NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE | Nanyang Environment and Water Research Institute

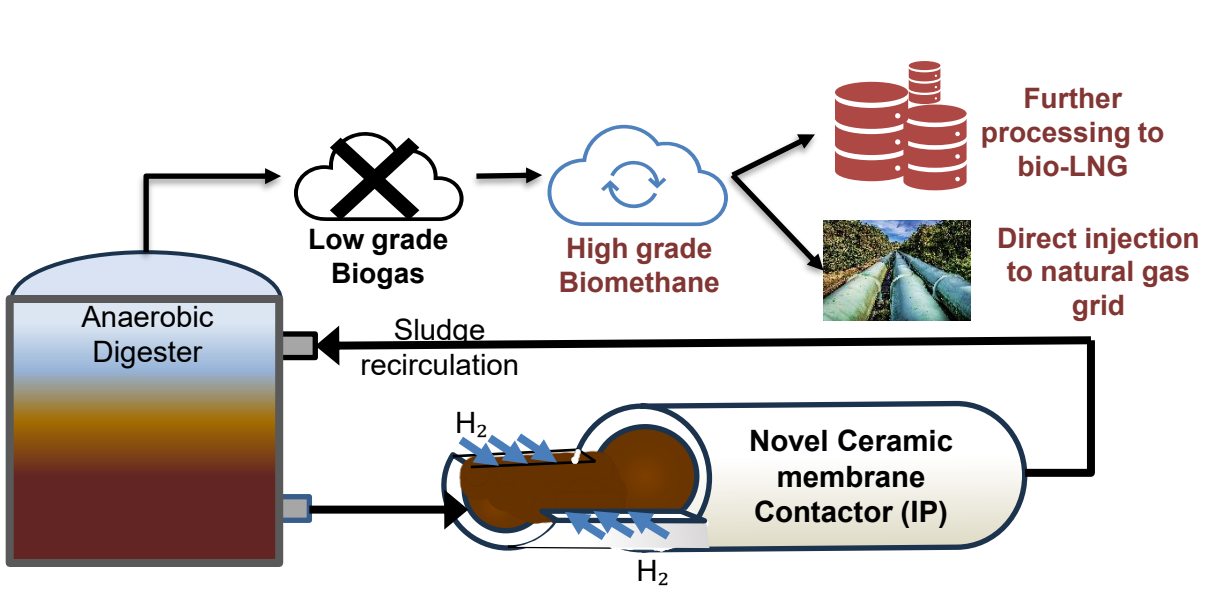
IN-SITU H_2 ASSISTED BIOGAS UPGRADING TOWARDS BIOLNG

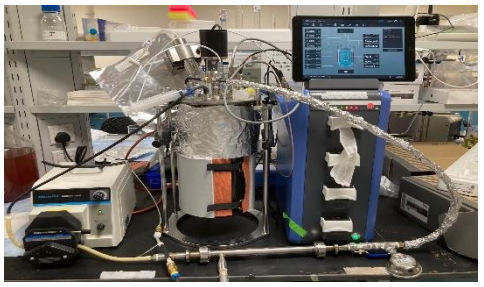
Abstract

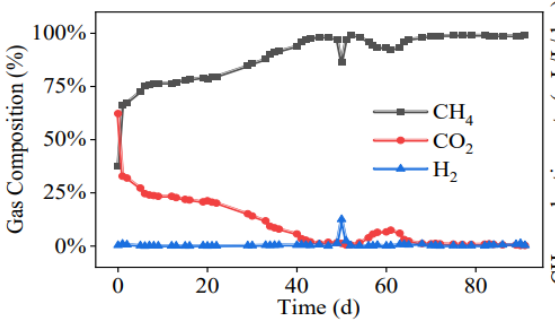
Biogas produced from the anaerobic digestion (AD) of biomass typically contains around 65% methane, giving it a relatively low energy content of about 20 MJ/m³, which limits its efficiency as an energy resource. To enhance its utility, biogas can be upgraded to biomethane, where the methane concentration exceeds 95% and the energy content rises to approximately 36 MJ/m³. This upgraded biomethane serves as a direct substitute for natural gas and can be further converted into liquefied natural gas (LNG), offering a versatile and high-value renewable energy carrier.

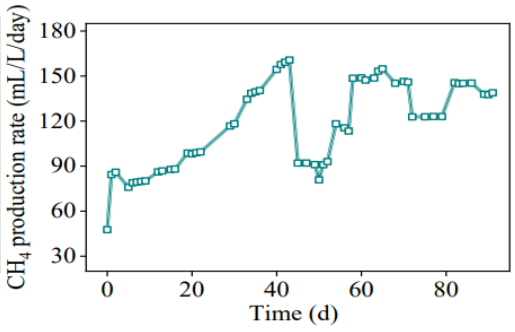
To achieve efficient biogas upgrading, this study employed an external ceramic membrane contactor module integrated with a typical AD system for effective hydrogen injection. Within this setup, hydrogen gas transfer and dissolution occur at the membrane's inner surface, supported by sludge recirculation to maintain process stability. The approach demonstrated several advantages, including the production of high-quality biomethane with minimal fouling, long operational lifespan, ease of maintenance and retrofitting, and the capability to generate biomethane suitable for direct gas grid injection or subsequent bio-LNG production.

TRANSFORMING BIOGAS INTO HIGH VALUE BIOMETHANE AND BIO-LNG









Key results

Max CH_4 content (%)	99.1
CH_4 production increase (%)	108
H_2 utilization rate (%)	99.6

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