THE NEXT SHIPPING FUEL: ELECTRIFYING STEAM METHANE REFORMING FOR BIOMETHANOL PRODUCTION

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ABSTRACT

As the maritime sector increasingly prioritizes sustainability and emission reduction, researchers have been focused on innovative fuel solutions. Biomethanol has emerged as a promising green fuel due to its potential to significantly reduce emissions compared to traditional marine fuels, while remaining economically viable. In traditional methanol synthesis, a steam methane reformer (SMR) reactor typically consists of numerous high-alloy steel tubular catalytic reactors, placed inside a large furnace equipped with gas burners. The SMR reactions are strongly endothermic, leading to significant fossil fuel consumption by the gas burners and subsequent CO_2 emissions. Due to the limited thermal conductivity of the reactor walls, only approximately 50% of the supplied heat effectively reaches the catalytic bed inside the SMR reactor, resulting in reduced energy efficiency. [1] Electrification of the SMR reactors aims to replace the large furnace with electric resistance-heated reactor walls, bypassing the thermal conductivity limitations inherent in conventional SMR reactors and enhancing catalyst utilization. This pioneer method achieves significantly reduced reactor volumes and possesses the capability to provide a carbon-neutral biofuel, by (i) eliminating directly associated CO2 emissions, (ii) utilizing renewable electricity to heat the reactor, and (iii) integrating onboard carbon capture technology. This study aims to preliminarily investigate the environmental impacts of electrifying the SMR process. Implementing electrified SMR technology on a global scale could potentially lead to a reduction of nearly 1% in global CO_2 emissions and holds the potential to transform the maritime industry by providing a zero-emission fuel alternative. [1,2]

KEYWORDS: Biomethanol, Alternative fuels, Electrification, SMR, Shipping fuels

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