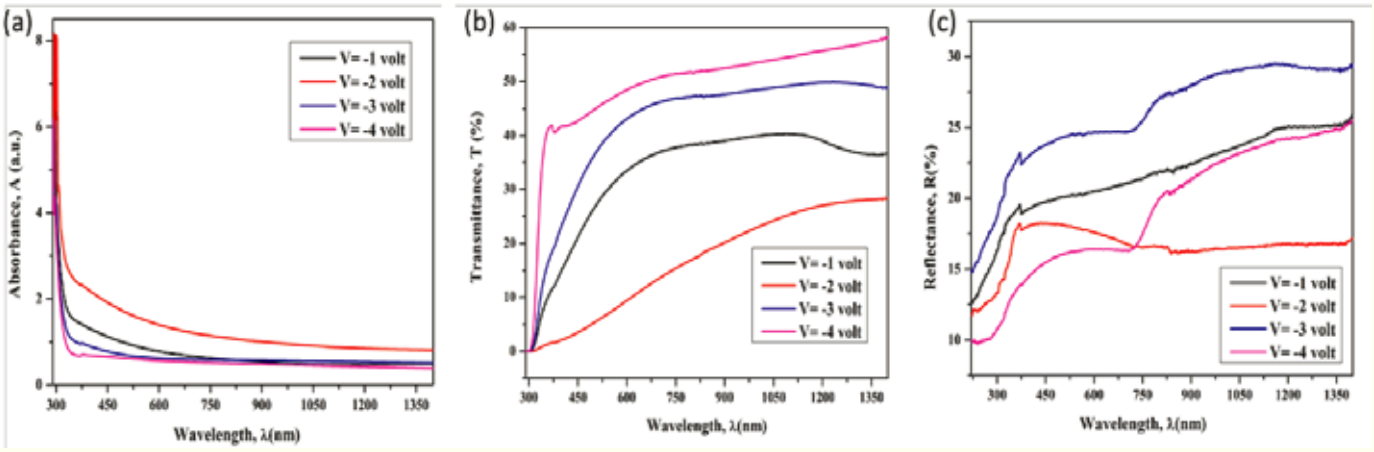
- Zn Sthin film has been deposited on ITO with different applied potential (-1V, -2V, -3V and -4V) through electro-deposition technique.
- Characterization of samples has been done by SEM, XRD, and optical band gap analysis by UV-Vis spectrophotometer.
- One manuscript has been written for publication.



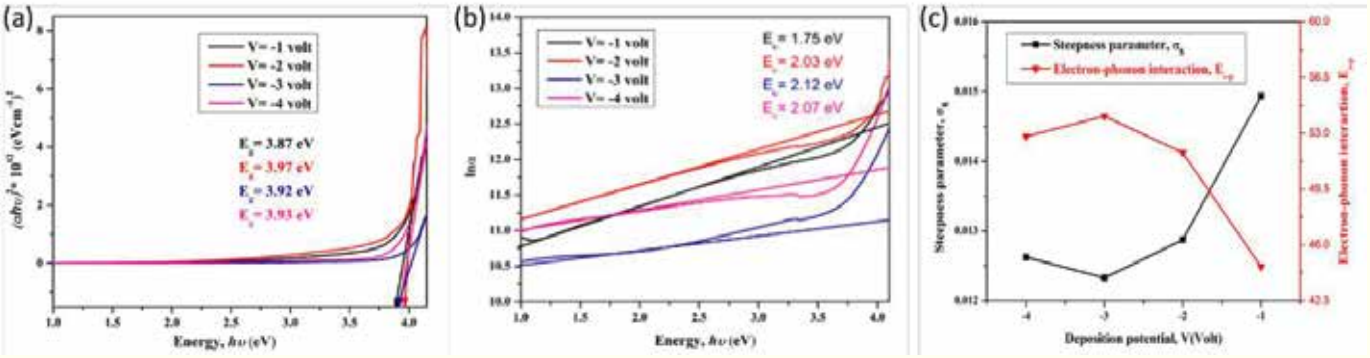
FESEM images of the ZnS thin film; where, a) -1V, b) -2V, c) -3V and d) -4V.



a) XRD patterns of all deposited ZnS thin films and b) peak shift of the films for (200) plane.



(a)Variation of Absorption, (b) transmission and (c) reflectance with incident photon wavelength for ZnS thin films.



a) Tauc plot b) linear fit of ln(α) against the photon energy hυ to obtain Urbach energy (Eu) and c) the variations of the steepness parameter (σs) and the electron-phonon interaction (Ee-p) with deposition potential.

Achievments and Activities

Research Papers

1. Suravi Islam, Ayesha Siddika, Nazia Khatun, Mohammad Sajjad Hossain, Most. Hosney Ara Begum, Nurzaman Ara Ahmed, *"Structural, electric and electrical properties of Manganess doped Barium Titanate", International Journal of Nanoelectronics and materials*, 11(4), **2019**.
2. Suravi Islam, Syed Abdus Satter, Nazia Khatun, Mohammad Sajjad Hossain, Syed Farid Uddin Farhad, Pasrimal Bala, Samia Tabassum, and Ayesha Siddika, *"Investigation of Structural, Dielectric and Electrical Properties of Barium Titanate Ceramics Co-Doped with Bismuth and Yttrium"*, Journal of Molecular and Engineering Materials, 7 (3), 1950006 (**2019**).
3. S.F.U. Farhad, D. Cherns, J. A. Smith, N. A. Fox, and D. J. Fermin, "*Pulsed laser deposition of single-phase n- and p-type copper oxide thin films with low resistivity*" *Journal of Materials & Design* (Elsevier), Vol. 193, 108884, **2020**.
4. S.A. Razi, N. K. Das, S. F. U. Farhad, and M.A. Matin, "*Influence of the $CdCl_2$ Solution Concentration on the Properties of CdTe Thin Films*" *International Journal of Renewable Energy Research (Scopus)*; Volume 10, Issue 2, 1012-1020, **2020**.
5. N. K. Das, S. F. U. Farhad, J. Chakrabartty, A. K. Sen Gupta, S. M. Dey, M. Al-Mamun, M.A. Matin, and N. Amin, "*Structural and Optical Properties of RF-Sputtered CdTe Thin Films Grown on CdS: O/CdS Bilayers*" *International Journal of Renewable Energy Research (Scopus)*; Volume 10, Issue 1, 293-302, **2020**.

6. N. K. Das, J. Chakrabartty, S. F. U. Farhad, A. K. Sen Gupta, E. M. K. Ikball Ahamed, K. S. Rahman, A. Wafi, A. Ammar, M.A. Matin, and N. Amin, "*Effect of Substrate Temperature on the Properties of RF Sputtered CdS Thin Films for Solar Cell Applications,*" Results in Physics (Elsevier), Volume 17,103132, **2020**.

7. S.F.U. Farhad*, M.M. Hossain, M.S. Bashar, N.I. Tanvir, and S. Islam,*"Texture and Bandgap Tuning of Phase Pure Cu_2O Thin Films Grown by a Simple PotentiostaticElectrodeposition Technique "* The Electrochemical Society (ECS) Meeting, E02: Nucleation and Growth Processes Enabling Energy Conversion and Storage (IOP), **2020**.

8. S.F.U. Farhad*, Md. A. Hossain, N.I. Tanvir, R. Akter, Md. A. M. Patwary, M. Shahjahan, and M.A. Rahman, *"Structural, Optical, Electrical, and Photoelectrochemical properties of Cuprous Oxide thin films grown by a modified SILAR method"* **Mater. Sci.** Semicond. Process.(Elsevier), 95, 68-75, **2019**.

9. Muhammad Rakibul Islam, Mukhlasur Rahman, S.F.U. Farhad, and Jiban Podder, *"Structural, optical and photocatalysis properties of sol-gel deposited Al-doped ZnO thin films",* Surfaces and Interfaces (Elsevier), 16, 120 - 126, **2019**.

10. Abu Kowsar, Mashudur Rahaman, Md. Saidul Islam, Abdullah Yousuf Imam, Sumon Chandra Debnath, Munira Sultana, Md. Azizul Hoque, Afrina Sharmin, Zahid Hasan Mahmood, and Syed Farid Uddin Farhad, *"Progress in Major Thin-film Solar Cells : Growth Technologies, Layer Materials, and Efficiencies"* International Journal of Renewable Energy Research (Scopus); Volume 9, Issue 2,579-597, **2019**.

11. Mohammad Sajjad Hossain, Yeasmin Akter, Mohammad Shahjahan, Muhammad Shahriar Bashar, Most. Hosney Ara Begum, Md. Moazzem Hossain, Suravi Islam, Nazia Khatun and Md. Al-Mamun*,"Influence of Ni substitution on structural, morphological, dielectric, magnetic and optical properties of Cu-Zn ferrite by double sintering sol-gel technique"*Journal of Advanced Dielectrics, 9(2) 1950021-1950029 (**2019**).

12. Mohammad Mahfuz Ali Khan Shawan, Nazmul Islam, Shahin Aziz, Nazia Khatun, Satya Ranjan Sarker, Mozammal Hossain, Tareq Hossain, Md. Mahbubul Morshed, Marzan Sarker, Md. Salman Shakil, Md. Nazibur Rhaman, Most. Hosney Ara Begum and Md. Ashraful Hasan,*"Fabrication of Xanthan gum: Gelatin (Xnt:Gel) Hybrid Composite Hydrogels for Evaluating Skin Wound Healing Efficacy"*, Journal of Modern Applied Science; 13(3); **2019**.

13. Mohammad Shahjahan, Salam Murshed Talukder, Mohammad Sajjad Hossain, Most. Hosney Ara Begum, R. L. Warnock, M. A. Haque, M. Hossain, Nurzaman Ara Ahmed, *" Study and characterization of Mg(0.25x)Cu(0.25x)Zn(1-0.5x)Fe2O4 ferrites by sol-gel method",*Ukranian Journal of Physics, Vol. 64, No. 9, 861-869, **2019**

Process accepted

Farhad S.F.U., Kowsar A., Tanvir N.I., and Begum M., H. Ara, A process for the "Development of a low-cost Portable and Rechargeable Spin Coater for thin film Solar Cell fabrication" (BCSIR Ref. No. 39.02.0000.043.37.147.18/751; date 14.04.2019

Participation in Training/Seminar/Symposium/Workshop/Conference

1. **Suravi Islam**, Principal Scientific Officer, attended training program On Public Procurement Management held on 02-20 Feb 2020 Organized by National Academy for Planning and Development (NAPD).

   Suravi Islam, Principal Scientific Officer, attended training program on "Innovation and Change Management" held on 27-31 Oct 2019 Academy for Planning and Development (NAPD).

3. **Suravi Islam**, Principal Scientific Officer, delivered an oral presentation entitled, "Investigation of structural, electrical, magnetic andoptical properties of pure and Aluminum doped Barium Titanate", in BCSIR Congress-2019, 14-16 December, 2019, BCSIR, Dhaka.

4. **Suravi Islam**, Principal Scientific Officer,participated in "National Conference on Physics-2019" organized by Bangladesh Physical Society (BPS), held on 07-09 February **2019** at Dhaka University.

5. **Dr. S.F.U. Farhad** (PSO) attendedthe virtual 237th ECS Meeting with 18th International Meeting on Chemical Sensors (IMCS 2020), May 10-14, **2020**, Montréal, Canada and contributed to a conference proceeding article entitled "Texture and Bandgap Tuning of Phase Pure Cu_2O Thin Films Grown by a Simple Potentiostatic Electrodeposition Technique".

6. **Dr. S.F.U. Farhad** (PSO) attended IEEE 47th PVSC virtual conference and contributed to an oral presentation entitled "The Role of CdS:O/CdS Bilayer in the Formation of $CdS_{1-x}Te_x$ Intermix Layer in CdTe Absorber" held in **2020**.

7. **Dr. S.F.U. Farhad** (PSO) attended the Royal Society Chemistry (RSC)-Faraday Discussion organized virtual conference entitled "New horizons in density functional theory"held on 02-04September, **2020.**

8. **Nazia Khatun** (SSO)**,** participated in "National Conference on Physics-2019" organized by Bangladesh Physical Society (BPS), held on 07-09 February **2019** at Dhaka University.

9. **Nazia Khatun** (SSO), participated in "BCSIR Congress-2019", organized by BCSIR, 14-16 December, **2019** and presented an oral presentation entitled" Effect of sintering temperature on Structural, magnetic and dielectric properties of Ni-Mn-Zn ferrites".

10. **Mohammad Sajjad Hossain (SSO)**, gave oral presentation at "BCSIR Congress 2019", on December 12-14, **2019** organized by Bangladesh Council of Scientific & Industrial Research, Dhaka, Bangladesh.

11. **Mohammad Sajjad Hossain (SSO)**, successfully completed training program on "Nano-technology training course" during June 18-July 08, 2018 at IIEST, Shibpur, India.

12. **Mohammad Sajjad Hossain (SSO)**, successfully completed training program on "Training workshop on Pulping and paper making technologies of non-wood fiber" during August 11-September 01, 2019 at CNPPRI, Beijing, China.

Award/Grant

1. **Dr. S.F.U. Farhad** has been awarded IEEE EDS_ISA (International Solar Alliance) fundon 5 June, 2020 to attend the IEEE 47th PVSC virtual conference 15 Jun.–21 Aug. **2020**.

Number of Analytical (Ad-Hoc) Problem Solved

Name of the Division	Routine type	Research	Total
Industrial Physics Division	20	130	150

Industrial Tours/Dissemination

Name and Designation	Name of the Institute	Date
Dr. Most. Hosney Ara Begum, CSO Dr. Syed Farid Uddin Farhad, PSO Nazia Khatun, SSO Mohammad Sajjad Hossain, SSO and Nazmul Islam Tanvir, RC	Walton Hi-Tech Industry	07.12.2019

Guidance to research Work (PhD/M.Phill/M.S/NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
1.	Fabrication of Zinc Oxide (ZnO) Nanorods on Aluminium doped ZnO (AZO) seeding layers by hydrothermal method	M.Phil.	Mr. Mukul Hossain	Department of Physics, University of Dhaka	Dr. S.F.U. Farhad, PSO
2.	Synthesis and characterization of Bismuth and Copper co-doped Barium Titanate (BaTiO3)	M.S thesis	Shamim Akter Juthi	Department of Physics, Mawlana Bhashani Science and technology University	Suravi Islam, PSO
3.	Green synthesis and characterization of Ag/ Zn/ Fe nanoparticals	M.S thesis	Syed Rokeya Khatun	Department of Chemistry, Khulna University	Suravi Islam, PSO
4.	Effect of Al doping on the physical properties of modified SILAR grown CZTS thin films	M.S thesis	Ms. Ummay Honey	Department of Physics, Jahangirnagar University	Dr. S.F.U. Farhad, PSO
5.	Effect of VO2+ doping on the physical properties of spin-coated ZnS thin films	M.S thesis	Ms. Badrun Nahar Dipa	Department of Physics, Jahangirnagar University	Dr. S.F.U. Farhad, PSO
6.	Synthesis and Characterization of Ball milled derived spin coated ZnO seed layers for ZnOnanorods	M.S thesis	Ms. Zinnat Tanzim	Department of Physics, Jahangirnagar University	Dr. S.F.U. Farhad, PSO

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
7.	Fabrication and Characterization of CdTe solar cells with ZnTe:Cu Hetero-interface at Back Contact	M.S thesis	Mr. Nipu Kumar Das	Department of EEE, CUET	Dr. S.F.U. Farhad, PSO
8.	Fabrication and Characterizations of MoS2nanoparticle	M.S thesis	Mr. Md. Hasive Ahmed	Department of Physics, BUET	Dr. S.F.U. Farhad, PSO
9.	Synthesis and Characterizations of Gelatin/SWCNT nanocomposite	M.S thesis	Ms. Rabeya Binte Alam	Department of Physics, BUET	Dr. S.F.U. Farhad, PSO
10.	Low cost Fabrication of thin film solar cell using environment friendly oxide based materials	M.S thesis	Ms. Shanta Majumder	Department of Chemistry, Comilla University	Dr. S.F.U. Farhad, PSO
11.	Bismuth Based metal oxides for Solar Fuels: Experimental and DFT analysis	M.S thesis	Ms. Jannatul Fardush Tanha	Department of EEE, University of Dhaka	Dr. S.F.U. Farhad, PSO
12.	Synthesis and characterization of Copper doped Barium Titanate (BaTiO3)	M.S thesis	Jafrin Sultana	Department of Physics, MawlanaBhashani Science and technology University	Suravi Islam, PSO
13.	Green synthesis and characterization of Ag/ Zn/ Fe nanoparticals	M.S thesis	Eshani Ghosh	Department of Physics, MawlanaBhashani Science and technology University	Suravi Islam, PSO
14.	Synthesis and characterization of structural, morphological, and dielectric properties of La3+ doped cobalt ferrite.	M.Sc thesis	M. Rashedul Karim	Department of Applied Chemistry and Chemical Engineering, Noakhali University of Science and Technology	Mohammad Sajjad Hossain, SSO

IPD Scientists' Outreach Activities

Special Contribution to the Nation

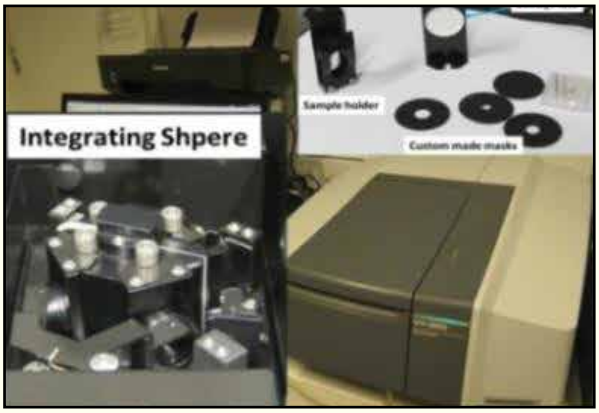
Apart from R&D works and analytical as well as technical supports to the diverse stakeholders, IPD scientists regularly visit local industries andarrange 'Stakeholder Meetings' for the following purposes:

1. Commercialization of IPD Developed products
2. Potential collaborative R&D projects for mutual benefits
3. Provide analytical & technical supports from IPD to local industries

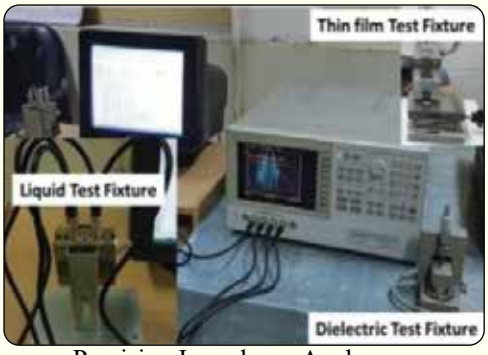
Scientists of IPD are also aware of the National and Global energy crisis and to resolve this issue aligned with UN SDGs "Everyone should contribute for the sustainability of our earth planet" and this is not possible only by inventing efficient equipment and developing renewable energy technology, because efficient technology development itself uses huge amount of energy. Scientists of IPD recognized this burning issue quite early and to this end, as a social commitment for the betterment of our people as well as for global citizens, they introduced a test project called "Energy Saving Initiative" by switching off unnecessary lights, fans and unattended equipment etc. to minimize the energy burden in the national grid. To implement this idea and to achieve the project target there is a rewarding system called "Earth Champions" for the person who scores the highest (See the right picture at the bottom panel).

Major Instruments of Industrial Physics Division

SEM with Ultra-dry EDx



UV-VIS-NIR Spectrometer



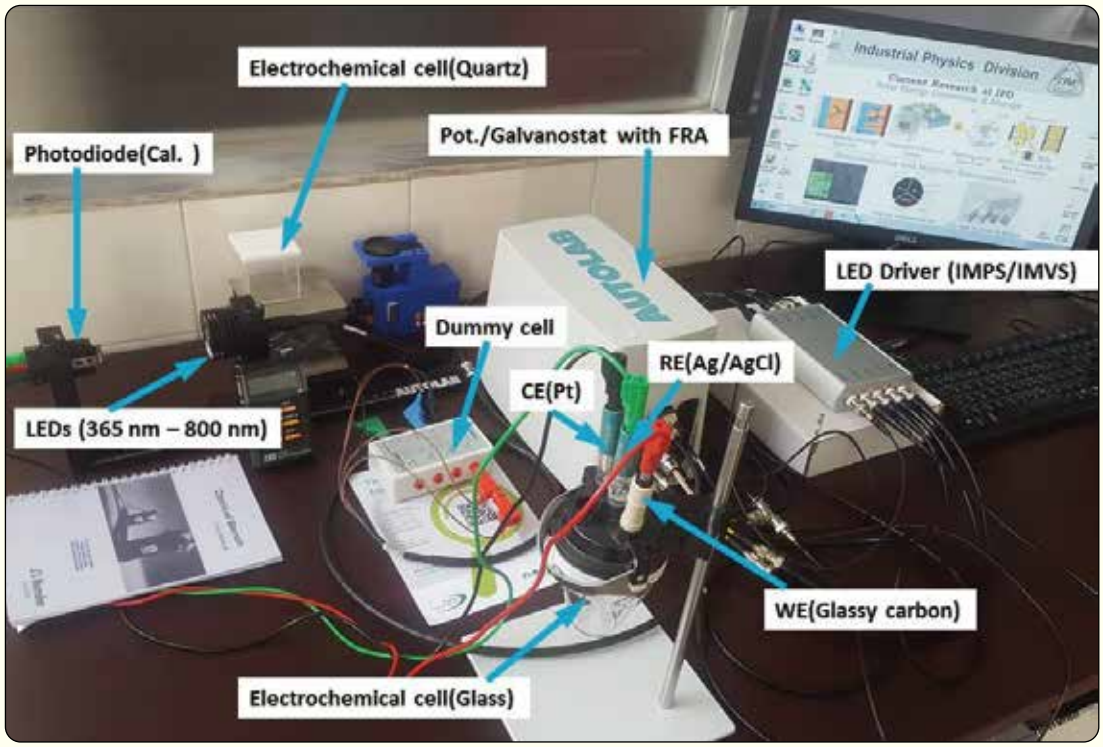
Precision Impedance Analyzer

Source Measure Unit

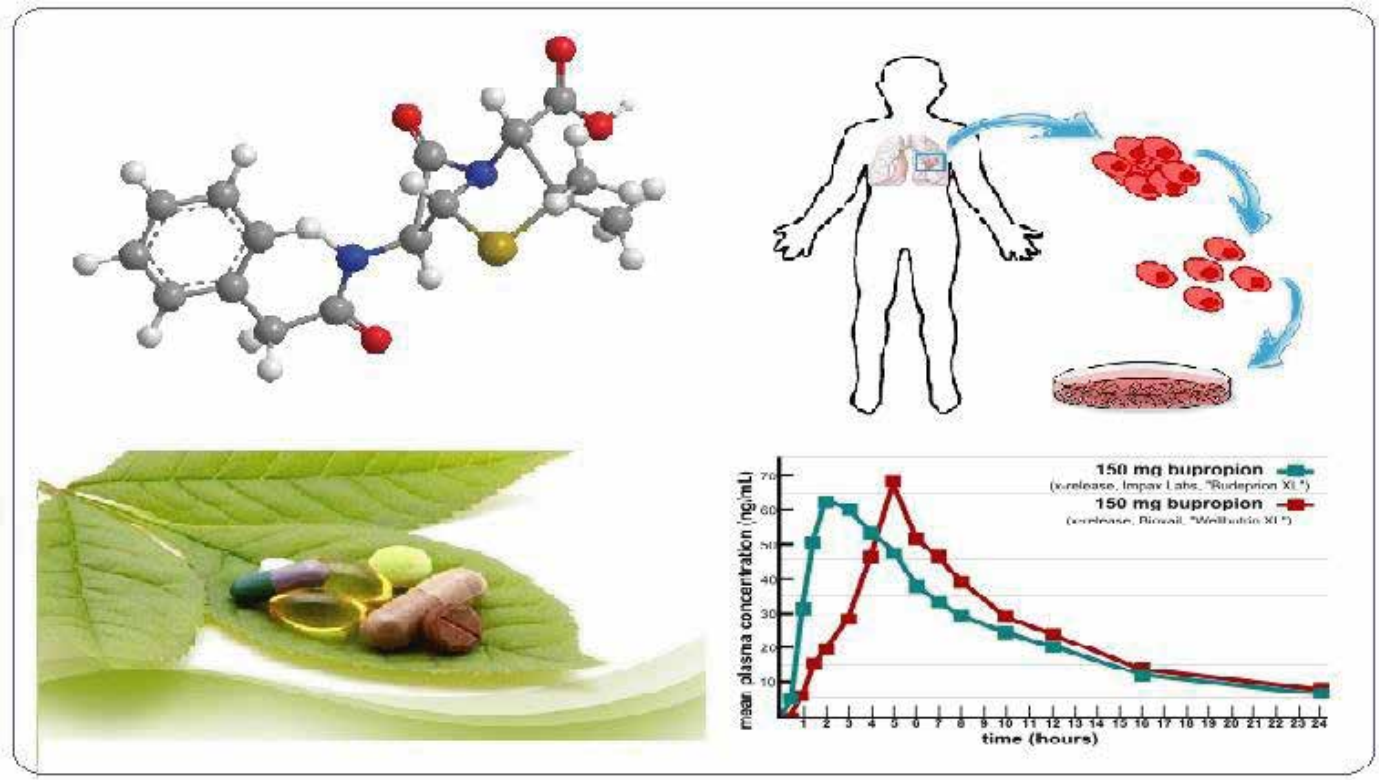
Tesla meter(0.1 μt-29.99 T) (Left)
Magnetic Susceptibility Balance (Right)

Source Measure Unit

(Photo) Electrochemical Workstation with FRA (10 μHz-1MHz)



Pharmaceutical Sciences Research Division (PSRD)



The pharmaceutical sector, one of the highly developed economic sectors in Bangladesh, contributes significantly to the country's economy. In spite of thedevelopments, it still have foreign dependency for import of Active Pharmaceutical Ingredients (APIs) and excipients, lack of Bioequivalence facility and advance research facilities for drug development etc. Pharmaceutical Sciences Research Division is working to overcome the aforementioned problems by establishing modern research facilities on Pharmaceutical Sciences and bioequivalence studies and thus help to support pharmaceutical industry of Bangladesh. Currently Pharmaceutical Sciences Research Division has five research sections named;

i) Active Pharmaceutical Ingredients (APIs) and Pharmaceutical Excipients,

ii) Quality assurance of modern and herbal medicines

iii) Dosage form design

iv) Biopharmaceutics and

v) Drug Discovery and Bioassay.

10 (ten) scientists are working at Pharmaceutical Sciences Research Division at different field of Pharmaceutical sciences. To ensure quality medicine, Pharmaceutical Sciences Research Division is also providing analytical services on different quality parameters of drugs.

Research and Development (R&D) Projects

Identification of pharmacophore of isolated bioactive compounds and their structure activity relationship (SAR) study

Dr. Md. Hossain Sohrab (PL), Dr. Farhana Afroz, Fatema Moni, Saima Mollick, Md. Ariful Huq and Muhammad Abdullah Al-Mansur

Introduction

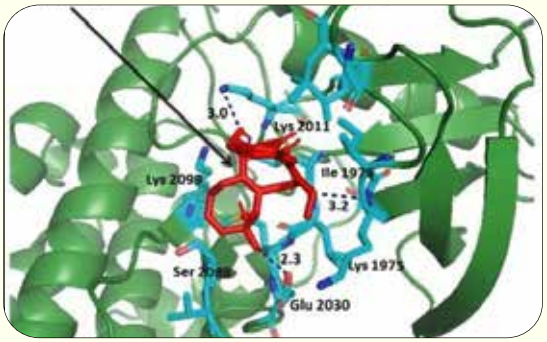
Drug discovery by synthetic chemistry is inspired by small molecules isolated from various natural sources including plants, bacteria and marine sponges to name a few. The bioactivity of these compounds is the most crucial part when it comes to devising a retrosynthesis (working backwards from natural product to simple starting materials). Efficient synthetic routes enable biological investigations that delve further into trying to uncover the rich biology that can be learned through the synthesis and detailed structure-activity relationship (SAR) of natural products and derivatives including simplified versions with comparable or unique biological activity. The analysis of SAR enables the determination of the chemical groups responsible for evoking a target biological effect in the organism.

Objective

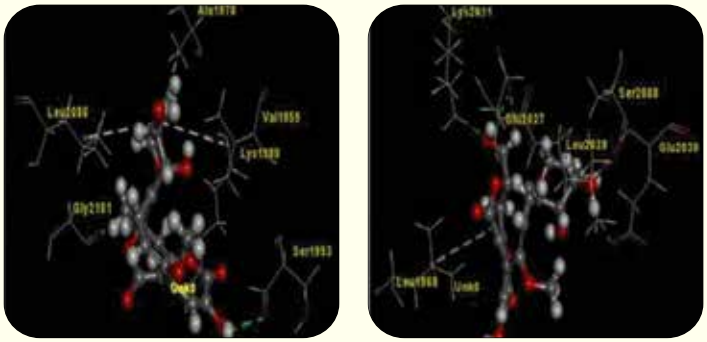
- Isolation of bioactive compounds from medicinal plants and their associated endophytic fungi.
- Identification of pharmacophore of bioactive compounds.
- Logical modification and Structure Activity Relationship (SAR) study for improved activity.

Work progress

- 01 (one) compound having potential anticancer property has been identified and chosen as lead for further drug development proceedings.
- Active site of the compound has been predicted by in-silico study of the compound.



Visualisation of active site and ligand-receptor interaction of selected compound



Non-bond interactions of selected compound with conforming presumed structures of ROS kinase

Bioassay screening of extracts, fractions and isolated metabolites obtained from natural sources

Dr. Farhana Afroz (PL), Dr. Md. Hossain Sohrab, Satyajit Roy Rony, Suriya Sharmin and Mst. Nadira Begum

Introduction

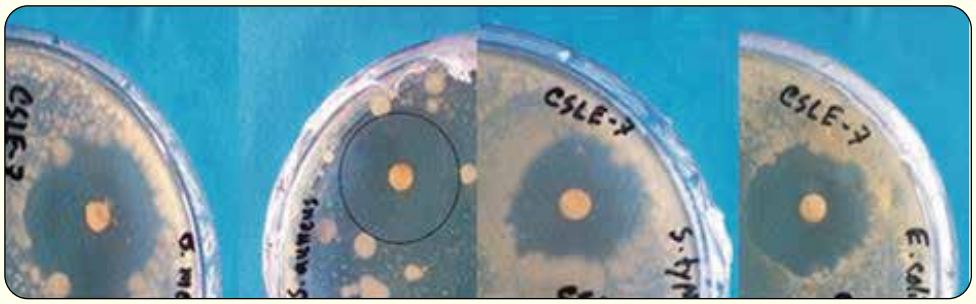
This project is an effort through a combination of basic and applied research to search anticancer/anti-inflammatory/other bioactive compounds by performing different preliminary bioassays.

Objectives

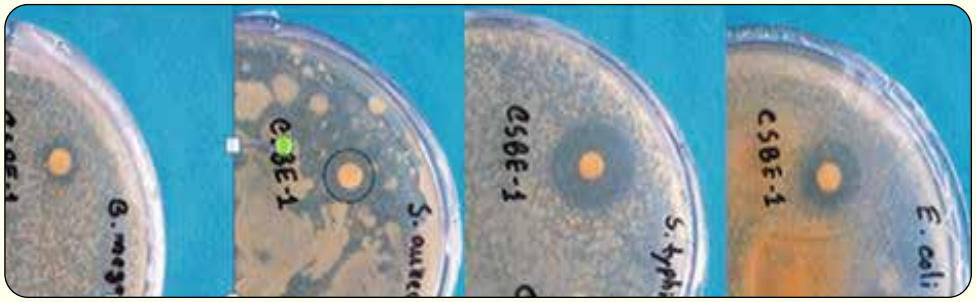
- Screening of anticancer/anti-inflammatory/other bioactivities of extracts, fractions and metabolites.
- To build knowledge and develop manpower capable to work in bioassay laboratory.

Work Progress

- Anticancer activity of several isolated compounds and extracts of plant endophytic fungi have been screened on Vero and human Lung cancer cell line.
- Antimicrobial activities of different crude extracts, their column fractions and pure compounds were screened.

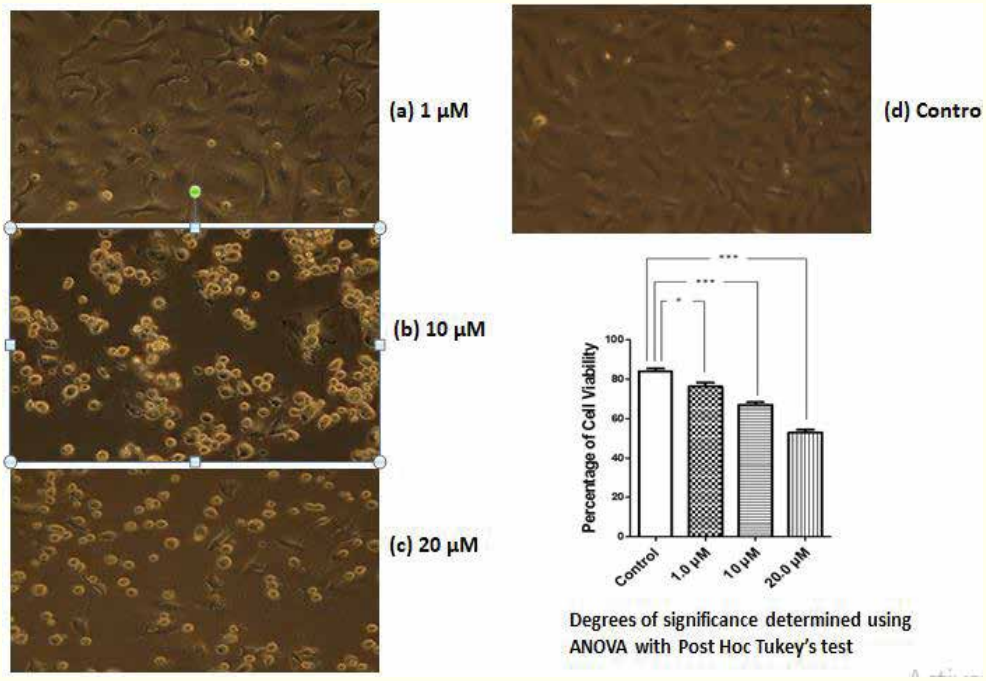


CSLE-7



CSBE-1

Significant antimicrobial activity against different microbes.



Microscopic images (20X) of Cytotoxic activity of the pure compound LE-7 (46) was determined on Africal Green Monkey Kidney cell (Vero cell) line at different concentration.

Analytical method development for determination of drugs in blood samples

Fatema Moni (PL), Shammi Akhter, Suriya Sharmin, Satyajit Roy Rony, Dr. Farhana Afroz and Dr. Md. Hossain Sohrab

Introduction

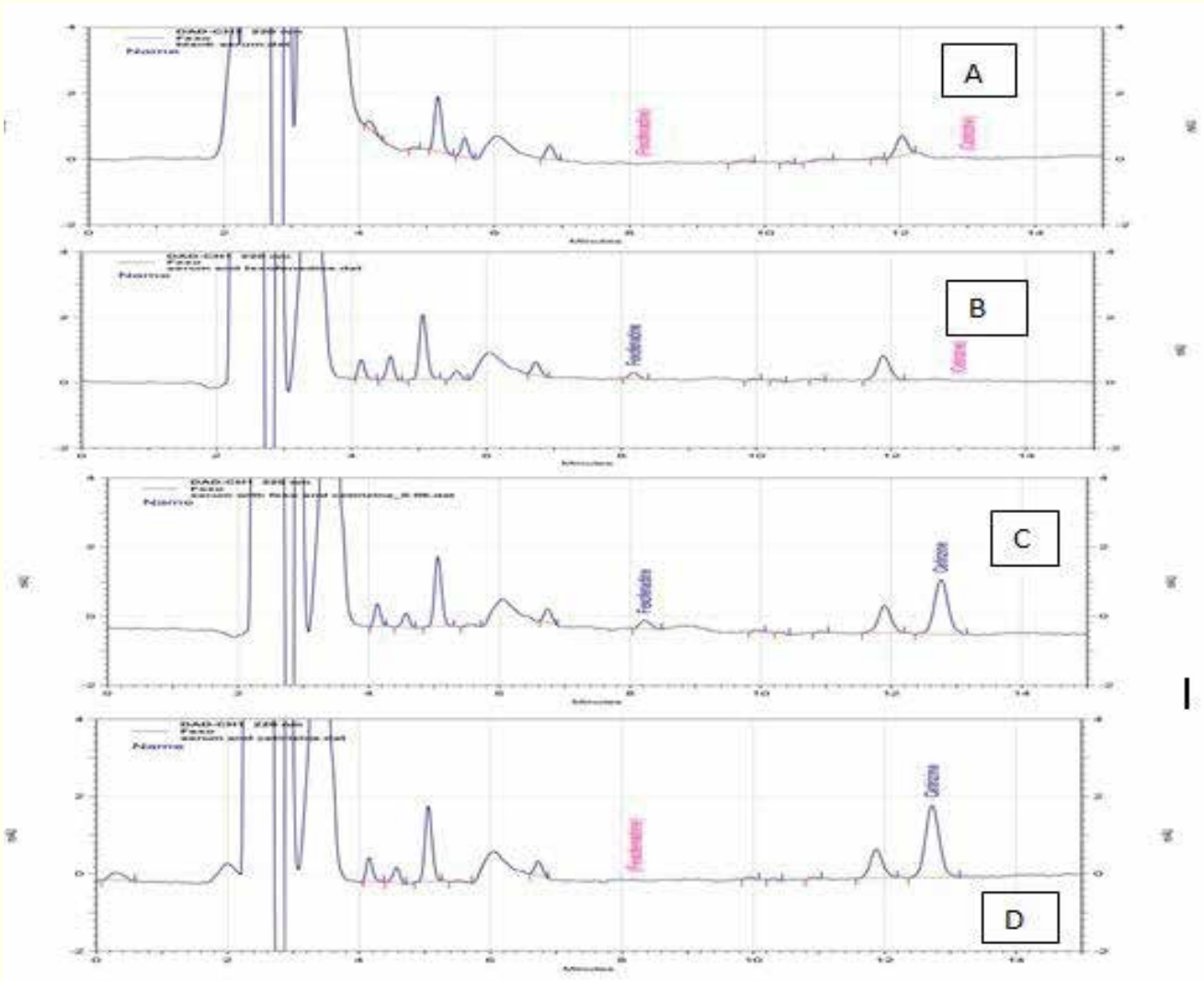
Development of simple, accurate, precise and reliable analytical method is crucial for development of generic and new drug. Bionalytical method for determination of drugs in blood sample is critical step for any clinical study which helps to make right decisions of clinical findings.The project will also help to determine drugs in blood sample which can be used in bioavailability, pharmacokinetic and bioequivalence studies.

Objective

- Quantitative analysis of drugs in blood samples for bioavailability and bioequivalence studies.
- Optimization and validation of the developed analytical methods.

Work Progress

- Bioanalytical methods for determination of Esomeprazole and Fexofenadine in blood sample have been developed and validated.
- Analaytical method for Aceclofenac quantification has been developed.



Bioanalytical method for analysis of Fexofenadin in human plasma.

Development of dissolution, analytical and bioanalytical methods for estimation of Trimetazidine

Suriya Sharmin (PL), Fatema Moni, Satyajit Roy Rony, Dr. Farhana Afroz and Dr. Md. Hossain Sohrab

Introduction

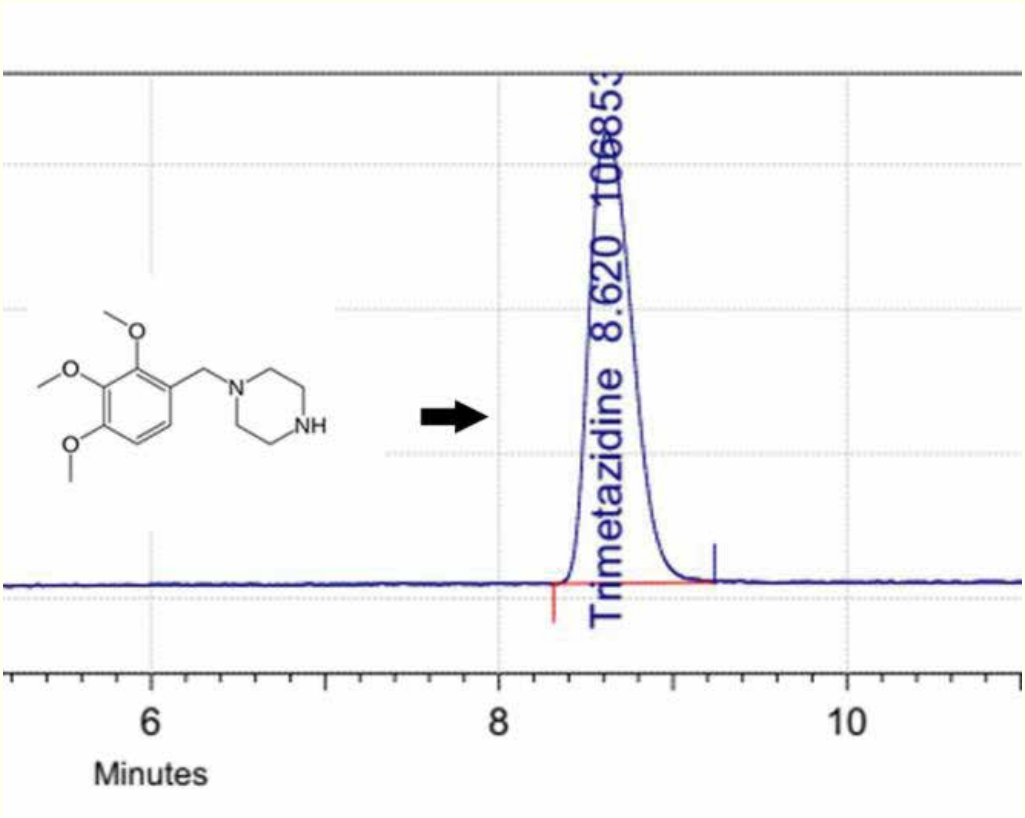
New analytical methods should be developed for drug or drug combinations when not officially included in pharmacopoeias as drug or specific formulation, or the analytical methods require expensive reagents and solvent. Bioanalytical method involves processing and analysis of biological matrix for a chemical compound or compounds that can be used in pharmacokinetic, drug interaction or bioequivalence studies. A discriminatory dissolution method characterizes tablets in presence of critical formulation factor to suggest bioavailability. Validation of these developed analytical methods will confirm that the procedure employed for a specific test is suitable for its intended use with satisfactorily reliable result.

Objective

- To develop and validate analytical methods for estimation of Trimetazidine hydrochloride.
- To develop and validate dissolution method of Trimetazidine hydrochloride MR tablets.
- To develop and validate bioanalytical method for estimation of Trimetazidine hydrochloride in blood sample for estimation of drug-drug interaction.

Work Progress

- A simple method has been developed and validated for quantification of Trimetazidine in tablet dosage forms and bulk.
- Dissolution method from Trimetazidine MR tablet have been developed.



Established analytical method of Trimetazidine.

Isolation of bioactive metabolites from marine weeds and sponges as well as their associated symbiotic fungi

Dr. Md. Hossain Sohrab (PL), Dr. Farhana Afroz, Satyajit Roy Rony, Fatema Moni, Saima Mollick and Mst. Nadira Begum

Introduction

Marine weeds are relatively unexplored but rich resources for bioactive compounds. For their survival in harsh environmental conditions they are producer of structurally unique secondary metabolites with diverse bioactivity.

Objective

- To explore the marine weeds and sponges as well as their associated symbiotic fungal extracts and screen them for bioassays.
- To purify crude extracts for isolation of active compounds.
- Total structure elucidation of the active compounds using NMR and MS.

Work Progress

- 10 marine species were collected and 15 associated fungal endophytes were isolated.
- Small scale cultivation has been completed for 07 fungi and large scale cultivation has been completed for 04 fungi.
- 06 (six) pure compounds have been isolated and successfally structure elucidation has been completed for 04 (four) compounds.

Isolation of bulk amount of active compounds from *Lawsonia alba* Lamk

Shammi Akhter (PL), Dr. Md. Hossain Sohrab, Satyajit Roy Rony, Suriya Sharmin and Md. Ariful Haq

Introduction

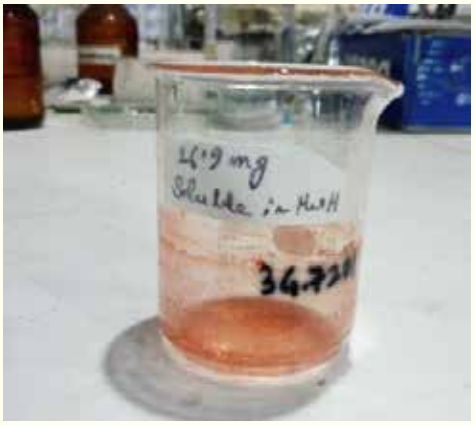
Nature has been the origin of therapeutic mediators for thousands of years. There have been many spectacular amount of latest preparations done from natural deposit, several of those isolations were supported the uses of the agents in ancient medicines. *Lawsonia* Alba Lamk. (mehedi) is now deliberated as a appreciated source of inimitable natural products for development of medicines against innumerable diseases and also for the expansion of industrial products.

Objective

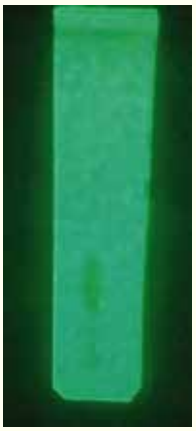
- To explore the possibility developing medicinal and cosmetic importance of henna plants as well as new process/product from it.
- To isolate selective compounds from *Lawsonia alba* Lam. which is responsible for natural color.
- Value addition of isolated active compounds (dye).

Work Progress

- One prime compound has been isolated and NMR spetra were recorded.
- Structure elucidation is ongoing.
- Development of different methodology for isolation of active compounds is under process.



Isolated Compound



TLC screening of isolated compound

Optimization of factors influencing extraction of bioactive compounds from medicinal plants using response surface methodology

Dr. Md. Anwar Hossain (PL), Dr. Md. Hossain Sohrab, Dr. Farhana Afroz, Satyajit Roy Rony, Shammi Akhter and Mst. Nadira Begum

Introduction

Commercial production of drugs based on specific medicinal plants often suffers serious setbacks as certain plants grow in specific geographical locations. It is an established fact that geographical location, season, time of collection and age of the plants often affect the quality and quantity of active constituents of plants. That is why the quality of the supplied natural raw materials varies from time to time, place to place and sample to sample which in turn affect the quality and price of the herbal drugs produced.

Objective

- To optimize the extraction parameters (temperature, period of soaking and solvent system) for the extraction of bioactive compounds from medicinal plants using response surface methodology.
- To evaluate the effects of these parameters on the total antioxidant, antimicrobial and cytotoxic properties using response surface methodology.

Work Progress

- Few plants have been collected to extract metabolite.
- Extraction efficiency of metabolite from few samples has been investigated based on time, temperature and concentration.
- Total phenolic content, total flavonoid content and DPPH scavenging activity of few extracts has been investigated.

Synthesis of some commonly used antiulcerants

Dr. Md. Hossain Sohrab (PL), Satyajit Roy Rony, Suriya Sharmin, Fatema Moni and Shammi Akhter

Introduction

Successful implementation of this project will help our Pharma Sector to reduce dependency on imported raw materials and thus, save foreign currency.

Objectives

- Development of improved synthetic routes of some antiulcerant APIs; such as Pantoprazole, Omeprazole, Esomeprazole etc.
- Development and validation of analytical process for the synthesized drugs and their related impurities.
- To transfer technology from R&D to actual manufacturing facilities.

Work Progress

- Synthetic schemes was designed for 03 (three) APIs namely, Pantoprazole, Omeprazole and Esomeprazole.

ADP (Annual Development Project)

Establishment of Institute of Bioequivalence Studies and Pharmaceutical Sciences

To avail the vast opportunity of pharmaceutical sector in the global market, BCSIR is implementing the ADP project "Establishment of Institute of Bioequivalence Studies and Pharmaceutical Sciences" since 2017. It will be a world class research institute creating facilities of clinical research and bioequivalence studies, synthesis of active pharmaceutical ingredients (APIs) and excipients, drug discovery and bioassay, new drug development, new and effective dosage form design, quality assurance and improvement of medicines etc. as well as related analytical services. These will open doors of export to regulated market, reduce import dependency, develop export quality generic drugs and thus save foreign currency. People will be able to get safe, effective and quality medicine with affordable price in local market.

Work Progress

- Procurement of scientific equipment and office appliances has been partly completed.
- Manpower for development project has been completed.
- Construction of laboratory building under the project is running.
- According to the guidance of regulatory bodies, procurement of consultant under the project has been completed.
- Training program entitled 'Method Development, Validation and R&D works' (05-11 February, 2020) at School of Pharmacy and Biomolecular Science, Liverpool John Moores University, Liverpool, United Kingdom has been completed successfully under the project.

Achievements

Research Papers

1. Fatema Moni, Suriya Sharmin, Satyajit Roy Rony, Farhana Afroz, Shammi Akhter, and Md Hossain Sohrab. Bioanalytical method validation of Esomeprazole by high performance liquid chromatography with PDA detection, *Acta Chromatographica*, 2020, Manuscript number: 769, doi: 10.1556/1326.2020.00769.
2. Tauhidur R Nurunnabi, Farah Sabrin, Dilara I. Sharif, LutfunNahar, Md Hossain Sohrab, Satyajit D. Sarker, SM Mahbubur Rahman and Md Morsaline Billah. Antimicrobial activity of endophytic fungi isolated from the mangrove plant *Sonneratia apetala* (Buch.-Ham) from the Sundarbans mangrove forest, *Advances in Traditional Medicine*. 2020, https://doi.org/10.1007/s13596-019-00422-9.
3. Md. Adnan, Md. Nazim Uddin Chy, A.T.M. Mostafa Kamal, Kazi Asfak Ahmed Chowdhury, Md. Atiar Rahman, A. S. M. Ali Reza, Md. Moniruzzaman, Satyajit Roy Rony, Mst. Samima Nasrin, Md. Obyedul Kalam Azad, Cheol Ho Park,Young Seok Lim, and Dong Ha Cho. Intervention in Neuropsychiatric Disorders by Suppressing Inflammatory and Oxidative Stress Signal and Exploration of In Silico Studies for Potential Lead Compounds from Holigarnacaustica (Dennst.) Oken leaves. *Biomolecules*, 2020, 10(4), 561.

4. Seagufta Afrin, Md Abdul Muhit, Md Hossain Sohrab, Choudhury Mahmood Hasan, and Monira Ahsan. Antioxidant, Thrombolytic, Antimicrobial and Cytotoxic Activities of Flavonoids Isolated from the Root Bark of *Pongamia pinnata, Dhaka University Journal of Pharmaceutical Sciences*, 2020, 19(1), 1-8.
5. Md Emdadul Islam, Kazi Mohammed Didarul Islam, Md Morsaline Billah, Rana Biswas, Md Hossain Sohrab, and SM Mahbubur Rahman. Antioxidant and anti-inflammatory activity of *Heritiera fomes* (Buch.-Ham), a mangrove plant of the Sundarbans, *Oriental Pharmacy and Experimental Medicine*, 2020, 20, 189-197.
6. Israt Farha Lini, FarhanaAfroz, Nadira Begum, Satyajit Roy Rony, Suriya Sharmin, FatemaMoni, and Md Hossain Sohrab. Identification and Bioactive potential of Endophytic Fungi from Marine Weeds available in the Coastal area of Bangladesh, *International Journal of Pharmaceutical Sciences and Research*, 2020, 11(3), 1249-1257.
7. Md Badrul Alam, Nargis Sultana Chowdhury, Md Hossain Sohrab, Md Sohel Rana, Choudhury Mahmood Hasan, and Sang-Han Lee. Cerevisterol Alleviates Inflammation via Suppression of MAPK/NF-κB/AP-1 and Activation of the Nrf2/HO-1 Signaling Cascade, *Biomolecules*, 2020, 10, 199.
8. Seagufta Afrin, Md. Hossain Sohrab, Md. Shamim Ahmed, Choudhury Mahmood Hasan, Monira Ahsan.Terpenoids and steroids from the stem bark of *Sesbania grandiflora* and biological studies of the plant extracts, *Pharmacy & Pharmacology International Journal,* 2019,7(6), 307–313.
9. Quazi Sufia Islam, Md Hossain Sohrab, Suraiya Sharmin, and Choudhury Mahmood Hasan. Phytochemical Investigation of *Calophylluminophyllum* L, *Dhaka University Journal of Pharmaceutical Sciences*, 2019,18(2), 179-182.
10. Tauhidur Rahman Nurunnabi, Shaymaa Al-Majmaie, Lutfun Nahar, Ismini Nakouti, S. M. M. Rahman, Md Hossain Sohrab, MdMorsalineBillah, F. M. D. Ismail, G. P. Sharples, and Satyajit D. Sarker.Sonneratinone: A new antimicrobial benzofuranone derivative from the endophytic fungus *Aspergillusniger* isolated from the mangrove plant *Sonneratiaapetala* Buch.- Ham,*Trends in Phytochemical Research*, 2019,3(3), 225-230.
11. Sabrina Adorisio, Alessandra Fierabracci, Isabella Muscari, Anna Marina Liberati, Lorenza Cannarile, Trinh Thi Thuy, Tran Van Sung, Md. Hossain Sohrab, Choudhury Mahmood Hasan, EmiraAyroldi, Carlo Riccardi, Abdul Mazid, Domenico V Delfino. Fusarubin and Anhydrofusarubin Isolated from a *Cladosporium* Species Inhibit Cell Growth in Human Cancer Cell Lines, *Toxins*, 2019 11, 503.
12. Md Emdadul Islam, SM Mahbubur Rahman, Md.Hossain Sohrab, Rana Biswas, Mohammad Shaef Ullah, and Kazi Didarul Islam. Concordance of antioxidant and anti-Inflammatory activity in *Xylocarpusgranatum* (Koen). *Journal of Bangladesh Agricultural University,* 2019, 17(4), 466-475.
13. Md. Hossain Sohrab, Fatima Binte Noor, Mst. KhodezaKhatun, Md. Shadiqul Islam, Sharif Md. Al-Reza. Metabolite profiling and pharmacological evaluation of *Phyllanthus amarus*stem extract. *World Journal of Pharmaceutical* Research, 2019, 8(11), 51-60.
14. Samia Kamal, Satyajit Roy Rony, Suriya Sharmin, FR Laboni, Md. HossainSohrab. Phytochemical and Pharmacological Potential of *Enhydrafluctuans*available in Bangladesh, *Journal of Pharmaceutical Research International*, 2019, 29(4), 1-11.
15. Kazi Jannatul Ferdous, Farhana Afroz, Md Rakibul Islam, Md Abdul Mazid, and Md Hossain Sohrab. Isolated endophyticfungi from the plant *Curcuma longa* and their potential bioactivity - A review, *Pharmacology & Pharmacy*, 2019, 10, 244-270.

Conference proceedings

1. **Sohrab MH**, Afroz F, Rony SR, Shahinuzzaman ADA, Sharmin S, Moni F, Akhter S, Mollick S, Uddin MN, Islam MA**:** Endophytic fungi: Sources of diversified bioactive natural compounds. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. IL-07, Page no. 52.

2. Akhter S, Ferdousi MT, Moni F, Sharmin S, Rony SR, Begum MN, Afroz F, **Sohrab MH:** Study on secondary metabolites of an endophytic fungus *Colletotrichum gloeosporioides* isolated from the plant *Justicia gendarussa* Burm. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/OP/A100, Page no. 68.
3. Smrity SZ, **Sohrab MH**, Afroz F, Begum MN, Rony SR, Akhter S, Sultana S: Biochemical investigation of endophytic fungi isolated from medicinal plant *Terminalia arjuna* Roxb. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/OP/A105, Page no. 69.
4. Uddin MN, Haq MA, Mollick S, Shahinuzzaman ADA, Rony SR, Afroz F, **Sohrab MH:** Comparative study on antimicrobial activity of different parts of *Abelmoschus moschatus*against multi-resistant pathogens. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/OP/A178, Page no. 75.
5. Ferdous KJ, **Sohrab MH**, Islam MR, Mazid MA, Afroz F, Begum MN, Akhter S**:** Bioactivity of endophytic fungi isolated from the plant *Curcuma longa* in Bangladesh. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/SO/A097, Page no. 87.
6. Zinnurine R, **Sohrab MH**, Afroz F, Begum MN, Rana MS: Bioactive metabolites isolated from endophytes of *Swietenia macrophylla*. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/SO/A102, Page no. 88.
7. Nasrin M, **Sohrab MH**, Afroz F, Hasan CM, Sharmin S, Begum MN, Rana MS: Isolation of *Fusarium keratoplasticum*, a novel bioactive compound producing fungus from the leaves of medicinal plants, *Commelina benghalensis* L. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/SO/A103, Page no. 89.
8. Afroz F, **Sohrab MH**, Moni F, Sharmin S: Bioanalytical method development and validation for determination of fexofenadine hydrochloride in human serum by RP-HPLC. PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh from 16 to 18 January, 2020. Abstract no. PSE-NPS2020Summit/PP/A127, Page no. 135.
9. **Sohrab MH**, Afroz F, Rony SR, Shahinuzzaman ADA, Sharmin S, Moni F, Akhter S, Mollick S, Uddin MN, Islam MA**:** Scopes and opportunity for new and generic drug developments in Bangladesh. BCSIR Congress 2019 on "Science and Technology for Sustainable Development", held at Bangladesh Council of Scientific and Industrial Research (BCSIR), Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh from 12 to 14 December, 2019. *Bangladesh Journal of Scientific and Industrial Research*. 54(Special Issue):12, 2019.

Scientists pursuing M.S/M.Phil/Ph.D. Courses in home or abroad

Name: A D A Shahinuzzaman, Senior Scientific Officer, Pharmaceutical Sciences Research Division, Ph.D. in Chemistry from Department of Chemistry and Biochemistry, University of Texas at Arlington, USA.

Duration: August 2014- August 2019.

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
1.	Search for Secondary Metabolites from the Plant of *Mesuanagassarium* and its associated Endophytic Fungi.	M.S thesis	Shamima Sultana Rimu	Department of Pharmacy, Jahangirnagar University, Savar, Dhaka.	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
2.	Isolation and Identification Mf metabolites from the plant *Bauhinia acuminita* and its associated endophytic fungi.	M.S thesis	Tasnim Hoque	Department of Pharmacy, Jahangirnagar University, Savar, Dhaka.	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
3.	Isolation and screening of bioactive potentials of endophytic fungi associated with P*unicagranatum* Linn.	M.S thesis	S.A.M. Salman Haque	Department of Mathematics and Natural Sciences, BRAC University, Dhaka.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
4.	Isolation of secondary metabolites from endophytic fungi associated with *Psidium guajava* Linn.	M.S thesis	Faiza Jaima	Department of Mathematics and Natural Sciences, BRAC University, Dhaka.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division. University.
5.	Identification of the drug like metabolites from marine endophyticfungi *Clonostachysrosea, Sclerotiniasclerotium* and Fusariumsolani.	M.S thesis	Mst. NilufaYea smin	Department of Fisheries, University of Dhaka .	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
6.	Effect of the Pumpkin seeds in the treatment of moderate to severe palmer arsenical Keratosis.	M.S thesis	Dr. Roksana Khatun	Department of Pharmacology, BSMMU-Bangabandhu Sheikh Mujib Medical University, Dhaka.	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
7.	Effect of the Compound of *Momordicacharanta* in the treatment of moderate to severe palmer arsenical Keratosis.	M.S thesis	Dr. Nurun Nahar Nupur	Department of Pharmacology, BSMMU-Bangabandhu Sheikh Mujib Medical University, Dhaka.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
8.	Profiling of polyphenolic content by chromatographic method and screening of anticancer, antimicrobial and antioxidant properties on *Acalyphaindica* L. grown in Bangladesh.	M.S thesis	Md. Saiful Alam	Department of Pharmacy, Jagannath University	Satyajit Roy Rony, SO, Pharmaceutical Sciences Research Division.

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
9.	Isolation of bioactive secondary metabolites from sea weeds and their associated fungi from the coast of the Bay of Bengal.	M.Sc thesis	HabibaMushfeka	Department of Fisheries, Faculty of Biological Science, University of Dhaka.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
10.	Studies on antibacterial and cytotoxic metabolites from endophytic fungi.	PhD thesis	Gazi Md. MonjurMurshid	Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Dhaka	Dr. Md. Hossain Sohrab, PSO,Pharmaceutical Sciences Research Division.
11.	Isolation and identification of secondary metabolites for endophytic fungi of *Camellia sinesis*.	MSc thesis	Md. Zahidul Hasan	Department of Biotechnology and Genetic Engineering, Jahangirnagar University.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
12.	Isolation, characterization and structure elucidation of secondary metabolites from endophytic fungi of *Syzigiumcumini* L.	MSc thesis	Mst. Mabiya Sultana	Department of Pharmacy, Jahangirnagar University, Savar, Dhaka	Dr. Md. Hossain Sohrab, PSO,Pharmaceutical Sciences Research Division.
13.	Isolation of secondary metabolites from the endophytic fungus *Curvularialunata*.	MSc thesis	Mst. Taamanna Ferdousi	Department of Pharmacy, JahangirnagarUniversity, Savar, Dhaka	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
14.	Chemical and biological investigation of *Randiadumetorum* and its associated endophytic fungi.	MSc thesis	Deblina Bhowmick	Department of Applied Chemistry and Chemical Engineering, University of Dhaka	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
15.	Isolation and structure elucidation of secondary metabolites from two ethnopharmacologically important plants of Fabaceae family and their associated endophytic fungi.	PhD thesis	Seagufta Afrin	Department of Pharmaceutical Chemistry, Faculty of Pharmacy, University of Dhaka.	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
16.	Analytical method development and validation of TrimetazidineHydrochloride INN drug.	MSc thesis	Chayanpria Sarker	Department of Pharmay, Daffodil International University, Shukrabad, Dhaka.	Suriya Sharmin, SO, Pharmaceutical Sciences Research Division.

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
17.	Isolation, identification and bioscreening of endophytic fungi isolated from two mangrove plants *Ceriopsdecandra* and *Heritieralittoralis*.	PhD thesis	Mita Munshi	Department of Biotechnology and Genetic Engineering, Jessore University of Science and Technology	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
18.	Taxonomical identification of endophytic fungi from *Justiciagendarussa* Burf.	MSc thesis	S.M. Neaz Mahmud	Department of Biotechnology and Genetic Engineering, MawlanaBhashani Science and Technology University.	Dr. Farhana Afroz, SSO, Pharmaceutical Sciences Research Division.
19.	Isolation and Identification of bioactive metabolites from endophytic fungi associated with *Withaniasomnifera*.	BSCIR Fellow	Sabrin Afroz Riya	Prof. Mofizuddin Ahmed Smrity Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
20.	Bioanalytical method development and validation of Fexofenadine Hydrochloride and Losartan Potassium in human plasma.	BSCIR Fellow	Farhana Afroz	Prof. Mofizuddin Ahmed Smrity Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
21.	Bioactive metabolites from three medicinal plants and their associated endophytic fungi.	BSCIR Fellow	Rabita Zinnurain	Prof. Mofizuddin Ahmed Smrity Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
22.	Role of natural antioxidants in high fat diet and adrenaline-induced cardiac hypertrophy.	BSCIR Fellow	Kazi Jannatul Ferdous	Dr. Qudrat-I-Khuda Doctoral Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
23.	Chemical and Biological investigation of *Agaricus* sp. (Mushroom) available in Bangladesh.	BSCIR Fellow	IsratFarha Lini	Prof. NurulAfsar Khan Post Graduate Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
24.	Isolation of Bioactive metabolites from *Nymphoideshydrophylla* and its associated endophytic fungi.	BSCIR Fellow	Zihan Rahman Khan	Prof. Mofizuddin Ahmed Smrity Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.
25.	Isolation of bioactive compounds from Commelinadiffusa and Commelinabenghalensisa nd their associated endophytic fungi.	BSCIR Fellow	Mahmuda Nasrin	Dr. Qudrat-I-Khuda Doctoral Fellowship (BCSIR)	Dr. Md. Hossain Sohrab, PSO, Pharmaceutical Sciences Research Division.

Participation in training/Seminar/Symposium/Workshop/Conference

1. **Dr. Md Hossain Sohrab (PSO)**, participated PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh, 16-18 January, 2020 and delivered a lecture on 'Endophytic fungi: Sources of diversified bioactive natural compounds'.
2. **Shammi Akhter (SO)** participated PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh, 16-18 January, 2020 and presented an oral presentation entitled 'Study on secondary metabolites of an endophytic fungus *Colletotrichum gloeosporioides* isolated from the plant *Justicia gendarussa* Burm'.
3. **Md. Najem Uddin (SO)** participated PSE-NPS 2020 Summit on "Natural Products for Healthy Living", organized by Khulna University, in association with the Phytochemical Society of Europe (PSE), held at Khulna University, Khulna, Bangladesh, 16-18 January, 2020 and presented an oral presentation entitled 'Comparative study on antimicrobial activity of different parts of *Abelmoschus moschatus* against multi-resistant pathogens'.
4. **Md Hossain Sohrab (PSO)** participated in BCSIR Congress 2019 on "Science and Technology for Sustainable Development", held at Bangladesh Council of Scientific and Industrial Research (BCSIR), Dr. Qudrat-I-Khuda Road, Dhanmondi, Dhaka-1205, Bangladesh 12-14 December, 2019, *Bangladesh Journal of Scientific and Industrial Research*.54(Special Issue): 12, 2019 and delivered a lecture on 'Scopes and opportunity for new and generic drug developments in Bangladesh'
5. **Dr. Md. HossainSohrab (PSO)** participated training on Computer aided drug and peptide design at the Red Green Research Center, Dhaka, Bangladesh, 22-24, November 2019.
6. **Dr. Farhana Afroz (SSO)** participated training on Computer aided drug and peptide design at the Red Green Research Center, Dhaka, Bangladesh, 22-24 November 2019.
7. **Dr. ADA Shahinuzzaman (SSO)** participated training on Computer aided drug and peptide design at the Red Green Research Center, Dhaka, Bangladesh, 22-24, November 2019.
8. **Md Najem Uddin (SO)** participated training on Computer aided drug and peptide design at the Red Green Research Center, Dhaka, Bangladesh, 22-24 November, 2019.

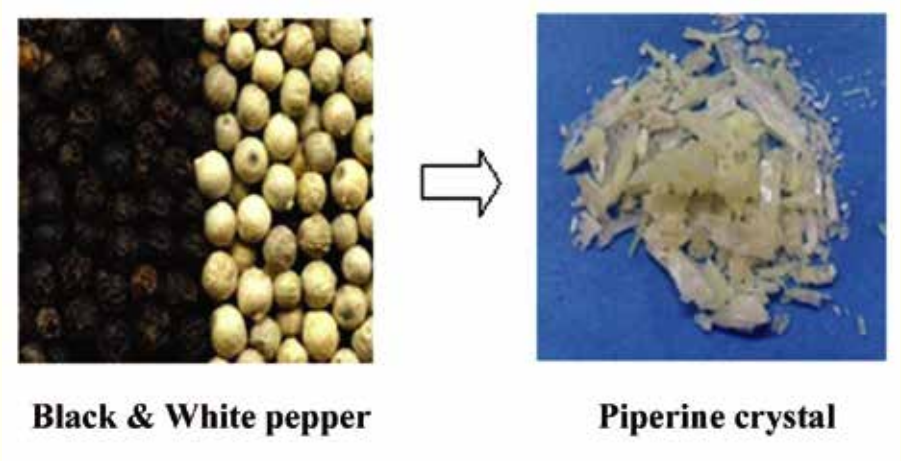
9. **Dr. Md. Hossain Sohrab (PSO)** participated training on Method Development, Validation and R&D works at the School of Pharmacy and Biomolecular Sciences, Liverpool John Moore University, Liverpool, United Kingdom, 05-11 February 2020.
10. **Dr. Farhana Afroz (SSO)** participated training on Method Development, Validation and R&D works at the School of Pharmacy and Biomolecular Sciences, Liverpool John Moore University, Liverpool, United Kingdom, 05-11 February, 2020.
11. **Satyajit Roy Rony (SSO)** participated in official visit to Lambda Therapeutic Research Limited, Canada and other related laboratories, Canada, 23-28 June, 2019.
12. **Dr. ADA Shahinuzzaman (SSO)** participated training on Method Development, Validation and R&D works at the School of Pharmacy and Biomolecular Sciences, Liverpool John Moore University, Liverpool, United Kingdom, 05-11 February, 2020.
13. **Suriya Sharmin (SSO)** participated training on Method Development, Validation and R&D works at the School of Pharmacy and Biomolecular Sciences, Liverpool John Moore University, Liverpool, United Kingdom, 05-11 February, 2020.
14. **Md Najem uddin (SO)** participated training on R&D Management at CSIR-Human Resource Development Centre, Council of Scientific and Industrial Research (CSIR) India, 17-21 February, 2020.

Number of Analytical (Ad-Hoc) Problem Solved

Name of the Division	Routine type	Research	Total
Pharmaceutical Sciences Research Division	75	-	75

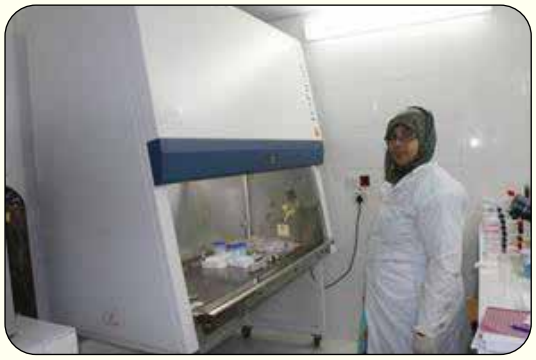
Products

Fruit flavoured salt for gastric comfort



Isolated pure piperine as Active Pharmaceutical Ingredient (API) from black pepper and white Papper

Scientists working at Pharmaceutical Sciences Research Division



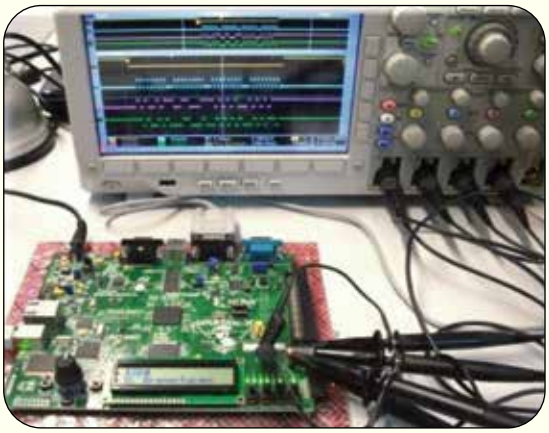
Official Visit

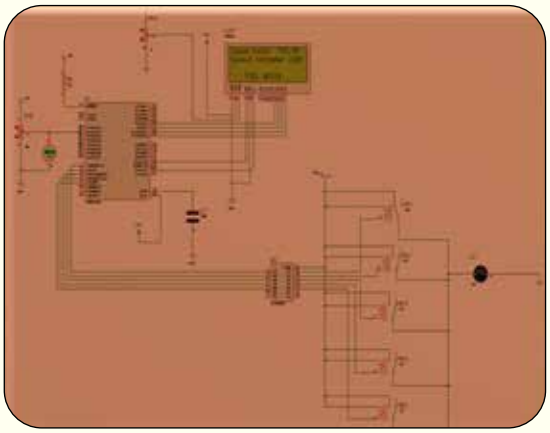
Official visit at Lambda Therapeutic Research Limited,Toronto, Canada (23-28 June, 2019)

Official visit at Ontario Institute for Cancer Research (OICR), Toronto, Canada ((23-28 June, 2019)

Training programme at School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Liverpool, United Kingdom (5-11 February, 2020)

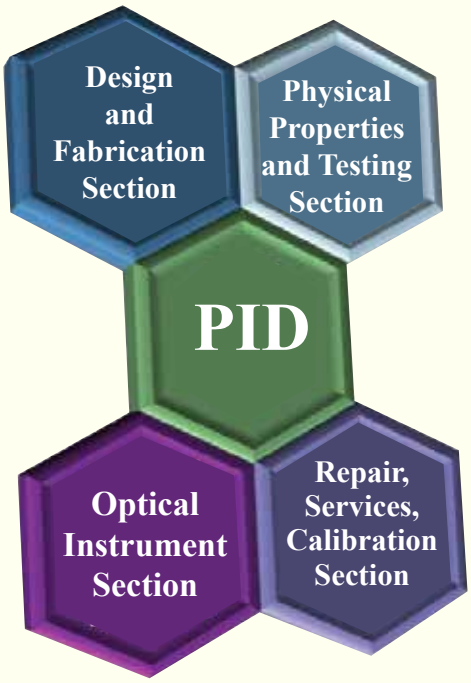
Physical Instrumentation Division (PID)





The main works of PID are:

- Conducting research activities for the development of scientific/laboratory instruments using locally available raw materials.
- Maintenance, repairing, servicing and installation of scientific equipment and electronic instrument.
- Conducting software development and other innovative activities in the field of information technology.
- Provide computer training (software and hardware).



Field of Research: Electrical and Electronics Engineering, Embedded System Design, Information and Communication Technology, Internet of Things (IoT).

R&D Project

Development of a multi agent based control system for fire disaster management

KhaledunNahar Babi (PL), Md. Saidul Islam, Abu Kowsar, Md. Sadequl Islam, Md. Forhad Hossain, Mst. Kamrun Nahar and Dr. Samina Ahmed

Introduction

Multi agent based control system combined with automatic fire detection, an emergency response and evacuation plan can significantly reduce property damage, personal injuries and loss of life from fire.

Objective

- To design and develop an effective multi-agent based conceptual prototype model for disaster management caused by fire spread.
- To develop a system for automatic control of firefighting equipment.
- To develop an agent based user interface for fire management.

Work Progress

- Data collection and gathering information is completed.
- Analyzing the collected data is going on.

Other Activities

Repairing, Servicing, Maintenance, Calibration and Installation of scientific/laboratory equipment:

During the period from 1st July, 2019 to 30th June, 2020 services were provided to 82 Laboratory/Scientific Instruments (such as: Computer CPU, Printer, UPS (Online & Offline), Monitor, Scanner, Refrigerator, Photocopy Machine, Water Bath Vacuum pump, Tintometer, Distillation plant etc.)

Achievements and Activities:

Published Paper:

S.M.A. Sujan, **Md. Abul Kashem**, A. N. M. Fakhruddin, "Lignin: a valuable feedstock for biomass pellet", *Bangladesh Journal of Scientific and Industrial Research,* 2020, 55(1):83-88 DOI: 10.3329/bjsir.v55i1.46735.

Scientists pursuing M.S/M.Phil/ PhD Courses in home or abroad:

1. **Khaledun Nahar Babi**, SSO**,** Physical Instrumentation Division, BCSIR Laboratories, Dhaka pursuing M.Phil course in Department of Computer Science and Engineering, Jahangirnagar University, Bangladesh, under supervision of Professor Dr. Israt Jahan and Professor Dr. Md. Zahidur Rahman (co-supervisor) and working on "Multi-Agent Based Modeling and Simulation for Natural Distillation Management: Bangladesh perspective.", session 2018-2019.

Guidance to research Work (PhD/MPhil /M.S/NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory	Name of the Research Fellow	Name of the Institution/Division	Name of Supervisors
01	Analysis and simulation modeling of a multi agent based fire management system.	BSCIR Fellow, Professor Mofiz Uddin Ahmed Sriti Fellowship	Sumaiya Afroze	Physical Instrumentation Division, BCSIR Laboratories, Dhaka	Khaledun Nahar Babi (SSO)

Participation in Training/Seminar/Symposium/Workshop/Conference

1) **Dr. Engr. Md. Abul Kashem (CSO)** participated in a seminar and exhibition on appropriate technology application and extension at Bakerganj, Barisal, organized by Ministry of Science and Technology and BCSIR, 26-29 October, **2019.**

2) **Dr. Engr. Md. Abul Kashem (CSO)** participated in a seminar and exhibition on appropriate technology application and extension at Jaldhaka, Nilphamari, organized by Ministry of Science and Technology and BCSIR, 2-5 November, **2019.**

3) **Dr. Engr. Md. Abul Kashem (CSO)** participated in a seminar and exhibition on appropriate technology application and extension at Belabo, Narsingdi, organized by Ministry of Science and Technology and BCSIR, 19-22 October, **2019.**

4) **Khaledun Nahar Babi (SSO)** participated in an International training course on "Science, Technology and Innovation Policy" organized by Indian Technical and Economic Cooperation, Government of India, 27 November – 3 December, **2019.**

5) **Khaledun Nahar Babi (SSO)** participated in a training program on "4 policy instruments (NIS, GRS, RTI, CC)" jointly organized by National Institute of Local Government and Platforms for Dialogue Project, 9-10 December, 2019**.**

6) **Md. Sadequl Islam (Maintenance Engineer)** participated in an International training program on "LC-MS/MS Machine Techniques and Operation with Mass hunter course" organized by Agilent Technologies (Sales) Pte Ltd., 27-30 August, **2019.**

7) **Md. Sadequl Islam (Maintenance Engineer)** participated in a training program on "3 policy instruments (NIS, GRS, RTI) to establish good governance" organized by BCSIR Laboratories Dhaka, BCSIR, 1st March, **2020**.

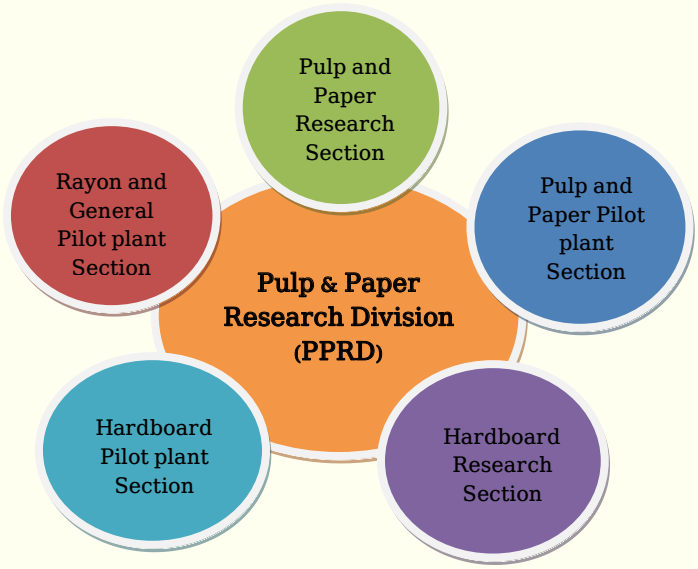
Product of PID: Digital Water Bath

Scientists working at PID

Pulp & Paper Research Division (PPRD)

Pulp and Paper Research Division (PPRD) is one of the oldest research divisions in BCSIR Laboratories, Dhaka which plays a crucial role in the development of pulping technology for the pulp and paper industries in Bangladesh from its beginning. Many efforts have been given over the past decades to find out high yield biomass for pulp production as well as easy propagation for forestry. This research division is mandated to utilize locally available bioresouces in producing pulp, paper and chemicals. Seven scientists including one CSO, one PSO, one SSO, three SO and one RC of this division are giving full effort in reducing green-house gas emission through the development of biobased products, and green pulping process for non-wood agricultural residues as well. Moreover, PPRD is developing human resources through supervising PhD and MS students of different universities of Bangladesh, and providing analytical and intellectual services to the local paper and paper products based industries of Bangladesh with great reputation. Currently, this research division is conducting three on-going R&D projects of national interest.

Field of Research



R&D Projects

High temperature Chlorine dioxide bleaching of non-wood pulp

Jannatun Nayeem (PL), Dr. Md. Sarwar Jahan, Dr. Mohammad Nashir Uddin, Kazi Md. Yasin Arafat and Razia Sultana Popy

Introduction

Bleaching section is one of the most chemical consuming sections of pulp, paper and allied industries. A large amount of chlorine dioxide is used in conventional bleaching process which contains not only a huge amount of money but also hazardous impact on health and environment. Temperature plays an important role in pulp bleaching. By using high temperature with lower chemical dosages, preparing high quality pulp can be a good option to pulp industries.

Objective

- To evaluate high temperature chlorine dioxide bleaching of non-wood pulp to make the pulping process more viable economically and environmentally.

Work progress

- Pulps from non-woods were subjected to D_{HT} at 85°C for 45 min and compared with D_0 at 70°C for 45 min.
- The kappa numbers after E_P stage in D_{HT} bleaching were always lower and brightness was higher than the corresponding D_0 bleaching without impacting pulp viscosity.
- The final brightness of corn stalks pulp was 84.8% at kappa factor of 0.25 in D_0 process, while the same in D_{HT} process produced brightness of 87.2% at kappa factor of 0.15, saved 40% ClO_2 in the first stage.
- Similarly, kash pulp exhibited 90% brightness at kappa factor of 0.15, which also saved 40% ClO_2 over conventional D_0 process.
- The brightness of baggase pulp in D_{HT} and D_0 processes was almost similar. The COD value in D_{HT} was lower than D_0 process.

A low temperature fractionation of agricultural residue with zero emission

Dr. Md. Sarwar Jahan (PL), Ariful Hai Quderi, Jannatun Nayeem, Razia Sultana Popy, Md Moniruzzaman, Nur Hossain, Aminul Ahshan, Ohidul Akbar and Badhon Saha

Introduction

Pulping of agricultural wastes in conventional process is not technically and environmentally friendly due to high content of silica and fines, which creates problem in chemical recovery and pulp processing. Pulping pre-extraction was carried out with KOH followed by KOH pulping and bleaching by DED. Silica was separated from the pre pulping extraction and pulping liquor. After silica extraction liquor was utilized in soil amendment.

Objective

- To optimize KOH pulping of nonwoods by varying active alkali charge and time at boiling temperature.
- To bleach KOH pulp by $D_0E_pD_1$ bleaching sequences.
- To evaluate papermaking properties of produced pulp.
- To amend soil by silica free KOH liquor and silica and lignin free KOH liquor.

Work progress

- In the delignification with KOH under optimum conditions (12 % alkali, 120 min, 90 °C), a pulp yield of 49.7 % with kappa numbers 30.3 was obtained.
- KOH Kash pulp was bleached to 86.3 % brightness in $D_0(EP)D_1$ bleaching sequence with good paper-making properties.
- The KOH spent liquor, which contains silica and dissolved organics, was further investigated for value-added utilization.
- The dissolved biomass in KOH spent liquor improved soil properties, thus increasing Kolmi sag production in pot experiment.

Rapid determination of Hexuronic Acid in non-wood pulp by multivariate analysis of FTIR spectroscopic data

Dr. Mohammad Nashir Uddin (PL), Dr. Md. Sarwar Jahan, Muhammad Saiful Islam, Jannatun Nayeem and Kazi Md. Yasin Arafat

Introduction

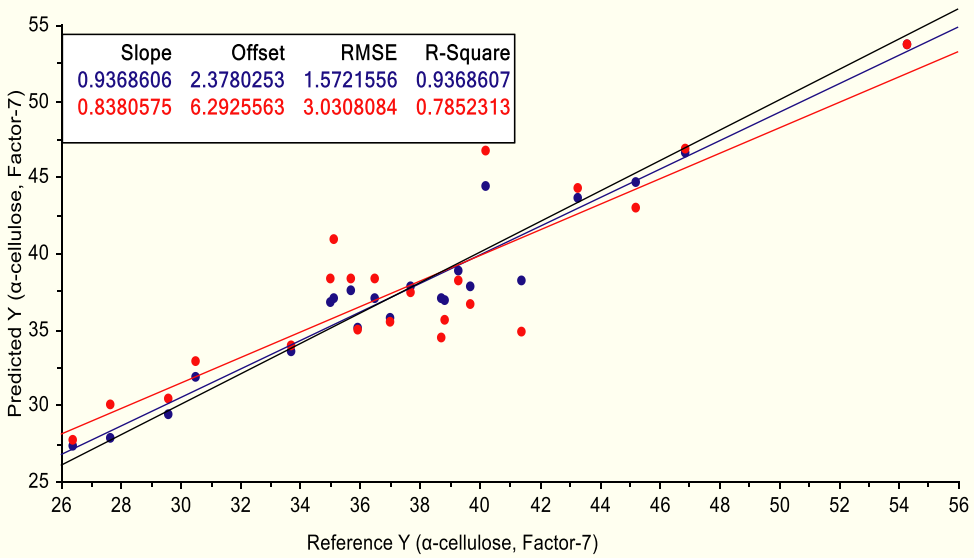
Traditionally pulp properties are done with wet chemical method or by using instrument for each individual test. These methods are time consuming, need chemicals and produce chemical waste. On the contrary, like many other fields of analytical chemistry, multivariate models could be used in this regard.

Objective

- To develop a method for determining characteristics of crop residue, potential raw materials for pulp and paper industries, by Chemometric analysis of FT-NIR spectroscopic data

Work progress

- **Phase I:** 22 distinct non-wood agriculture residue or wastes were chemically characterized by traditional methods.
- **Phase II:** Spectral data were taken from the range 10,000-4,000cm^{-1}. Most informative region of FT-NIR spectral data was found 7000-5000cm^{-1}.



Model for prediction of α-cellulose

- **Phase III: Modeling:** For lignin prediction de-trained and smoothed with Savitzky-Golay (S-G) filtering and PLSR (R^2= 0.829) produced best results where as for Holocellulose and α-cellulose these values are PLSR (R^2=0.912) and PLSR (R^2=0.937) respectively. Next, calibration model were prepared with 1. PCR, and 2. PLSR. The best calibration models with raw data are for Pentosan, PCR (R^2= 0.678) and for Ash is PLSR (R^2= 0.872).

Achievements & Activities

Paper Published

1. Razia Sultana Popy, YonghaoNi, Abbdus Salam, M. SarwarJahan. Mild potassium hydroxide-based alkaline integrated biorefinery process of Kash (Saccharumspontaneum). Industrial Crops and Products, **2020**, Volume 154.
2. MAQ Mohammad Nashir Uddin, Taslima Ferdous, Zahidul Islam, M. Sarwar Jahan. Development of Chemometric Model for Characterization of Non-wood by FT-NIR Data. Journal of Bioresources and Bioproducts, **2020**, 5 (3), 205-212.
3. MS Sutradhar, S., Arafat, K. M. Y., Nayeem, J., & Jahan. Organic acid lignin from rice straw in phenol-formaldehyde resin preparation for plywood. Cellulose Chemistry and Technology, **2020,** 54 (5-6), 463-471.
4. T Ferdous, MS Jahan, MA Quaiyyum, U M.N.. Formic acid pulping of crops residues available in Bangladesh. Biomass Conversion and Biorefinery10, **2020,** 289–297.
5. M Sarwar Jahan, Moinul Haque, Kazi M Yasin Arafat, YangcanJin, Hui Chen. Effect of prehydrolysis on pulping and bleaching of Acacia auriculiformis A. Cunn. exBenth. BIOMASS CONVERSION AND BIOREFINERY, **2020**.
6. SA Ria, T Ferdous, KMY Arafat, MS Jahan. Pulp refining in improving degree of substitution of methylcellulose preparation from jute pulp. BIOMASS CONVERSION AND BIOREFINERY, **2020**.
7. Taslima Ferdous, M. Abdul Quaiyyum, Shahriar Bashar and M. Sarwar Jahan. Anatomical, morphological and chemical characteristics of kaun straw (Seetaria-ltalika). Nordic Pulp & Paper Research Journal, **2020,** Volume 35: Issue 2.
8. Tawhida Akter, Jannatun Nayeem, Ariful Hai Quadery, M. Abdur Razzaq, M. Tushar Uddin, M. Shahriar Bashar and M. Sarwar Jahan. Microcrystalline cellulose reinforced chitosan coating on kraft paper. Cellulose Chemistry and Technology, **2020,** 54 (1-2), 95-102.
9. Haque, M. M., Aziz, M. I., Hossain, M. S., Quaiyyum, M. A., Alam, M. Z., & Jahan, M. S. .Pulping of Hybrid Acacia Planted in a Social Forestry Program in Bangladesh. *Cellulose Chemistry and Technology,* **2019,** 53 (7-8), 739-745.
10. Jahan, M. S., Haque, M. M., Quaiyyum, M. A., Nayeem, J., & Bashar, M. S. Radial variation of anatomical, morphological and chemical characteristics of Acacia auriculiformis in evaluating pulping raw material. *Journal of the Indian Academy of Wood Science*, **2019,** *16*(2), 118-124.
11. Nayeem, J., Jahan, M. S., Popy, R. S., Uddin, M. N., & Quaiyyum, M. A. Prehydrolysis kraft pulping of jute cutting and caddis mixture for rayon production. *TAPPI Journal*, **2019,** *18*(5), 287-293.
12. Haque, M. M., Uddin, M. N., Quaiyyum, M. A., Nayeem, J., Alam, M. Z., & Jahan, M. S. .Pulpwood quality of the second generation Acacia auriculiformis. *Journal of Bioresources and Bioproducts*, **2019,** *4*(2), 73-79.S
13. Haque, M., Nanjiba, M., Jahan, M. S., Quaiyyum, M. A., Alam, M. Z., &Nayeem, J.Pre-bleaching of kraft acacia pulp. *Nordic Pulp & Paper Research Journal*, **2019,** *34*(2), 165-172.

14. Ferdous, T., Jahan, M. S., Quaiyyum, M. A., & Uddin, M. N. Formic acid pulping of crops residues available in Bangladesh. *Biomass Conversion and Biorefinery*, **2019,** 1-9.

15. Uddin, M. N., Nayeem, J., Islam, M. S., & Jahan, M. S. Rapid determination method of dissolving pulp properties by spectroscopic data and chemometrics. *Biomass Conversion and Biorefinery*, **2019,** *9*(3), 585-592.

16. Uddin, M. N., Ahmed, S., Ray, S. K., Islam, M. S., Quadery, A. H., & Jahan, M. S. Method for predicting lignocellulose components in jute by transformed FT-NIR spectroscopic data and chemometrics. *Nordic Pulp & Paper Research Journal*, **2019,** *34*(1), 1-9.

17. Jahan, M. S., Al-Maruf, A., Ahsan, M. A., & Mun, S. P. Characterisation of Lignin Extracted From Six Mangrove Species Grown in Bangladesh. *Cellulose Chemistry and Technology*, **2019,** *53*(1-2), 63-7

Scientists pursuing M.S/M.Phil/PhD Courses in home or abroad

1. **Mamon Sarkar,** RC, Pulp and Paper Research Division, Pursuing PhD degree from University of Wyoming, USA.

Guidance to research Work (PhD/M.Phil/M.S/NCST & BCSIR Fellow)

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
1	Morphological and Chemical Characteristics of different non-wood species and their effect on pulping	PhD (Student)	Taslima Ferdous	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. M Sarwar Jahan
2	Application of Chitosan in paper Coating	Dr. Abdullah Al-Muti Sharfuddin Smriti Post Graduate Fellow	Tawhida Akter	BCSIR	Dr. M Sarwar Jahan
3	Preparation and Characterization of Methyl Cellulose	MSc thesis	Sumaiya Akhter Ria	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. M Sarwar Jahan
4	High Temperature Chlorine dioxide bleaching of non wood pulps: Kash, Corn Stalks and Bagasse	MSc thesis	Md. Imran Hossain	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. M Sarwar Jahan
5	Isolation and Characterisation of Lignin from Coconut Coir	MSc thesis	Md. Zobaer Rahman	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. M Sarwar Jahan
6	Quantitative analysis of the adulteration of orange juice with sucrose using infrared spectroscopy and chemometrics.	MSc thesis	Md. Mohiuddin	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. Mohammad Nashir Uddin

Sl. No.	Title of research	Research Catagory	Name of Student	Name of academic Institute	Name of Supervisors
7	Determination of paper quality parameters (GSM, Brightness, Opacity etc) in available papers in market by Multivariate analysis of spectroscopic data.	MSc thesis	Md. Mizanur Rahman	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. Mohammad Nashir Uddin
8	Development of a method for classification of capsule shells as from vegetable or animal sources and for quantification of gelatin (if there in any) in vegetable capsule shell by chemometric analysis of spectroscopic data.	MSc thesis	Akash Debnath	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. Mohammad Nashir Uddin
9	Development of rapid and cost effective method for the quantification of honey adulteration by chemometrics analysis of spectroscopic data	MSc thesis	Md. Tanvir Hasan	Applied Chemistry & Chemical Engineering, University of Dhaka	Dr. Mohammad Nashir Uddin

Participation in training/Seminar/Symposium/Workshop/Conference

1. **Kazi Md. Yasin Arafat (SO),** participated in Training workshop on Non-wood pulping and paper making technology organized by China National Pulp and Paper Research Institute, Beijing, China, 12-31 August, **2019**.
2. **Dr. M. Sarwar Jahan (CSO),** participated in workshop on Biodiversity and its research management organized by International Network for Government Science Advice(INGSA), 23-24 September, **2019** and presented a case study on Pulpwood crisis: A potential trade-off between biodiversity and the economy.
3. **Dr. M. Sarwar Jahan (CSO),** participated in Sixth International Casuarina workshop: Casuarinas for green economy and environmental sustainability organized by IUFRO and Kasetsart University, Bangkok, Thailand, 21-25 October, **2019** and presented an oral presentation entitled, "Chemical and morphological characterization of *Casuarina equisetifolia* ".
4. **Dr. Md. Mustafizur Rahman (SSO),** participated in Bangladesh Chemical Society Conference organized by Department of Chemistry, Rajshahi University, 09-10 November, **2019** and presented an oral presentation entitled, "Displacement washing of Spruce Pulp".
5. **Jannatun Nayeem (SO),** participated in Bangladesh Chemical Society Conference organized by Department of Chemistry, Rajshahi University, 09-10 November, **2019** and presented an oral presentation entitled, "Dissolving pulp from crops residue by prehydrolysis KOH process".

6. **Kazi Md. Yasin Arafat (SO),** participated in Bangladesh Chemical Society Conference organized by Department of Chemistry, Rajshahi University, 09-10 November, **2019** and presented an oral presentation entitled, "Biorefinery initiative of *Casuarina equisetifolia* by formic acid".
7. **Razia Sultana Popy (SO),** participated in Bangladesh Chemical Society Conference organized by Department of Chemistry, Rajshahi University, 09-10 November, **2019** and presented an oral presentation entitled, "A low temperature fractionation of agricultural residue with zero emission".
8. **Razia Sultana Popy (SO),** participated in Conference on environmental solutions for sustainable development: towards developed Bangladesh (CESSD 2019) organized by Forest and Environment affairs sub-committee of Bangladesh Awami League, 27-28 November, **2019** and presented an oral presentation entitled, "Low temperature KOH pulping of straws".
9. **Dr. M. Sarwar Jahan (CSO),** participated in International workshop on Learning about Sustainability, SDGs and Global Challenges, Gebze, Turkey, 03-05 December, **2019.**
10. **Dr. Mohammad Nasir Uddin (SSO),** participated in BCSIR Congress-2019 organized by Bangladesh Council of Scientific and Industrial Research (BCSIR), 12-14 December, **2019** and presented an oral presentation entitled, "Development of Chemometric models for the chemical characterization of non-wood by FT-NIR spectroscopic data.
11. **Dr. Md. Mustafizur Rahman (SSO),** participated in BCSIR Congress-2019 organized by Bangladesh Council of Scientific and Industrial Research (BCSIR), 12-14 December, **2019** and presented an oral presentation entitled, "Displacement washing of Spruce Pulp".
12. **Jannatun Nayeem (SO),** participated in BCSIR Congress-2019 organized by Bangladesh Council of Scientific and Industrial Research (BCSIR), 12-14 December, **2019** and presented an oral presentation entitled, "Dissolving pulp from crops residue by prehydrolysis KOH process".
13. **Kazi Md. Yasin Arafat (SO),** participated in BCSIR Congress-2019 organized by Bangladesh Council of Scientific and Industrial Research (BCSIR), 12-14 December, **2019** and presented an oral presentation entitled, "Biorefinery initiative of *Casuarina equisetifolia* by formic acid".
14. **Razia Sultana Popy (SO),** participated in BCSIR Congress-2019 organized by Bangladesh Council of Scientific and Industrial Research (BCSIR), 12-14 December, **2019** and presented an oral presentation entitled, "Low temperature KOH pulping of straw".

Number of Analytical (Ad-hoc) problem solved

Name of the Division	Routine type	Research Type	Total
Pulp and Paper Research Division	305	05	310

Scientists working at Pulp and Paper Lab

Major Instruments

UV-Vis Spectroscopy

Fiber Quality Analyzer

HPLC

Mini Paper Machine

Micrometer

Tear Tester

Photo Gallery

Major Instruments of BCSIR Laboratories Dhaka

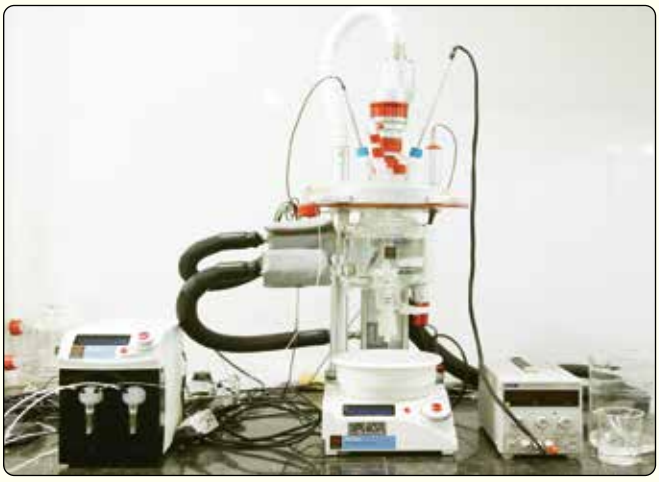
AtomicAbsorptionSpectroscopy (AAS)

TG-GC-MS System

UPLC-MS-MS System

Centrifugal Partition Chromatograph

Acelarated Solvent Extractor



Reaction Calorimeter

NovaSeq 6000, NextSec 500

Paper Sheet Former

Universal Testing Machine

Kjeldahl Nitrogen Digestion

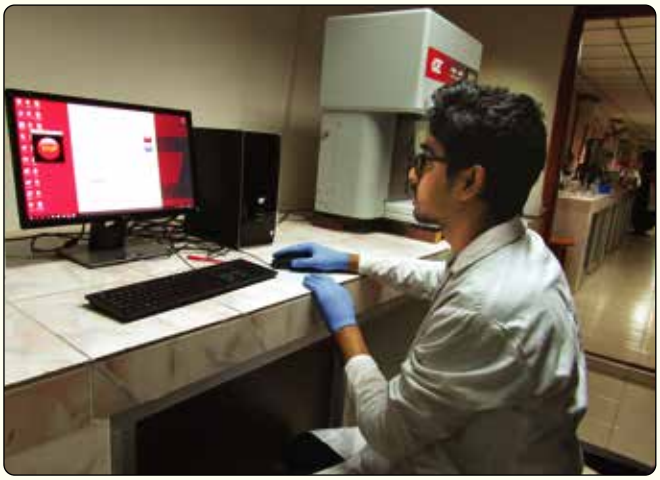
Microtome

Bursting Tester

Group Photos of Different Divisions

Scientists working at laboratories


with LM or LMA



Seminar/Conference

Services and Technology Dissemination