The List of 2019 KIST School Partnership Project Awardee

	분야	성명	과제명	국적	소속	직위	졸업학기	지도교수
1	에너지환경 융합공학	Ghulam Ali	Development of high voltage phosphate–based cathodes for Li–ion batteries	파키스탄	National University of Science and Technology (NUST)	Assistant Professor	2016 후기	정경윤
2	나노–정보 융합	Faisal Shahzad	Solution–processed, Semi–transparent Two–Dimensional (2D) Transition Metal Carbides and Polymer Composite films for electromagnetic interference (EMI) Shielding	파키스탄	Department of Metallurgy and Materials Engineering (DMME), Pakistan Institute of Engineering and Applied Sciences (PIEAS)	Associate Professor	2017 후기	구종민
3	에너지환경 융합공학	Chairul Hudaya	Hybrid supercapacitor derived from lithium titanate oxide and sugarcane bagasse–based activated carbon	인도네시아	Universitas Indonesia	Assistant Professor	2016 전기	이중기
4	생물화학	Ahmed Mohammed ElKamhawy	Design and synthesis of first–in–class novel quinoline derivatives as potent and selective DAPK1 inhibitors for treatment of cancer disorders	이집트	Mansoura University	Lecturer (Assistant Professor)	2015 후기	노은주
5	에너지환경 융합공학	Arenst Andreas Arie	Porous Graphene Like Nanosheets–Lithium Sulfide (PGLNS/Li2S) Composite Cathodes for Lithium Sulfur Battery	인도네시아	Parahyangan Catholic University	Head of Advanced Material and Product Design Research Center	2011 전기	이중기
6	바이오–메디컬 융합	Zhi–Qiang Zhang	Magnetic hyperthermia enhanced gas/chemotherapy for orthotopic invasive bladder tumor by using a thermosensitive hydrogel	중국	Urology Institute of Shenzhen University	Senior Researcher	2017 후기	송수창
7	생물화학	Mohammed Samir Abdelmaksoud	Design and synthesis of novel pan Raf inhibitors having sulfonamide terminal moiety and imidazo[2,1–b]oxazol scaffold and their antiproliferative effect	이집트	Medicinal and Pharmaceutical Chemistry, Pharmaceutical Industries Research division, National Research Center	Researcher	2016 전기	오창현
8	에너지–환경 융합	Sheeraz Mehboob	Heteroatom–doped carbon materials as electrocatalysts for all–vanadium redox flow batteries	파키스탄	Chemistry Division, PINSTECH	Principal Scientist	2019 후기	하흥용
9	에너지공학	Haryo Pandu Winoto	Development of Robust Catalytic Reaction System for Gamma Valerolactone (GVL) Production Using Cheap Biomass Feedstock	인도네시아	Lembaga Afiliasi Penelitian dan Industri Institut Teknologi Bandung (LAPI ITB)	Project Leader	2017 후기	안병성
10	생물화학	Mohamed Mahmoud Ibrahim Attia AlSanea	Novel Ligustrazine–based SLC–0111 Analogues as Selective Carbonic Anhydrase IX Inhibitors Endowed with Antitumor Activity: Design, Synthesis, Biological Evaluation and In Silico Insights	이집트	Aljouf University	Assistant professor	2015 전기	이소하
11	청정연료 화학공학	Fidelis Stefanus Hubertson Simanjuntak	Activated carbon from waste biomass as cobalt catalyst support for green diesel production	인도네시아	Universitas Prasetiya Mulya	Assistant Professor	2013 후기	안병성
12	나노재료공학	Bui Thi Phuong Quynh	Development of water–resistant and active packaging film based on cross–linked polyvinyl alcohol (PVA) and natural extracts	베트남	Ho Chi Minh City University	Lecturer	2015 전기	김상훈
13	청정연료 화학공학	Shoyebmohamad Fattemohamad Shaikh	A facile chemical synthesis approach for metal doped Metal organic frameworks (MOFs) as efficient electrocatalyst for supercapacitor application	인도	King Saud University	Assistant Professor	2015 전기	주오심
14	청정연료 화학공학	Antonius Indarto	Development of Catalytic Reaction System for Cascade Turpentine Valorization	인도네시아	Department of Chemical Engineering Institut Teknologi Bandung (ITB)	Assistant Professor	2012 후기	김재훈
15	청정연료 화학공학	Rika Tri Yunarti	Synthesis of SiO2 from pumice stone and sugarcane bagasse and its modification with silver loading for reduction of 4–nitrophenol	인도네시아	Universitas Indonesia	Head of Undergraduate Program	2017 전기	하정명
16	에너지 변환공학	Vo Nguyen Xuan Phuong	Improvement of performance and biofouling resistance of polyamide–based RO membrane	베트남	Ton Duc Thang University	Researcher	2011 전기	남석우
17	생체분자 과학과	Nguyen Thi Minh Huyen	Optimization of growth condition for culture Bifidobacterium in Vietnam	베트남	Institute of Biotechnology, Vietnam Academy of Science and Technology	Principle Researcher	2010 전기	김기선
18	청정연료 화학공학	Ratna Frida Susanti	Hierarchical porous nitrogen–doped carbon from waste biomass synthesized under subcritical water carbonization followed by chemical activation for Lithium Ion Capacitor's electrode	인도네시아	Parahyangan Catholic University	Associate Professor	2012 전기	김재훈
19	연료전지	Hary Devianto	Performance Evaluation of Solid Oxide Fuel Cell Stack on Start–Stop Cycle	인도네시아	Lembaga Afiliasi Penelitian dan Industri Institut Teknologi Bandung (LAPI ITB)	Project Leader	2005 후기	임태훈
20	환경에너지 기계공학	Hoang, Anh Le	Design A Low–Cost Sensor Platform for Air Quality Monitoring	베트남	Faculty of Environmental Sciences (FES) VNU University of Science (VNU–HUS) Vietnam National University (VNU)		2012 전기	정종수
21	에너지 환경융합 공학	Zubair Ahmed	Production of high–quality potable water using riverbank filtration/canal bank filtration from the Indus River	파키스탄	Mehran University	Professor	2007 후기	안규홍
22	에너지 변환공학	Dashkhuu Khasbaatar	Adsorption of selenium by layered double hydroxide and cryogel composite	몽골	National University of Mongolia	Associate professor	2008 후기	최웅수
23	HCI 및 로봇응용공학	Nova Eka Diana	Social Engagement for Cardio Augmented Reality	인도네시아	Universitas YARSI	Manager of Research Development	2012 전기	이득희

KIST School Partnership Technical Report

General Information Principal Investigator

Ghulam Ali

Affiliation (department)	National University of Science and Technology (NUST), Islamabad, Pakistan
Position	Assistant Professor
Project Title	Development of high voltage phosphate-based cathodes for Li-ion batteries
Project Period	2020.01.01~2020.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of high voltage phosphate-based cathodes for Li-ion batteries
- **Research Field** Energy Storage
- **Research Duration** 01.01.2010 ~ 31.12.2020
- **Research Objectives**
  - ·To produce high voltage cathode materials based on metal phosphate for Li-ion batteries.
  - ·Development of lithium-ion full cells comprising theabovementioned cathodes with graphite as anode material to test the feasibility of the cathodes.
  - ·Li+ insertion/extraction mechanism of the prepared cathode will be investigated using synchrotron-based x-ray absorption spectroscopy at Pohang Accelerator Laboratory, South Korea.
  - ·In-situ XRD of the cathode materials will be investigated at KIST with the collaboration of Dr. Chung Kyung Yoon.
- **Research Contents** The current generation of cathode materials is lacking to deliver high energy density. A lot of efforts have been made to develop high voltage cathode materials in the last decade. High working voltage cathodes are important to design high energy density batteries and metal phosphates such as LiMPO4 (M = V, Mn, Co, Ni) can deliver high working voltages (>4 V). These phosphate materials suffer from poor electronic conductivity and irreversible structural changes during Li+ insertion/extraction. Two different strategies; 1) effective conductive coating and 2) appropriate metal doping, will be applied to these materials to get high-performance cathode materials. Improving the capacity of cathode materials will lead to the use of the low weight of cathode that will decrease the weight, size, and cost of lithium-ion batteries and made this technology suitable for large-scale applications.
- **Research Outputs**
  - ·High working potential ~4 V metal phosphate cathode materials for high energy density LIBs with stability over 100 cycles.
  - ·We expect to fill patents and high impact factor papers of the proposed work.
  - ·Improving the research capability of industries for energy storage research.
- **Collaboration with KIST researcher** The electrochemical properties of the prepared electrodes were characterized with the help of **Dr. Kyung Yoon Chung** at Center for Energy Storage Research, Korea Institute of Science and Technology (KIST). The reaction mechanism of cathodes was carried out at PAL using synchrotron based x-ray spectroscopy and in-situ XRD with the collaboration of **Dr. Chung Kyung Yoon**.

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Faisal Shahzad

Affiliation (department)	Department of Metallurgy and Materials Engineering (DMME), Pakistan Institute of Engineering and Applied Sciences (PIEAS)
Position	Assistant Professor
Project Title	Solution-processed, Semi-transparent Two-Dimensional (2D) Transition Metal Carbides and Polymer Composite films for electromagnetic interference (EMI) Shielding
Project Period	2020.01.01~2020.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title**: Solution-processed, Semi-transparent Two-Dimensional (2D) Transition Metal Carbides and Polymer Composite films for electromagnetic interference (EMI) Shielding
- **Research Field**: Light Weight Electrically conductive Nanomaterials for EMI shielding
- **Research Duration**: 2020.01.01 ~ 2020.12.31 (12 months)
- **Research Objectives**: The major objectives of the proposed research are as given below:
  1. Single to Few Layer synthesis of novel 2D nanomaterials “MXenes” (Ti3C2, Ti3CN), Transition metal oxides (MnO2) and their polymer composites.
  2. Development of etching process such as to avoid the toxic fluoride based etchants and promote delamination.
  3. Improving the dispersion ability of as-prepared MXenes by surface functionalization.
  4. MXene thin film fabrication of varying thickness by solution casting & semi-transparent films by spray coating.

- **Research Contents**: This project aims to develop solution processable flexible, bendable, light weight, highly conducting, semi-transparent and mechanical strong EMI shielding films based on MXenes. Following is the brief outline of research contents;
  1. Research on etching methods will be conducted such as to avoid toxic acids while achieving single to few layer- MXene sheets by tuning the synthesis parameters.
  2. Research on stable dispersion of MXene in water/ethanol system will be conducted. Establishment of spray coating technique that can spray the MXene inks on different substrates will be developed. A comparison with other nanomaterial will also be made.
  3. Control drying will be conducted to develop homogenous MXene films on the flexible substrate. The distance of spray-machine and substrate heating temperature will be optimized to develop good quality films.
  4. Characterization of nanomaterials by XRD, SEM, XPS, Raman, TEM and their subsequent EMI shielding and mechanical property measurement

- **Research Outputs**: During this year KIST project, we were able to make HF-free MXene via minimally intensive delamination method. The basic infrastructure for synthesis of MXenes was established which includes fume hoods, hot plates, centrifuge machines, ultrasonication bath, vacuum filtration assembly etc. The MXene powders which were made indigenously at PIEAS was characterized by different techniques and then subsequently used for terahertz shielding, GHz shielding, water purification and electrochemical reaction studies. On the KIST side, we were able to develop a new type of MXene, called as titanium carbon nitride. This MXene exhibited outstanding EMI shielding efficiency of over 100 dB because of smart heat treatment at very low temperatures. This heat treatment generated pores and removed the undesired entrapped water and functional groups which lead to high EMI SE. The shielding results were reported in SCIENCE journal during year 2020. The developed MXene was also explored for other applications such as biosensing, water-purification via adsorption and electrochemical water splitting. The papers on the concerned topics are under writing stages.

- **Collaboration with KIST researcher**: Through the KIST School Partnership Project, I developed a strong research collaboration with KIST researchers, in particular with Prof. Chong Min Koo and his students. We held several online meetings and a regular exchange via email. I have been involved in discussion with several KIST students upon their experimental works and assisted them in their difficulties. As a result of this collaboration, we together published 02 research papers and 01 book chapter is under writing stages.

KIST School Partnership Technical Report

General Information Principal Investigator

Chairul Hudaya, Ph.D

Affiliation (department) Department of Electrical Engineering, Faculty of Engineering, Universitas Indonesia

Position Assistant Professor

Project Title Hybrid supercapacitor derived from lithium titanate oxide and sugarcane bagasse-based activated carbon

Project Period 2020.01.01~2020.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Hybrid supercapacitor derived from lithium titanate oxide and sugarcane bagasse-based activated carbon
- **Research Field** Electrochemical Energy
- **Research Duration** 12 months (December 2019 – December 2020)
- **Research Objectives** The aim of this research is to investigate the utilization of activated carbon derived from sugarcane bagasse as the cathode material of hybrid supercapacitor. The effect of this material design toward the electrochemical performance of lithium ion capacitor will be comprehensively investigated. We will use sugarcane bagasse as the biomass-based activated carbon due to its abundant resources especially in tropical countries like Indonesia.
- **Research Contents** Research contents will incorporate 4 main activities: ① cathode material preparation by using hydrothermal and pyrolysis processes to form the porous activated carbon (AC) ② material characterizations (e.g. BET, SEM, EDX, XRD, FTIR, XPS, Raman, etc), ③ cell fabrication where lithium titanate oxide (LTO) will be used as the anode materials and developed AC as cathode materials, and ④ electrochemical characterization (e.g. galvanostatic charge/discharge, cyclic voltammetry, electrochemical impedance spectroscopy, etc).
- **Research Outputs** This study overcome the notorious problems lithium ion capacitors and the use of abundant resources of biomass, originated from precursors of sugarcane bagasse.
  - ❶ The biomass-derived sugarcane bagasse activated carbon has been successfully synthesized and it has been applied as the main active material in the cathode of lithium ion capacitor (LIC).
  - ❷ The most optimal activation temperature is 800oC produced porosity of 3554 m2 /g.
  - ❸ The activated carbon porosity affects the performance of the battery. Meanwhile as the porosity increase not always brings good performance in the battery, it should be an optimum value of porosity.
  - ❹ From electrochemical measurement, LIC full-cell performance can reach specific capacitance 31.94 F/g, specific energy 35.49 W h/kg, and specific power 2954.36 W/kg
- **Collaboration with KIST researcher** We have been collaborated in research with Prof. Joong Kee Lee. Some fruitful discussion and several material characteristic measurements have been done in KIST laboratories, such as X Ray Diffraction (XRD) measurement and Raman Spectroscopy measurement. Some of our colleagues from University of Indonesia also visiting KIST to do some laboratory works and reports, even our junior from University of Indonesia are continuing their studies (Master and Ph.D. programs) in KIST. In the end of the works, we elaborate for manuscript preparation for joint publications.

KIST School Partnership Technical Report

General Information Principal Investigator

Ahmed Elkamhawy

Affiliation (department) Department of Pharmaceutical Organic Chemistry, Faculty of Pharmacy, Mansoura University, Egypt

Position Lecturer (Assistant Professor)

Project Title Design and synthesis of first-in-class novel quinoline derivatives as potent and selective DAPK1 inhibitors for treatment of cancer disorders

Project Period 2020.01.01~2020.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Design and synthesis of first-in-class novel quinoline derivatives as potent and selective DAPK1 inhibitors for treatment of cancer disorders
- **Research Field** Medicinal Chemistry, Pharmaceutical Organic Chemistry
- **Research Duration** 12 months (2020.01.01 ~ 2020.12.31)
- **Research Objectives** DAPKs comprise five members (DAPK1, DAPK2, DAPK3, DRAK1, and DRAK2) and belong to the calcium/calmodulin-dependent kinases domain. As time goes on, the list of biological functions of this family is constantly updated. The most extensively studied member is DAPK1 that plays fundamentalbiological roles depending on the cellular context. DAPK1 regulates apoptosis, autophagy, contributes to the pathogenesis of Alzheimer's disease, acts as a tumor suppressor, inhibits metastasis, mediates the body responses to viral infections, and regulates the synaptic plasticity and depression. For their biological roles, several DAPKs' modulators have been reported for treatment of many diseases as well as acting as probe compounds to facilitate the understanding of the biological functions elicited by this family. Despite that, the number of reported modulators is still limited and more research needs to be conducted on the discovery of novel strategies to activate or inhibit this family. Motivated by the vigorous need to develop potent, safe and selective potential candidates for treatment of DAPK1-related diseases, our objectives are as follow:
  - ❶ Development of safe DAPK1 inhibitors as promising therapeutic agents.
  - ❷ Through this research, we will acquire a unique methodology for development of treatments.
  - ❸ Enhancement of the ability of the working team and the collaborative Korean and foreign researchers.
  - ❹ Successfully developed molecules would be transferred to pharmaceutical industry for local and international commercialization.
- **Research Contents** The proposed research plan pursues the design and development of innovative MAO-B selective inhibitors. The chemical structure of the potent compounds will be submitted to extensive structure activity relationship study and optimization through synthesis and evaluation of various libraries of compounds. Comprehensive biological and computational studies will be performed to obtain highly selective and potent compounds which will be subjected to in vitro and in vivo studies.
- **Research Outputs**

  Technological goals: Through this research, we will acquire a unique methodology for development of new treatments via modulation of DAPK1.

  Educational goals: Enhancement of the research ability of the working team and the collaborative Korean and foreign researchers involved in this project.

  Economic and industrial goals: Successfully developed organic molecules would be transferred to pharmaceutical industry for further development and later domestic and international commercialization.

  Scientific publications and patent application: One patent in addition to at least two high impact SCI papers to be published in the top of 10% JCR rank.
- **Collaboration with KIST researcher** I have collaborated with Prof. Eun Joo Roh to synthesis and evaluate novel agents as DAPK1 and Aurora A kinase inhibitors related to the chemical structure of the proposal. The results are very promising and we are in progress to get more potent small molecule and publish a highquality article in the field.

KIST School Partnership Technical Report

General Information Principal Investigator

Arenst Andreas Arie, Ph.D

Affiliation (department) Department of Chemical Engineering, Faculty of Industrial Technology, Parahyangan Catholic University, Ciumbuleuit 94 Bandung 40141 Indonesia

Position Head of Advanced Material and Product Design Research Center

Project Title Porous Graphene Like Nanosheets-Lithium Sulfide (PGLNS/Li2S) Composite Cathodes for Lithium Sulfur Battery

Project Period 2020.01.01~2020.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Porous Graphene Like Nanosheets-Lithium Sulfide (PGLNS/Li2S) Composite Cathodes for Lithium Sulfur Battery
- **Research Field** Advanced Energy Materials for Secondary Battery
- **Research Duration** 1 Year (01.01.2020-31.12.2020)
- **Research Objectives**
  ❶ To prepare porous graphene like nanosheets (PGLNS) derived from biomass waste(palm oil empty fruit bunch) using simultaneous graphitization-activation method.
  ❷ To synthesize porous carbon-Lithium Sulfide (PC/Li2S) composite using melt diffusion method.
  ❸ To study the structural and morphology characteristics of the PC and PC/Li2S composites.
  ❹ To investigate the electrochemical characteristics of the PC/Li2S composite cathodes for LiS batteries.
- **Research Contents** Firstly, porous graphene like nanosheets (PGLNS) will be prepared from the oil palm empty fruit bunch) by **simultaneous graphitization-activation** method, which may be utillized as cathode's components for LiS Battery. After that, PGLNS will be used along with sulfur to form PC/S composite by using melt diffusion method. **The structural and morphology characterization** of PGLNS and PGLNS/Li2S composite will be studied by various instruments such as XRD, XPS, BET, SEM, TEM, TGA and Raman spectroscopy. The coin cells will be used to study the electrochemical performance of NPC/S composite cathodes for LiS battery with and without the addition of NPC based interlayer. Various electrochemical measurements will be used to study the electrochemical characteristics of PC/Li2S composite such as the galvanostatic charge-discharge (GCD) tests, cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS).
- **Research Outputs** The results of this work has been presented in the **international conferences** and **submitted to the reputated SCI/SCIE journal** in the area of electrochemistry or carbon materials related subjects. In addition, there will be probably **one of our master student/junior researcher** working on this research projects, he/she will synthesis the carbon materials at our department in Bandung, Indonesia.
- **Collaboration with KIST researcher** The research collaboration has been conducted at the Advanced Energy Material Processing Laboratory, Center of Energy Convergence, KIST with Dr. Joong Kee Lee as the research partner at KIST.

KIST School Partnership Technical Report

General Information Principal Investigator

Zhi-Qiang Zhang

- **Affiliation (department)** Shenzhen Following Precision Medical Research Institute Urology Institute of Shenzhen University
- **Position** Senior Researcher

- **Project Title** Magnetic hyperthermia enhanced gas/chemotherapy for orthotopic invasive bladder tumor by using a thermosensitive hydrogel
- **Project Period** 2020.01.01~2020.12.31
- **Budget** 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Magnetic hyperthermia enhanced gas/chemotherapy for orthotopic invasive bladder tumor by using a thermosensitive hydrogel
- **Research Field** Biomedical Science
- **Research Duration** 2020/01/01-2020/12/31
- **Research Objectives**
  ❶ To explore a new drug delivery system for invasive bladder tumor treatment by using a biodegradable and thermosensitive hydrogel, instead of traditional intravesical instillation.
  ❷ To prove the whether the storing time of hydrogen gas and its synergistic effect with chemical drugs by using a hydrogel is enhanced compared to traditional intravesical instillation.
  ❸ Clinical translation of drug-loaded injectable hydrogels for invasive bladder cancer patients
- **Research Contents**
  ❶ In order to enable hydrogel to generate heat in magnetic field and to prolong the storage of hydrogen gas, FePt nanoparticles are prepared by thermal decomposition method and characterized.
  ❷ To realize the transmucosal delivery, fluorination of polyorganophosphazene hydrogel by conjugation between carboxyl group and amine group of fluorinated chitosan.
  ❸ Examine the synergistic effect of hydrogen gas and chemical drugs in vitro.
  ❹ Test the transmucosal delivery of chemical drugs to bladder cancer cells in vitro
  ❺ Prove the clinical potential of this new drug delivery by experiments using orthotopic bladder tumor model of nude mice.
- **Research Outputs**
  ❶ Publish one SCI paper as Focus on the Crosstalk between COVID- 19 and Urogenital Systems
  ❷ Apply for a patent of hydrogel-based drug delivery for invasive bladder tumor as an alternative to traditional intravesical instillation
  ❸ Prepare two manuscripts ready to submit, titled as Multiple Hyperthermia Enhanced Oncolytic Effect of Adenovirus using Injectable Thermosensitive Hydrogels, and Multiple Hyperthermia Enhanced Oncolytic Effect of Adenovirus using Injectable Thermosensitive Hydrogels.
- **Collaboration with KIST researcher** Young-Min Kim, Soo-Chang Song

KIST School Partnership Technical Report

General Information Principal Investigator

Mohammed Samir Mohammed Abdel-Maksoud

Affiliation (department)	Medicinal and Pharmaceutical Chemistry, Pharmaceutical Industries Research division,National Research Center, Egypt
Position	Researcher

Project Title	Design and synthesis of novel pan Raf inhibitors having sulfonamide terminal moiety and imidazo[2,1-b]oxazol scaffold and their antiproliferative effect"
Project Period	2020.01.01~2020.12.31
Budget	15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title**: Design and synthesis of novel pan Raf inhibitors having sulfonamide terminal moiety and imidazo[2,1-b]oxazol scaffold and their antiproliferative effect
- **Research Field**: Medicinal Chemistry/Biological Chemistry
- **Research Duration**: 1 year (1/1/2020 ~31/12/2020)
- **Research Objectives**:
  ❶ Synthesis of new anticancer candidates for melanoma and/or colon cancer by in vitro screening.
  ❷ Discovery of new Pan B-RAF inhibitors.
  ❸ Study the structure activity relationship for the new synthesis compounds
- **Research Contents**:
  ❶ Synthesis of main intermediate compound
  ❷ Synthesis of side chains.
  ❸ Synthesis of new final compounds.
  ❹ Evalution of their antiproliferative active over cell line (60 cell lines to determine their activity).
  ❺ Evaluation of the new compounds over B–RAF, V600E BRAF and C–RAF
- **Research Outputs**:
  ❶ An international publication.
  ❷ According to activity, new candidate for melanoma and /or colon cancer.
  ❸ In deep understanding of Imidazo[2,1-b]thiazole binding mode to B-RAF and V600E B-RAF
- **Collaboration with KIST researcher**: Dr. Oh Chang Hyun, Usama Ammar, Eslam Ali

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Sheeraz Mehboob

Affiliation (department)	Chemistry Division, Directorate of Science, Pakistan Institute of Nuclear Science and Technology (PINSTECH), Islamabad, Pakistan
Position	Principal Scientist
Project Title	Heteroatom-doped carbon materials as electrocatalysts for all-vanadium redox flow batteries
Project Period	2020.01.01~2020.12.31
Budget	1,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Heteroatom-doped carbon materials as electrocatalysts for all-vanadium redox flow batteries
- **Research Field** Electrochemical energy conversion and storage technologies
- **Research Duration** 12 Months
- **Research Objectives**
  - ·To initiate the research and development of redox flow batteries in Pakistan, by establishing lab–scale set–up.
  - ·To develop initial set–up of instruments and glass–ware/chemicals for future advanced projects.
  - ·To develop heteroatom doped carbon materials as electrocatalysts using cost–effective methods.
  - ·To improve the kinetics of vanadium redox reactions using the heteroatom–doped carbon materials.
  - ·To apply the developed electrocatalytic materials for performance improvement of carbon/graphite felt electrodes for all–vanadium redox flow batteries.
- **Research Contents** All–vanadium redox flow batteries (VRFB) are a promising candidate for kilo–to–Mega Watt grid–scale applications. VRFB technology suffers from low power ratings at high current densities due to the low performance of carbon/graphite felt electrodes as a result of increased overpotentials. Therefore, redox kinetics of vanadium couples need to be increased at the electrodes for which incorporation of electrocatalysts is one of the applicable strategies. In this regard, heteroatoms such as sulfur, phosphorous, nitrogen and boron can be effective as they have ability to tune the electronic properties of substrate materials. Therefore, carbon / graphite felt electrodes are doped with nitrogen, phosphorous, and sulfur through single doping. In addition to this, carbon blacks are also investigated. The fabricated electrodes are used to increase the key performance parameters of VRFBs such as energy efficiency, specific discharge capacity, specific discharge energy density and capacity retention.
- **Research Outputs** In this project, carbon materials and heteroatom doping materials is investigated to improve the performance of all–vanadium redox flow batteries. In this regard, carbon blacks (ketjenblack, blackpearl, Vulcan carbon) and nitrogen doped carbon blacks (N–doped ketjenblack, Ndoped Blackpearl, N–doped Vulcan carbon) are investigated. Similarly, nitrogen, sulfur and phosphorous doping of the graphite electrodes is investigated for VRFBs. The developed electrodes except Vulcan Carbon exhibited high performance for VRFB through acceleration of the kinetics of vanadium redox couples (V(IV)/V(V) & V(III)/V(II)) which resulted in a significant increase in specific discharge capacity and energy efficiency. Therefore, it is proposed that heteroatom doping of carbon materials at the electrodes can be an attractive approach towards high performance VRFB with high power ratings at high current densities. The results of the project will be published in international journals and manuscripts are in writing.
- **Collaboration with KIST researcher** The research project of KIST School Partnership Project and related research on redox flow batteries is being carried out in collaboration with Dr. Heung Yong Ha (Principal Research Scientist, Center for Energy Storage Research, KIST). Dr. H. Y. Ha provided needed support and cooperation to conduct research. The research results will be published in collaboration with Dr. H. Y. Ha. In addition to this, further research with Dr. Ha lab is in progress and this collaborative work will bring great success.

KIST School Partnership Technical Report

General Information Principal Investigator

Haryo Pandu Winoto

Affiliation (department) Lembaga Afiliasi Penelitian dan Industri Institut Teknologi Bandung (LAPI ITB)

Position Project Leader

Project Title Development of Robust Catalytic Reaction System for Gamma Valerolactone (GVL) Production Using Cheap Biomass Feedstock

Project Period 2020.01.01~2020.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of Robust Catalytic Reaction System for Gamma Valerolactone (GVL) Production Using Cheap Biomass Feedstock-Later on changed to Lignocellulose Biomass Utilization through Heterogeneous Catalytic Reaction
- **Research Field** Catalysis, Biomass Valorization
- **Research Duration** 12 months
- **Research Objectives**

Initial objectives:

Overall research activities are aimed to:

❶ Design and complete the reactor set up for continuous production of GVL through direct and transfer hydrogenation reaction pathway

❷ Preparation of heterogeneous catalysts used for GVL production Discover optimum reaction set up and condition for GVL production from polymeric feedstock.

Later on changed to:

Brief assessment of catalytic transfer hydrogenation scheme for simultaneous dehydrogenation of paraffin and phenolic compound deoxygenation.

- **Research Contents**

One important reaction of lignin monomeric substance (phenolic compounds) valorization is oxygen removal. Aromatic substances such as Benzene and Toluene are produced through oxygen removal from guaiacol molecule. Hydrodeoxygenation of guaiacol is aimed to remove oxygen atoms from it. Though conventionally hydrogen for Hydrodeoxygenation process is supplied by external molecular hydrogen, in this work it is supplied from hydrogen atom abstraction of methyl cyclohexane. Therefore, in a one pot catalytic reaction system, methyl cyclohexane dehydrogenation is sole hydrogen provider for subsequent hydrodeoxygenation of guaiacol and this novel concept of circular hydrogen economy has been proven its feasibility through heterogeneous catalytic reaction scheme conducted in this work.

Metal supported on zeolite beta is selected as heterogeneous catalysts in order to evaluate the feasibility of one–pot hydrodeoxygenation and dehydrogenation reaction. Of every catalytic reaction attempt, multiple products consist of alkylated phenol, phenol itself, and toluene are observed proofing the feasibility of this concept. Possible interaction of catalyst surface acidity and metal contents are also probed through distribution of byproducts. Overall, sequential dehydrogenation and hydrodeoxygenation has been proven through catalytic reaction catalyzed by metal supported zeolite beta catalyst and this work can potentially pave the way of for further application.

- **Research Outputs**

❶ Brief assessment for paraffin (Methylcyclohexane/MCH) dehydrogenation by using cheap transition metal catalysts

❷ Brief assessment for guaiacol dehydrogenation by using cheap transition metal catalyst with the absence of molecular hydrogen

❸ One–pot dehydrogenation and hydrodeoxygenation catalyzed by cheap transition metal catalyst

❹ Effect of support acidity towards methylated product

- **Collaboration with KIST researcher**

During working period there is no collaboration with KIST researcher due to limited access to the lab equipment caused by COVID-19 Pandemic situation.

KIST School Partnership Technical Report

General Information Principal Investigator

Mohamed Mahmoud Ibrahim Alsanea

Affiliation (department) Pharmaceutical Chemistry Department, College of Pharmacy, Jouf University, Sakaka, Al-Jouf Province, Jouf, Saudi Arabia

Position Assistant professor

Project Title Novel Ligustrazine-based SLC-0111 Analogues as Selective Carbonic Anhydrase IX Inhibitors Endowed with Antitumor Activity: Design,Synthesis, Biological Evaluation and In Silico Insights

Project Period 2020.01.01~2020.12.31

Budget 15,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Novel Ligustrazine-based SLC-0111 Analogues as Selective Carbonic Anhydrase IX Inhibitors Endowed with Antitumor Activity: Design, Synthesis, Biological Evaluation and In Silico Insights
- **Research Field** Drug Design and Pharmaceutical Chemistry
- **Research Duration** 12 Months
- **Research Objectives** Herein, we present a research project for KIST Institutional Program that utilizes a multidisciplinary team of scientists from various specialties; Pharmaceutical Chemistry, Organic Chemistry, Pharmacology and Molecular biology. This proposal aims to develop novel small molecules with selective inhibitory activities toward tumor-associated carbonic anhydrase (CA) isoforms hCA IX and XII, with good druggability and leadlikeness characters. A bioisosteric replacement approach was adopted to replace the 4-fluorophenyl tail of SLC-0111, a selective CA IX inhibitor in Phase I/II clinical trials for the treatment of advanced hypoxic tumors, with Ligustrazine, a Chinese traditional medicinal herb endowed with inhibitory activities toward growth, invasion and metastasis of tumor cells. Accordingly, the proposed small molecules expected to possess promising biological activities against solid tumors.
- **Research Contents** Design, synthesis and purification of the target sulfonamides using convenient chemical reactions, in addition to, verification of their structure via spectral and elemental methods of analysis. This will be accompanied by biological evaluations of the target quinazolines as SMO antagonist.
  All the newly prepared SLC-0111 analogues will be in vitro evaluated for their inhibitory activities toward a panel of hCA I, II, and IX isoforms, using an applied Photophysics stopped-flow instrument. Then, the most potent analogues with good selectivity profile for inhibition of the tumorassociated isoforms will be in vitro examined for their anti-proliferative activity. Thereafter, the most effective anti-proliferative agents will be examined for their apoptotic induction potential. Furthermore, a molecular docking study will be performed to investigate the binding pattern with CAs IX active site.
- **Research Outputs** The proposed project has broad implications for many areas of science, including drug discovery, chemistry, and cancer tackling. From the rigorous synergetic application of our team we expect by the end of the funding period:
  ·Identifying novel hits useful in controlling cancer with drug–like properties.
  ·At least 2 publications, in highly-reputable international journals and/or conferences are expected.
  ·Active compounds could be patented. Also, this collaboration positively contributes to capacity building.
- **Collaboration with KIST researcher** Dr. Ashraf Kareem did his role in the verification of the structures of most of the target compounds.
  Dr. Mohamed Samir did his role in the investigation of the possible binding pattern through carrying out a molecular docking study.

KIST School Partnership Technical Report

General Information Principal Investigator

Fidelis Stefanus Hubertson Simanjuntak

Affiliation (department) Renewable Energy Engineering Department, School of Science, Technology, Engineering and Mathematics, Universitas Prasetiya Mulya, Indonesia

Position Assistant professor

Project Title Nickel based catalyst for green diesel production

Project Period 2020.01.01~2020.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Nickel based catalyst for green diesel production
- **Research Field** Renewable Energy & Catalysis
- **Research Duration** 2020.01.01 – 2020.12.31
- **Research Objectives** Investigate the catalytic activity of mono-metallic (Ni or Cu) and bimetallic (Ni-Cu) catalyst supported on Si-Al in deoxygenation of lauric acid.
- **Research Contents**
  - ·Monometallic catalyst, Ni/Si-Al and Cu/Si-Al and bimetallic catalyst, Ni-Cu/Si-Al were prepared by wet impregnation method.
  - ·The catalysts are used in the synthesis of biohydrocarbon/green diesel from fatty acid via deoxygenation reaction. Lauric acid is used as model compound of vegetable oil.
- **Research Outputs** A manuscript will be prepared and will be submitted to International Journal of Technology

KIST School Partnership Technical Report

General Information Principal Investigator

Bui Thi Phuong Quynh

Affiliation (department) Faculty of Chemical Engineering, Ho Chi Minh City University of Food Industry, Ho Chi Minh City, 705800, Vietnam

Position Lecturer

Project Title Development of water-resistant and active packaging film based on cross-linked polyvinyl alcohol (PVA) and natural extracts

Project Period 2020.01.01~2020.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of water-resistant and active packaging film based on crosslinked polyvinyl alcohol (PVA) and natural extracts
- **Research Field** Chemical Engineering
- **Research Duration** 12 months
- **Research Objectives** This project aims to develop water-resistant and active packaging films based on cross-linked polyvinyl alcohol and natural extracts for effective preservation of agricultural products in tropical regions.
- **Research Contents**
  - ·Preparation and characterization of water-resistant films, which are polyvinyl alcohol (PVA) cross-linked by using edible biopolymers.
  - ·Development of active food packaging film from the cross-linked PVA incorporated with Piper betle Linn. leaf extract
  - ·Development of active food packaging film from the cross-linked PVA incorporated with Sonneratia ovata (Sonneratiaceae) leaf extract
  - ·Application of the developed active PVA films for fruit preservation
- **Research Outputs**
  - ·Active biodegradable films with enhanced water resistance and good mechanical properties were successfully produced by combining PVA, agar, Dglucose (or maltodextrin) and Piper betle Linn. leaf extract.
  - ·The co-addition of agar and D-glucose (or maltodextrin) were found to improve the hydrophobicity of the PVA-films. The addition of PBLLE to the blends induced enhancement in antibacterial/antioxidant activities as well as UV-resistance of the films. The antioxidant/ antibacterial performance of films was found to depend crucially on the plant extract to PVA ratio.
  - ·The PVA/agar/ D-glucose (or maltodextrin)/Piper betle Linn. leaf extract films show their effectiveness in preservation of banana, mango and bread during the test periods.
  - ·The antibacterial PVA/agar/D-glucose/Sonneratia ovata leaf extract films were successfully fabricated and preliminary characterization results have been obtained.
  - ·Important active components of Piper betle Linn. leaf extract were determined using HPLC analysis.
  - ·One paper about the analysis of Piper betle Linn. leaf extract was published in Engineering Reports (August 2020). Two other manuscripts about the developed films have been submitting to ISI-indexed journals.
  - ·The developed active films appear as good candidates for other studies regarding their potential applications in pharmaceutical field or other related areas.
- **Collaboration with KIST researcher** The performer (PI) has cooperated with Dr. Kim Sang Hoon (KIST) so far in the progress of publishing the data achieved in the project.

KIST School Partnership Technical Report

General Information Principal Investigator

Shoyebmohamad Fattemohamad Shaikh

Affiliation (department) College of Science, Chemistry Department, King Saud University, P.O. Box 2455, Riyadh 11451, Saudi Arabia.

Position Assistant Professor

Project Title A facile chemical synthesis approach for metal doped Metal organic frameworks (MOFs) as efficient electrocatalysts for supercapacitor application

Project Period 2020.01.01~2020.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** A facile chemical synthesis approach for metal doped Metal organic frameworks (MOFs) as efficient electrocatalyst for supercapacitor application
- **Research Field** Clean energy
- **Research Duration** 1 Jan 2020-31 Dec. 2020
- **Research Objectives**
  - ·The aim of this work is development of highly efficient supercapacitor by using facile chemical methods, to achieve high energy and power density.
  - ·The effect of synthesis temperature, solution concentration and electrolyte on structure, and morphology properties will be exported initially.
  - ·The morphology, porosity, and physical properties will be optimized.
  - ·The electrochemical supercapacitive performance in terms of energy and power density of metal doped MOFs and their hybrid supercapacitor devices will be investigated.
- **Research Contents** The intent of this project to development of highly efficient metal doped MOFs electrodes by facile chemical methods, to achieve high energy and power density. The proposed work will be carried out in three-stages as, (a) various experimental parameters including doping concentration, synthesis and annealing temperature will be optimized, (b) structural and morphological properties, will be investigated and (c) Fabrication of symmetric as well as asymmetric electrochemical supercapacitors devices for commercial application.
- **Research Outputs** In this project, efforts will be made to develop metal doped MOF for high performance of electrochemical supercapacitor. The electrode materials will be synthesized using facile chemical approach. The structural and morphological properties as well as electrochemical performance of the material will be investigated. Various experimental parameters including doping concentration, synthesis and annealing temperature will be optimized. We assume that our synthesized metal doped MOF will show high electrochemical supercapacitor performance.
- **Collaboration with KIST researcher** Due to Covid pandemic situation running on overall worlds this academic year 2020 we are unable to visit KIST and do collaborative research work

KIST School Partnership Technical Report

General Information Principal Investigator

Dr. Antonius Indarto

Affiliation (department)	Department of Chemical Engineering, Institut Teknologi Bandung, Indonesia
Position	Assistant Professor
Project Title	Development of Catalytic Reaction System for Cascade Turpentine Valorization
Project Period	2020.01.01~2020.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Development of Catalytic Reaction System for Cascade Turpentine Valorization
- **Research Field** Biomass Valorization (Chemical Process Technology)
- **Research Duration** 1 year (12 months)
- **Research Objectives** This research project is specifically aimed to develop a robust catalytic system adjustable for production of various products from Turpentine
- **Research Contents** Turpentine oil which can be obtained from resin distillation of various trees, in particular pines, consists of multiple phenolic compounds. These phenolic compounds, mainly α-pinene, have potential usage for multiple applications such as fragrance, flavoring agents, disinfectants, pesticides, and multiple pharmaceutical applications. The remaining issues for turpentine valorization lie in its product purity due to the existence of multiple side products resulted from side reaction during turpentine catalytic conversion. Thus, this research consists of the development of acid catalysts capable of catalyzing: ① raw turpentine and ② α-pinene conversion into the desired product(s), in this section catalysts will be tuned for terpineol for targeted products
- **Research Outputs** Two catalyst receipts for two different feedstock of turpentine, ie. raw turpentine and α-pinene, have been obtained during this project. The results are presented in the two international Q1 Journal papers.

KIST School Partnership Technical Report

General Information Principal Investigator

Rika Tri Yunarti, M.Eng., Ph.D

Affiliation (department)	Vo Nguyen Xuan Phuong
Position	Ton Duc Thang University, No. 19 Nguyen Huu Tho Street, Tan Phong Ward, District 7, Ho Chi Minh City, Vietnam
Project Title	Improvement of performances and biofouling resistance of polyamide-based RO membrane
Project Period	2020.01.01~2020.12.31
Budget	5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Improvement of performances and biofouling resistance of polyamide-based RO membrane
- **Research Duration** 2020-01-01~2020-12-31
- **Research Objectives**
  ❶ Develop anti-adhesion function for polyamide top layer and anti ·microbial function for the polyamide (PA) and adjacent polyethers ulfone (PES) layers;
  ❷ Produce lab-scale biofouling-resistant RO membrane composed of polyester, anti-microbial PES and anti-adhesive/antimicrobial PA;
  ❸ Establish physico–chemical properties and performance dataset of ❷ in exposure to common microorganisms found in tap water, aiming to demonstrate the water flux and antimicrobial performance of the membrane during filtration service of domestic water and sea water.
- **Research Contents** This work demonstrates the concept of inorganic-organic hybrid membrane for increasing the permeation flux of water through 5,000,000 KRW the membrane thin film in addition to the resistance of the contaminated salts and micro-organisms. The improved performance of the self-made RO membrane in comparison to the commercial one is attributed to the supplemental channels of the inorganic component, which is the microporous zeolite of Na-LTA or Na-ZSM-5. To be applicable within the commercial membrane, the zeolite must be produced without the expensive template in particles with uniform sub-micron sizes as well as be compatible with the organic phases.
- **Collaboration with KIST researcher** The template-free synthesis protocols have been doneto produce successfully the Al-rich Na-LTA withSi/Al ratio of ca. 1 and the Al-lean Na-ZSM-5 with Si/Al ratio of ca. 18. The PALS analysis shows that surface modification via PEG-400 coating enhanced the compatibility between the Agexchangedzeolite particles and the bulky PES andPA layers. The higher the hydrophilicity of the zeolite, the better the inorganic-organic compatibilitycould be obtained. The obtained hybrid membrane withoutincompatible voids shows a significant increase in separation selectivity towardsdissolved salts and in high resistance towards contaminated E-coli community. We plan to study the hybrid RO membrane in technical scale beforesubmitting a research plan and a proposal to local R&D companies which are interested in developing their own products with enhanced performance.

KIST School Partnership Technical Report

General Information Principal Investigator

Vo Nguyen Xuan Phuong

- **Affiliation (department)** Ton Duc Thang University, No. 19 Nguyen Huu Tho Streey, Tan Phong Ward, District 7, Ho Chi Minh City, Vietnam
- **Position** Researcher

- **Project Title** Improvement of performance and biofouling resistance of polyamide-based RO membrane
- **Project Period** 2020.01.01~2020.12.31
- **Budget** 5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Improvement of performance and biofouling resistance of polyamide-based RO membrane
- **Research Duration** 2020.01.01 ~ 2020.12.31
- **Research Objectives**
  ❶ Develop anti-adhesion function for polyamide top layer and anti-microbial function for the polyamide (PA) and adjacent polyethersulfone (PES) layers;
  ❷ Produce lab-scale biofouling-resistant RO membrane composed of polyester, anti-microbial PES and anti-adhesive/anti-microbial PA;
  ❸ Establish physico-chemical properties and performance dataset of ❷ in exposure to common microorganisms found in tap water, aiming to demonstrate the water flux and antimicrobial performance of the membrane during filtration service of domestic water and sea water.

- **Research Contents** This work demonstrates the concept of inorganic-organic hybrid membrane for increasing the permeation flux of water through the membrane thin film in addition to the resistance of the contaminated salts and micro-organisms. The improved performance of the self-made RO membrane in comparison to the commercial one is attributed to the supplemental channels of the inorganic component, which is the microporous zeolite of Na-LTA or Na-ZSM-5. To be applicable within the commercial membrane, the zeolite must be produced without the expensive template in particles with uniform sub-micron sizes as well as be compatible with the organic phases. The template-free synthesis protocols have been done to produce successfully the Al-rich Na-LTA with Si/Al ratio of ca. 1 and the Al-lean Na-ZSM-5 with Si/Al ratio of ca. 18. The PALS analysis shows that surface modification via PEG-400 coating enhanced the compatibility between the Ag-exchanged zeolite particles and the bulky PES and PA layers.

- **Research Outputs** This work demonstrates the concept of inorganic-organic hybrid membrane for increasing the permeation flux of water through the membrane thin film in addition to the resistance of the contaminated salts and micro-organisms. The improved performance of the self-made RO membrane in comparison to the commercial one is attributed to the supplemental channels of the inorganic component, which is the microporous zeolite of Na-LTA or Na-ZSM-5. To be applicable within the commercial membrane, the zeolite must be produced without the expensive template in particles with uniform sub-micron sizes as well as be compatible with the organic phases. The template-free synthesis protocols have been done to produce successfully the Al-rich Na-LTA with Si/Al ratio of ca. 1 and the Al-lean Na-ZSM-5 with Si/Al ratio of ca. 18. The PALS analysis shows that surface modification via PEG-400 coating enhanced the compatibility between the Ag-exchanged zeolite particles and the bulky PES and PA layers. The higher the hydrophilicity of the zeolite, the better the inorganic-organic compatibility could be obtained. The obtained hybrid membrane without incompatible voids shows a significant increase in separation selectivity towards dissolved salts and in high resistance towards contaminated E-coli community.

KIST School Partnership Technical Report

General Information Principal Investigator

Nguyen Thi Minh Huyen

Affiliation (department)	Institute of Biotechnology, Vietnam Academy of Science and Technology
Position	Principle Researcher
Project Title	Optimization of growth condition for culture Bifidobacterium in Vietnam
Project Period	2020.01.01~2020.12.31
Budget	5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Optimization of growth condition for culture Bifidobacterium in Vietnam
- **Research Field** Microbiology
- **Research Duration** 1 year
- **Research Objectives** Isolation and investigation for the best condition of biomass production of Bifidobacterium to use as probiotic bacteria in Vietnam
- **Research Contents**
  - ·Isolate Bifidobacterium from commercial-source yogurt (Morigana, Japan) or infant feces.
  - ·Identification of bacterium species using Biomolecular technique such as DNA identification, PCR, DNA sequencing and gene analysis...
  - ·Evaluate condition for long-term storage or preservation of Bifidobacterium.
  - ·Evaluate condition for biomass production of Bifidobacterium, such as: culture medium, pH, temperature, and time of incubation, volume of culture, amount of nitrogen supplement, and amount of carbon supplement.
- **Research Outputs**
  - ·1 or 2 strains of Bifidobacterium
  - ·Detail information for condition of long-term storage of Bifidobacterium
  - ·Detail information of condition for biomass production of Bifidobacterium

KIST School Partnership Technical Report

General Information Principal Investigator

Ratna Frida Susanti, Ph.D

Affiliation (department) Chemical Engineering Department, Industrial Technology Faculty, Parahyangan Catholic University, Indonesia

Position Associate Professor

Project Title Hierarchical porous nitrogen- doped carbon from waste biomass synthesized under subcritical water carbonization followed by chemical activation for Lithium Ion Capacitor's electrode

Project Period 2020.01.01~2020.12.31

Budget 10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Hierarchical porous nitrogen- doped carbon from waste biomass synthesized under subcritical water carbonization followed by chemical activation for Lithium Ion Capacitor's electrode
- **Research Field** Energy Storage Material
- **Research Duration** 1 year
- **Research Objectives** In this research, it is proposed to investigate the potential of biomass as a low cost electrode material for LIC by ① synthesis N-doped porous carbon nanostructure-based electrode materials to improve specific capacitance ② improving the specific surface area (SSA) by chemical activation of porous carbon, beneficial for charge accommodation ③ building a hierarchical micro-mesoporous structure which is essential for high performance carbon-based electrode material in the LIC. In capacitive behavior, micropores can support large SSA for charge accommodation and mesopore is served as channels for rapid ions diffusion at a low current density.
- **Research Contents** The candidates of biomass waste used as a precursor for electrode material synthesis in this research is salacca peel. Briefly, the research consists of precursor preparations (washing, drying, grinding and screening), hydrothermal carbonization by subcritical water and chemical activation by pyrolysis/ microwave assisted chemical activation using different activating agents. The carbonization in subcritical condition is chosen because in subcritical condition, water acts as a solvent and a catalyst that facilitates hydrolysis and cleavage of lignocellulosic biomass. Water possess high ionization constants at high temperatures and is responsible for hydrolysis of organics which can further be catalyzed by acid or bases. The different activating agents will determine the hierarchical of porous structure (micro-meso-macro). The material synthesized is characterized physically by SEM, TEM, FTIR, XRD, TGA, BET, XPS and Raman analysis while electrochemically by GCD, CV and EIS analysis.
- **Research Outputs** Paper will be submitted to RSC advances (Q1) in the 2nd week of January 2021. Now it is under final review.
- **Collaboration with KIST researcher** Due to the pandemic situation, I could not be able to do the experiment and analysis in KIST. However we are collaborating during paper writing.

KIST School Partnership Technical Report

General Information Principal Investigator

Hary Devianto, Ph.D

Affiliation (department)	Lembaga Afiliasi Penelitian and Industri Institut Teknologi Bandung (LAPIITB)
Position	Project Leader
Project Title	Performance Evaluation of Solid Oxide Fuel Cell Stack on Start-Stop Cycle
Project Period	2020.01.01~2020.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Performance Evaluation of Solid Oxide Fuel Cell Stack on Start-Stop Cycle
- **Research Field** Institut Teknologi Bandung
- **Research Duration** 12 (twelve) months
- **Research Objectives**
  ❶ To identify the effect of start-stop cycle on SOFC performance
  ❷ To identify the effect of Fe doping on SOFC performance
- **Research Contents**

Solid Oxide Fuel Cell (SOFC), a fuel cell with solid oxide electrolyte, is one of the promising developments in the fuel cell system. The intermediatetemperature SOFC (IT-SOFC), operated at 500 – 800oC, gives a wide range of material, rapid start-up and shut down, low corrosion rate of metallic component, improved durability and more robust construction. The anode, electrolyte and cathode material of IT-SOFC commonly used is NiO-YSZ, yttria-stabilized zirconia (YSZ) and lanthanum strontium manganite (LSM), respectively. However, these materials are very expensive due to relatively rare in Indonesia. To replace those rare materials, cheaper and available material in Indonesia such as calcia-stabilized zirconia (CSZ), NiO-CSZ and calcium cobalt zinc oxide (CCZO) can be used as an anode, electrolyte and cathode, respectively. Based on 1st year research, the anode-supported cell showed the better performance than an electrolyte-supported cell and the optimum condition of operating temperature was 800oC which exhibited the highest maximum power density and lowest total resistance. In this research, anodesupported cell was used. SOFC evaluated under start-stop cycle to simulate real condition. SOFC operated at 800°C, turned off for 10 hours, then re-operated at 800°C.

Experiments:
❶ Variation on cycle number to observe SOFC performance with influence of start-stop cycle
❷ Variation on electrolyte with Fe doping (2%mol) and without Fe doping
❸ Variation on Fe source (Fe2O3 and Fe(NO3)3.9H2O)

Characterization methods:
Electrochemical Characterization: Potentiodynamic and Electrochemical Impeandce Spectroscopy (EIS).
Physical Characterization:
Scanning Electron Microscope (SEM) and ASTM C373-88

- **Research Outputs**
  ❶ Voltage and power density of the cell with influence of start-stop cycle
  ❷ Voltage and power density of the cell with Fe doping and without Fedoping
  ❸ Resistivity of electrolyte
  ❹ Presented in international conference
- **Collaboration with KIST researcher** Due to the pandemic situation, I could not be able to do the experiment and analysis in KIST. However we are collaborating during paper writing.

KIST School Partnership Technical Report

General Information Principal Investigator

Hoang Anh Le

Affiliation (department)	• Faculty of Environmental Sciences (FES) • VNU University of Science (VNU-HUS) • Vietnam National University (VNU) • Hanoi, Vietnam
Position	Head, Department of Environmental Management
Project Title	Design A Low-Cost Sensor Platform for Air Quality Monitoring
Project Period	2020.01.01~2020.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Design A Low-Cost Sensor Platform for Air Quality Monitoring
- **Research Field** Hanoi, Vietnam
- **Research Duration** January 1st 2020 - December 31st 2020
- **Research Objectives** Design a low–cost sensor platform (HUS–Air sensor) to monitor the air quality locally, which is performed by air quality index (AQI).
- **Research Contents**
  - ·Design a low-cost sensor platform consisting of sensors to monitor air parameters including PM2.5, SO2, NO2, CO, CO2, NH3, TVOC, and other representative meteorological parameters, such as temperature and humidity.
  - ·Compare and assess the reliability of HUS-Air sensor other sources of data.
  - ·Utilize HUS-Air sensor to monitor air pollutant concentrations and meteorological parameters in the city center and suburban area of Hanoi.
  - ·Calculation of the air quality index.
- **Research Outputs**
  - ·A low–cost sensor platform.
  - ·Dataset of air pollutants (PM2.5, SO2, NO2, CO, CO2, NH3, TVOC) and meteorological parameters (temperature, humidity) in the city center and suburban area of Hanoi.
  - ·Scientific journal article on low-cost sensor development and its application.
  - ·Result dissemination through conferences, networking and training of students in VNU-HUS.
- **Collaboration with KIST researcher** I have been collaborating closely with Dr. Lee Seung-bok, senior research scientist, leading the KIST staffs. The KIST partner has provided knowledge, experiences and consultation for designing and conducting the project. He will also join us to prepare a manuscript to publish in a ISI/SCOPUS journal.

KIST School Partnership Technical Report

General Information Principal Investigator

Zubair Ahmed

Affiliation (department) Environmental Engineering, USPCAS-W, Mehran University of Engineering and Technology, Jamshoro, Pakistan

Position Professor

Project Title Production of high-quality potable water using riverbank filtration/canal bank filtration from the Indus river.

Project Period 2020.01.01~2020.12.31

Budget 5,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Production of high-quality potable water using riverbank filtration/canal bank filtration from the Indus river.
- **Research Field** Environmental Engineering and Science
- **Research Duration** 2020.01.01 ~ 2020.12.31
- **Research Objectives** To investigate sorption and biodegradation of emerging micropollutants, including metals, by a riverbed filtration (RBF)/canal bank filtration (CBF) system using an onsite RBF/CBF system.
- **Research Contents** This study was conducted to investigate the removal of emerging micropollutants and metals from the Indus river through riverbank filtration (RBF)/canal bank filtration (CBF) system in the province of Sindh, Pakistan, to produce high-quality potable water. CBF method has been planned to be adopted for the supply of naturally filtered water instead of physio-chemical treatment of water.
  Water samples from the Indus river/canal bank were analyzed for the identification of micropollutants present in the water, followed by the selection of the micropollutants was studied. The study will not only provide a better understanding of the micropollutants removal by RBF/CBF but also act as a model study for local water providing agencies aiming to adopt the RBF/CBF system for water treatment.
- **Research Outputs** The extraction of water from canal was highly turbid, it required more treatment process such as physiochemical method for pure and safe potable water. These treatment methods are coagulation/flocculation, sedimentation and sand filtration but their treatment costs are very high. On the other side, alternative technique for extraction of water to reduce operational costs and free of chemical based method is canal bank filtration (CBF). In proposed project, it was observed that utilization of CBF on KB feeder, could be beneficial of water supply for MUET. High quality water which was extracted from well, is free of microbial contamination, turbidity, and free of metal contamination such as arsenic and lead, causing serious problems for aquatic as well as human life. On the other hand, lab scale column experiment was performed at advanced wastewater and water quality lab USPCASW, MUET.
  During column operation it was observed that column having Granular activated carbon (GAC) showed better pharmaceutical drug removal as compared to soil filled column. The results indicate that CBF method can be used for the extraction of potable water in villages and cities. This study will help to provide clean drinking water at a low cost and also save a huge sum of money, which otherwise will be used in high-cost treatment methods.

KIST School Partnership Technical Report

General Information Principal Investigator

Dashkhuu Khasbaatar

Affiliation (department)	Department of Chemical and Biological Engineering
Position	Associate professor
Project Title	Adsorption of selenium by layered double hydroxide and cryogel composite
Project Period	2020.01.01~2020.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Adsorption of selenium by layered double hydroxide and cryogel composite
- **Research Field** Material science
- **Research Duration** 2020.01.01 ~ 2020.12.31
- **Research Objectives**
  ·To determine the areas where selenium is high in drinking water.
  ·To determine the content of selenium in drinking water.
  ·To synthesize LDH and modify
  ·To synthesize Cryogel–LDH composite (the composite)
  ·To characterize the composite
  ·To batch test for adsorption and desorption of selenium using Cryogel– LDH composite (the composite)

- **Research Contents** There is a variety of mineral resources in the southern part of Mongolia. For instance, there is one of the biggest mining activities named “OyuTolgoi” LLC for copper, and “Badrakh Energy” LLC for uranium. Selenium species, particularly the oxyanions selenite (SeO32–) and selenate (SeO42-), are significant pollutants in the environment that leach from rocks and are released by anthropogenic activities. Traces of these metals also appear in the water.
  Layered double hydroxide is one of the promising methods to remove selenium oxyanions from water. However, the particle size of LDH is nano and this tiny particle is not easy to handle after the adsorptionprocess.
  We will use cryogel that synthesized and polymerized below zero temperature. The cryogel can be mixed with LDH during the polymerization process. The cryogel is high porosity material, and water easily goes through the cryogel. LDH is attached to the wall of the cryogel and adsorbs oxyanions.
  In this study, adsorption of selenium oxyanion will be studied using Cryogel-LDH composite in deferent pH conditions, reaction kinetics, and materials characterizations.
- **Research Outputs**
  Final report
  JCR journal: 1 paper
  International conference: 1 oral ppt
- **Collaboration with KIST researcher** Ung Su Choi, Principle Research Scientist, Energy and Environmental Engineering, KIST

KIST School Partnership Technical Report

General Information Principal Investigator

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Affiliation (department)	Informatics Department, Faculty of Information Technology, Universitas YARSI
Position	Manager of Research Development
Project Title	Social Engagement for Cardio Augmented Reality
Project Period	2020.01.01~2020.12.31
Budget	10,000,000 KRW

Results of Research Project Summary of the Project

- **Project Title** Social Engagement for Cardio Augmented Reality
- **Research Field** Bio-medical Science and Technology
- **Research Duration** 12 months
- **Research Objectives** There are two primary aims for “Social Engagement for Cardio AR” project:
  ❶ to provide deep engagement in CardioAR that will produce positive perception and conclusion through natural interaction with the virtual contents.
  ❷ to assist users in reflecting their understanding, fill gaps in their reasoning, and aid them to organize their thought via social interaction features.
- **Research Contents** This research connected an interdisciplinary area to develop a novel natural interaction to engage with virtual contents in CardioAR profoundly. This interaction would be a critical part of presenting a broader mechanism to promote social interaction amongst users in the CardioAR scene.

  This project employed gestures detection to implement natural interactions on the CardioAR. We carried out some observations to discover the typical gesticulations used by users to manipulate the objects. This project also intimately engaged with the stakeholders (students and lecturer) to fully understanding the fittest design that encourages social interaction among users, such as collaboration and bi-directional feedback. We implemented a multiplayer mode that accommodates CardioAR users to collaborate and a mechanism to assist the instructor in giving feedback according to students' learning achievement.

  These aims have a border research influence. They will propose a novel procedure to promote social interaction in augmented reality applications. This issue is still rarely tackled by earlier researches. Research training for students was one of the critical parts of the project's activities. We utilized grant funds to assist the activities performed by core researcher teams and students. We designed the student projects to be an integral part of ensuring the continual progress of the project.
- **Research Outputs**
  ❶ A CardioAR version 2.0 that integrates the previous release with the upgraded natural engagement and social interactions.
  ❷ Generate awareness of the research results through publication in the National Symposium for IT Students on November 11, 2020.
- **Collaboration with KIST researcher** At first, we were planning to visit the KIST lab to perform the experiments. However, due to the COVID-19 pandemic, we could not visit KIST and decided to perform the experiments with our institution's existing resources.