ASSESING THE ECONOMIC IMPACT OF CO_2 CAPTURE AND RES-H_2 PROCESSES ON THE FEASIBILITY OF OLEFINS PRODUCTION

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ABSTRACT

Anthropogenic greenhouse gas emissions are the main contributors to the climate change, causing a rise in global temperature and catastrophic weather effects. Among them, CO_2 is emitted from a series of activities that involve the use of fossil fuels in power plants, heavy industrial units (e.g. cement, steel) and in transportation sector. To this end, the deployment of CO_2 capture and utilization (CCU) strategies along with the use of green H_2 can provide a valorization pathway to value-added products, such as methanol, olefins, formic acid, etc. Among the various products, light olefins are vital chemicals extensively employed as a building block for numerous petrochemical products (plastics, textiles, rubbers, etc.).

In view of the above aspects, the present work aims to assess an industrial scale process for the production of C2-C4 olefins under zero C-emissions and market-competitive prices. The proposed study will include the following step-by-step assessment:

- *Simulation, process design and economic evaluation of a CO_2 capture process through MEA.*
- *Optimal design, energy management and economic evaluation of a RES-H_2 production system based on solar/wind energy and PEM electrolysis.*
- *Preliminary analysis on the design of a flexible catalytic process that will be able to combine two high purity streams (CO_2+H_2) towards the production of olefins in multi-step reactors and purification units.*

Specifically, ASPEN PLUS will be used to simulate the CO_2 capture process through the use of MEA in a consequent absorption-desorption cycle. Heat exchange is highly important and will be fully considered in our study. The proposed process will aim at the processing of a complete flue gas exit stream from a cement factory (~10,000ktn/yr) and will be economically evaluated targeting a price range of 40-70€/tn for the captured CO_2. In parallel, the optimal design and simultaneous energy management of H_2 production from solar and wind energy will take place for a continuous production rate (~300ktn/yr) and will target a price range of 10-20€/kg of H_2 (excluding transportation costs). The above analysis will be used to retrofit the preliminary study of scaled-up olefins production in a catalytic reactor and purification process and will be compared with conventional olefin production in petrochemical industries.

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