Global Research Group on the SDGs in Asia
Call for Participation

■ Introduction

The purpose of the Global Research Group on the SDGs in Asia is to promote, implement and study the best practices related to the Sustainable Development Goals across the Asian region. We hope the Global Research Group will facilitate and inspire more in-depth and thought-provoking research on SDGs practices in Asia. The group will promote the development of SDGs and WUN both in Asia and beyond, by:

- Studying research problems related to the SDGs across the Asian region, while with characteristics of promoting collaboration between universities and industry, government, and society
- Nurturing international research teams which connect the perspectives of the global north and south for the betterment of our society
- Investigating and promoting innovative solutions to SDG-related challenges across the Asian region.

■ Suggested SDG focus areas

We propose to initially focus on the following SDG areas:

- SDG3 Good Health and Well-being
- SDG6 Clean Water and Sanitation
- SDG7 Affordable and Clean Energy
- SDG13 Climate Action

Within the above-mentioned SDGs, we suggest that a good starting point (though these are suggestions only and open to discussion with researchers interested in joining the Group) could be to focus on a few subjects important to Asia's development such as: public health policy, aging society, COVID-19, the prevention and control of disaster caused by extreme weather, the challenges of green energy development under extreme weather, and the control and prevention of air and water pollution.

■ Call for Participation

We invite researchers from WUN member universities (both within and outside the Asia) who have a research interest in the Asian region, particularly on topics related to the SDGs, to connect with us. by **proposing an active project or project idea** that aligns with the mission and aims of this proposed research group.

If you would like to participate in the group, please complete the attached form. Beyond the opportunity to identify your own project, NCKU researchers have identified some existing projects that you may wish to join if of interest as your vehicle for engagement in the research group.

Global Research Group on the SDGs in Asia:
Solutions for Sustainable Development in Asia

Please send the following form no later than 31 May 2021 to Ms. Mia Wang at em50902@email.ncku.edu.tw

Researcher Information

Name & Title: Professor Mohammed Farid	**Department/Unit: Department of Chemical and Materials Engineering, University of Auckland, New Zealand**
Contact Email: m.farid@auckland.ac.nz	
Link to your profile or CV: http://orcid.org/0000-0001-8921-1215 https://scholar.google.co.nz/citations?user=RizfkXYAAAAJ&hl=en	

Interest in Participation

■ **x I want to propose a project**

Prime Investigator	
Name & Title: New Development in the synthesis of biodiesel	**Department/Unit: Chemical and Materials Engineering, University of Auckland, New Zealand**
Contact Email:m.farid@auckland.ac.nz	
Research Team(Names of co-investigators and their corresponding universities)	
Name & Title	**University**

Project Research SDGs Priorities	☐ SDG3 Good Health and Well-being ☐ SDG6 Clean Water and Sanitation x SDG7 Affordable and Clean Energy ☐ SDG13 Climate Action
Project Research focused Area and Country	☐ Asia: India x Other Area/Country: New Zealand
Project Title:	

Project Description: (max 1000 words)
- Please include a summary of your active project or project idea.(Background, research question, research methods, expected result…)
- Please identify existing or potential collaborating researchers or organizations.
- Where relevant, please identify existing or potential sources of sponsorship or financial support

Project research SDGs priority: SDG7 Affordable and Clean Energy

Title: New developments in the synthesis of biodiesel.

Current problems with biodiesel production: Lesser-polluting and carbon-efficient systems are the new standards of energy globally. Biodiesel is an excellent bioenergy source due to its industrial feasibility and engine adaptability. However, biodiesel resource inventory still lacks feedstock flexibility on a commercial scale and mainly relies on vegetable oils for production. This creates a problem regarding the allotment of resources for biodiesel production at the cost of the food supply. Besides, the cost of these virgin oils is a significant factor influencing the commercial pricing of biodiesel. An alternative is to consider low-grade non-edible sources, which contain high free fatty acids (FFAs) such as the crude vegetable oil refining rejects and waste cooking oil. These inferior quality feedstocks come at a fractional price of vegetable oils and invoke no threat to global food resources.

Additionally, the increased biodiesel production has caused a surplus of crude glycerol. Crude glycerol is refined for numerous other purposes, such as for various chemicals synthesis. However, refining comes at increased expenses. Re-routing the crude glycerol in-situ for the pre-treatment of low-grade feedstock is one way to increase biodiesel profitability and sustainability.

During the purification of biodiesel lot of hot water is required for washing, which is incompatible with current green chemistry principles. In this context, improved biodiesel production using green solvents is under research.

Proposed research-based solution (status- Active)

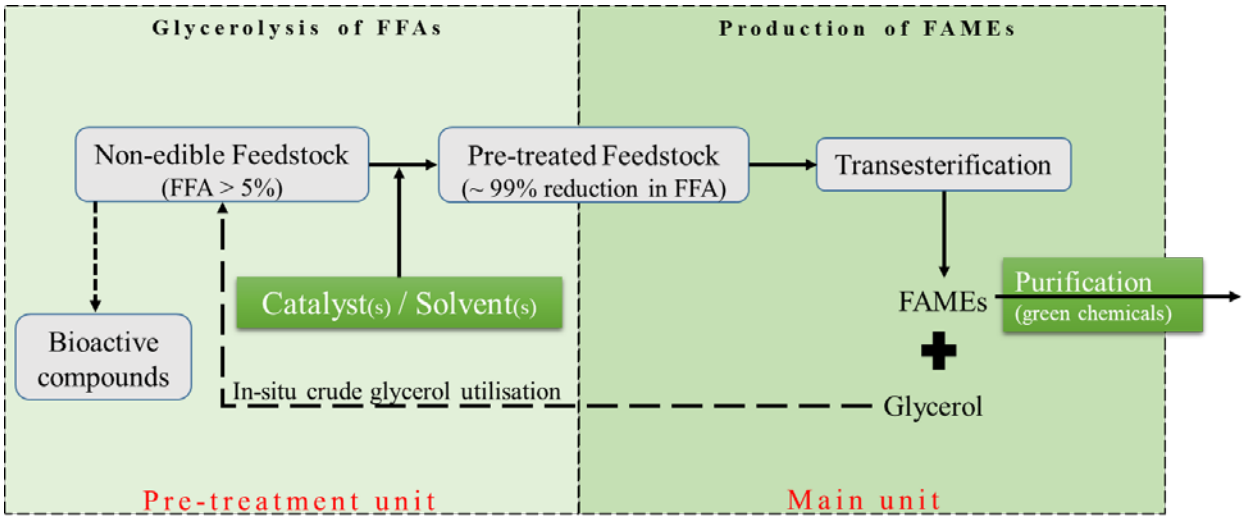
Development of a bio-economy based on inferior/waste sources of lipids/oil as starting feedstock. In this mini biorefinery, the objective is to expand the product inventory compared to conventional biodiesel plants, where biodiesel is a sole commercial product. By expanding the product inventory, i.e. addition of secondary products to the chain, greater sustainability is provided to the whole project, and also it helps in relaxing the biodiesel selling price without government subsidiaries. Similarly, reducing the crude-glycerol`s (low-profit margin) net production by re-routing it to a pre-treatment unit gives an optimized plant economy.

Another emphasis is laid on keeping the whole process within 12 principles of green chemistry. These guidelines dictate that using harmful solvents/ chemicals should be avoided, including water (a vital resource). Thus, the purification of crude-biodiesel by other green solvents is under investigation.

Summing up the active research projects currently active within our research group are:

1. Improvement in glycerolysis unit (esterification of FFAs with crude-glycerol) to pre-treat the inferior feedstock containing high FFAs.
2. Improved purification unit of crude biodiesel or fatty acid methyl esters (FAMEs).
3. Extraction of bioactive components such as terpenes from the non-edible sources of oils.

The proposed schematic diagram of two-stage biodiesel production from inferior feedstocks is shown below. It consists of two units, a pre-treatment unit and the main unit.



Our group has been involved in biofuels since the early 2000s, and we have made constant improvements in the various aspects of biofuel production. Some of the highlights of the research of our group in chronological order are tabulated below.

2005-2007	•Investigating production of biodiesel from various feedstocks such as waste plastics and beef tallow.
2009	•Patented Gas-Liquid reactor for biodiesel production. •Begining of glycerolysis as a pre-treatment method.
2011-2007	•Patented process for biofuel production from plant materials. •Investigations into various aspects of microalgae based biofuel production. Supercritical CO_2 and wastewater based technolgies.
2017-2021	•Improvements in biodiesel purification using novel deep eutectic solvents. •Improvement in glycerolysis reaction using novel deep eutectic solvents.

Facilities available for laboratory scale demonstration:

1. Pyrolysis reactor
2. Fractionation column.
3. Glycerolysis reactor.
4. All the analytical techniques used in the biodiesel research are available.