NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | Nanyang Environment and Water Research Institute

"WASTE-TO-PRODUCTS" VIA GASIFICATION-BASED CHEMICAL RECYCLING OF MIXED CARBON WASTE STREAMS FOR FEEDSTOCK AND PRODUCT FLEXIBILITY

Abstract:

Via gasification-based chemical recycling (i.e., waste gasification), a range of mixed, unsorted and challenging carbon-containing waste streams (e.g., MSW, sewage sludge, agricultural residues and green cuts, ...) could potentially be recirculated back into the chemical production cycle as alternative carbon raw materials for the production of value chemical products such as carbon monoxide, hydrogen, methanol, ammonia, SAF etc. However, as an emerging technology, waste gasification not only faces significant technical challenges, its economic feasibility and ecological benefits compared to conventional waste management routes (i.e., waste incineration) as well as alternative routes for decarbonization and circularity in the chemical sector (e.g., electrification, CCUS) remain to be determined.

Furthermore, besides technological-economic-ecological aspects, a systemic approach to address the corresponding socio-political dimension to increase the Technology Readiness Level/TRL of waste gasification remains outstanding. As waste gasification has the potential to contribute towards the parallel achievement of multiple sustainability goals ranging from resource efficiency, circularity to decarbonization, reduction of adverse environmental impacts to supply security and increased robustness against disruptions in the international supply chains, this project CR-Waste2Products utilizes a systemic and multidimensional Socio-Technological-Economical-Ecological-Political (i.e., STEEP) approach to address the above gaps and develop new knowledge and expertise as well as synergies between Singapore and German partners for innovative solutions in the field of waste that can be implemented in major cities and metropolitan regions in Germany and Singapore, with transference opportunities for other nations.

Project objective: Explore feasibility for chemical recycling of various local waste feedstock

Sampling of carbonaceous waste

MSW

Horticultural waste

Industrial waste

Chemical analysis of all available wastes

Feedstock pre-treatment

Various steps such as drying, shredding, mixing

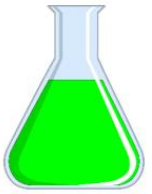
Briquetting /Pelletizing

Design of "feedstock menus"

Gasification

Modelling-based gasification for FlexiSlag gasification technology

Chemical production



Flexibility between Hydrocarbons, SAF, hydrogen and others

Establish a local chemical recycling network "SG-NK2 Network" with workshops and international events

PI: Assoc Prof Grzegorz Lisak **(NEWRI)**