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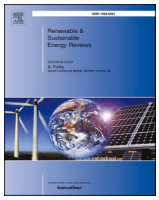

Green synthesis of MeOH derivatives through *in situ* catalytic transformations of captured CO_2 in a membrane integrated photo-microreactor system: A state-of-art review for carbon capture and utilization

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ABSTRACT

Globally, industrial production sectors have become increasingly concerned about reducing CO_2 evolution, through planned carbonization with concurrent substitution of fossil fuels with renewable energy resources, since the release of the Paris climate accord regulations. CO_2 is an inexpensive substrate used for the production of useful chemicals and fuels through various chemical and biological processes. As a result, reducing CO_2 emissions while producing non-fossil fuels, such as methanol or its derivatives, could be an appealing solution to the global energy problems. The high cetane number, low autoignition temperature, and low extract pollutant value of dimethyl ether, one of the most valuable methanol derivatives, make it a clean and eco-friendly alternative to fossil fuels. Recent literature from the last five years is critically reviewed in the present study to assess the current best practices for CO_2 capture and conversion into high value fuels. Particular emphasis has been placed on atmospheric CO_2 capture, photoconversion, and the downstream purification of the final product using membrane-based technologies for a sustainable future. Currently, there is a compelling need for an impending transition away from fossil fuel-based technologies toward inventive new technologies using renewable energy sources through carbon management via CO_2 conversion and utilization.

1. Introduction

The increasing global population has led to rapid energy consumption and demand for chemical, pharmaceutical, and related industrial sector products. It has resulted in large-scale CO_2 emissions and concentrations in the biosphere. Global energy consumption is expected to increase by 56% between 2010 and 2040, according to a US Energy Information Administration report in 2013 [1]. Most of the world's

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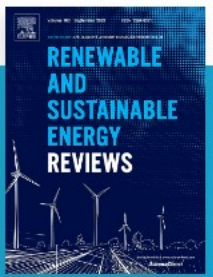

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