ICCDU XVI
27-30 August, 2018
Rio de Janeiro, Brazil

16th INTERNATIONAL CONFERENCE ON CARBON DIOXIDE UTILIZATION

Selecting Which Products to Manufacture from CO_2

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Keywords: Product selection, CO_2-derived chemicals, Process industry

Globally there is a need to reduce CO_2 emissions and simultaneously increase carbon-based resources within the European process industries. By identifying target routes whereby fossil-derived carbon could be replaced by carbon from CO_2 and CO these aims may be achieved; minimising the import of fossil carbon (especially oil) by reducing the dependency of the process industries upon chemical feedstocks derived from petrochemicals and facilitating a cyclic follow of CO_2/CO gases from one industry to another.

An extensive list of products (including chemicals, fuels and solid materials) which can be derived from CO_2 and CO, together with production routes, was identified from the literature. This long list must be further analysed to identify key target products from CO_2 or CO. Business cases can be constructed to assess the economic case and life cycle analysis can be conducted to assess the environmental impacts of each product selection to narrow the choice. However, both of these techniques involve fairly extensive input in terms of time and effort. A pre-selection tool is presented here to enable decision makers to narrow-down a long list of possibilities to a short-list of contenders.

To identify near-term key targets for the European process industry it was concluded that: (1). The Technology Readiness Level of the process must be high for implementation to be achievable within a reasonable timeframe. (2). Products must have a medium to high market value, as they need to be economically viable to be adopted. (3). The CO/CO_2 utilisation potential should be significant so that the amount of fossil carbon being replaced is meaningful. (4). The products should not require other non-catalytic chemical inputs containing fossil-sourced carbon in order to maximise the replacement of fossil-sourced carbon.

By ranking the above data collected for each product and route a simple pre-selection can be made and is presented here.

Furthermore, an alternative, more sophisticated tool has also been developed which uses additional data determined by the requirements of the user. For instance, the H_2 and/or energy requirement of the product synthesis can be included in the selection. The relative importance of the market and environmental factors can be manipulated by using weightings applied to the ranked data. The user inputs their own priorities (such as utilising the maximum quantity of CO_2 or minimising their reliance upon H_2 availability) and even decide upon their own attitude to risk when choosing which products to produce using CDU. In this way, CO_2/CO derived products and the optimal route to create them can be determined for specific situations.

Acknowledgements

The CarbonNext project was funded by the European Commission DG Research & Innovation as a H2020 Spire5 project.