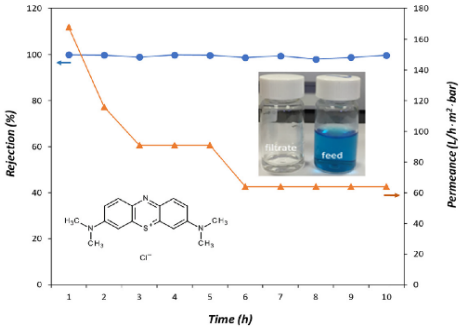
Intellectual Properties & Commercialisation

A) Water and Waste water treatment

1. Clearer And Cleaner Through Ceramic Nanofiltration

NUS has developed a technology, that can use either zeolite or kaolinite to produce ceramic membranes for nanofiltration. This approach assembles micro-particles of zeolite or kaolin on a polymer matrix to form a membrane, which is then subjected to heat treatment (<500°C). The process leads to the formation of pores in the membrane that are sufficiently small, for use in nanofiltration. These ceramic membranes can be made into disc-sheets or tubular forms, which are commonly used in industrial-scale applications. Laboratory experiments have also shown that these membranes can be used for nanofiltration of different organic solvents.

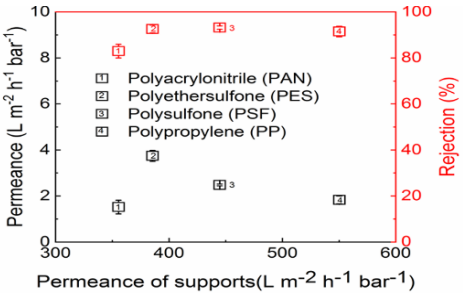


The rejection-permeance profile of the rejection of Methylene Blue (10 ppm) aqueous solution. Pressure drop is <1 bar. NF performance can be provided upon request

For more details, please refer to:
https://nustech.sg/clearer-and-cleaner-through-ceramic-nanofiltration

2. Smooth Composite Membranes For Reverse Osmosis & Nanofiltration

This invention discloses a free-standing technique for the formation of smooth thin film composite (TFC) membranes for fouling-resistant reverse osmosis and nanofiltration applications. It allows the formation of smooth selective thin films independent of the material used for porous support, hence, removing the need for the material to be pre-treated. It also does not call for the addition of expensive or toxic chemicals. In fact, this method reduces chemical consumption and shortens the production line of conventional TFC membrane fabrication processes.



Water permeability and NaCl rejection of the TFC membranes prepared on different supports via free-standing interfacial polymerization

For more details, please refer to:
https://nustech.sg/smooth-composite-membranes-reverse-osmosis-nanofiltration

3. High-Yield Membrane For Efficient Brackish Water Desalination

The invention describes an improved, highly permeable TFC membrane for the desalination of brackish water through reverse osmosis, as well as a method for production thereof. Here, functionalized carbon quantum dots (CQDs) are synthesized and incorporated into the membrane. A highly hydrophilic material, CQDs also have a large surface area that can be functionalized to enhance water permeability. Meanwhile, the groups used for functionalization resemble other membrane components like m-phenylenediamine (MPD), enabling easy incorporation and polymerization. Compared to the original membrane, the modified version has a 42.1 percent higher rate of pure water permeability.

For more details please refer to:
http://nustech.sg/product/135

B) Sustainability

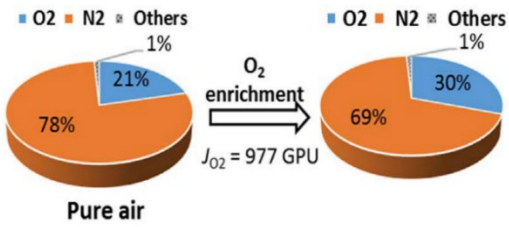
1. Eco-Friendly And Efficient Waste Shell Fractionation

This proposed technology is a simple, green and efficient method to fully recover the constituent materials of waste crustacean shells-chitin, proteins and CaCO3. Considering that the shell can take up a large proportion of a crustacean's weight (e.g. 60% of a crab), this method could potentially reduce seafood waste while producing valuable chemicals for industry use.

For more details, please refer to:
https://nustech.sg/product/134

2. Polyacrylonitrile (PAN)-Based Membranes For Dehumidification And Oxygen Enrichment

This invention discloses a modified PDMS that can be used to form an extremely thin selective layer onto a low cost, commonly available PAN substrate. This results in a high-performance composite membrane with superior gas permeance that eliminates the issues arising from the solution coating process and removes the need for inefficient workarounds.



Oxygen enrichment from air

For more details, please refer to:
https://nustech.sg/polyacrylonitrile-pan-based-membranes-dehumidification-and-oxygen-enrichment

3. Environmentally-Friendly Electrochemical Regeneration Of Activated Carbon

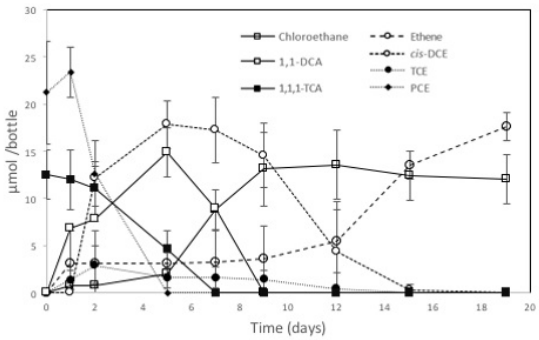
This invention describes an efficient and environmentally-friendly method for the adsorption and electrochemical regeneration of activated carbon in a single reactor. In this method, a constant stream of the compounds is fed into the reactor for adsorption by the activated carbon. An electric current then generates hydroxyl radicals that desorb and degrade the compound, freeing the activated carbon for reuse using a methodology developed by the research team which does not involve additional equipment compared to the conventional method.

For more details, please refer to:
https://nustech.sg/product/97

4. Detoxifying Pollutants Through Biological Means

NUS researchers have developed a defined mixed microbial culture to be used for biological remediation. It is capable of carrying out the complete dehalogenation of polychlorinated ethenes (PCE and TCE) to non-toxic ethene, as well as breaking down common soil and groundwater co-contaminants 1,1,1-trichloroethane and chloroform.

For more details, please refer to:
https://nustech.sg/detoxifying-pollutants-through-biological-means

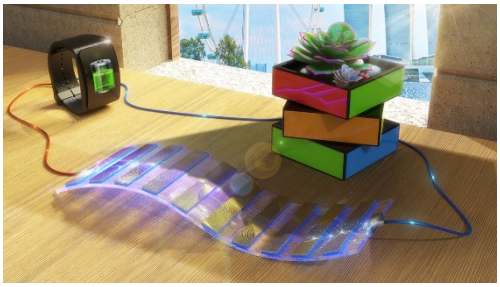


Dechlorination of 1,1,1-trichloroethane (TCE) and tetrachlorethene (PCE) by the defined consortium of this technology. Data points are averaged from triplicates.

5. Shadow Effect Energy Generator

This novel Shadow Effect Energy Generator (SEG) is able to work under shadowed conditions to convert low intensity light into electricity. Each SEG cell consists of a silicon substrate coated with a thin film of gold, platinum or tungsten. And it costs between US$31.6–51.67 to produce, as compared to US$486.76–676.47 per square metre for commercial solar panels.

For more details, please refer to:
https://www.nustech.sg/product/121



Shadow Effect Generator
Credit: Royal Society of Chemistry

6. A Sequential Sensor For Detection And Quantification Of Multiple Targets

This invention relates to a sequential and multiple sensor - a thin polymeric film coated on quartz crystal chip and the method thereof for the sequentially detection of multiple organic or biological compounds. The polymeric thin film could be any polymeric film prepared from any methods, such as polyvinylidene difluoride (PVDF), polytetrafluoride ethylene (PTFE). If needed, the film could be further treated, functionalized or imprinted.

For more details, please refer to:
https://www.nustech.sg/product/148

A thin polymeric thin film coated on quartz crystal chip

7. Alcoholic Beverages Fermented From Spent Coffee Grounds

This invention relates to the valorization of spent coffee grounds (SCG) and its preparation thereof. Hydrolyzed SCG is fermented with commercial wine yeast to produce alcoholic beverages. A range of flavor compounds, organic acids, and a certain amount of ethanol are generated in the SCG alcoholic beverages. The SCG alcoholic beverages present pleasant aroma with different alcohol contents, which can be utilized in the development of specialty alcoholic beverages from a side (waste) stream of coffee processing in food industry.

For more details, please refer to:
https://www.nustech.sg/product/147

The Hydrolyzed SCG is fermented with alcohol producing yeast to produce alcoholic beverages