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Optimized process chain for resource efficient methanol synthesis accompanied by Life Cycle Assessment

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Methanol is a valuable product within carbon-based process chains. Methanol is versatile and is usually used as a chemical raw material. Essential products of methanol are i.e. Formaldehyde, acetic acid and methyl methacrylate. In addition, methanol can also be used as fuel in internal combustion engines or in fuel cells. The global demand for methanol in 2015 was approximately 70 million tons [1].
The aim of the presentation is to provide an overview of the development of an innovative process chain for the synthesis of the C1-basic chemical methanol without the use of fossil raw materials or exclusively by using compulsory by-products (Figure 1).

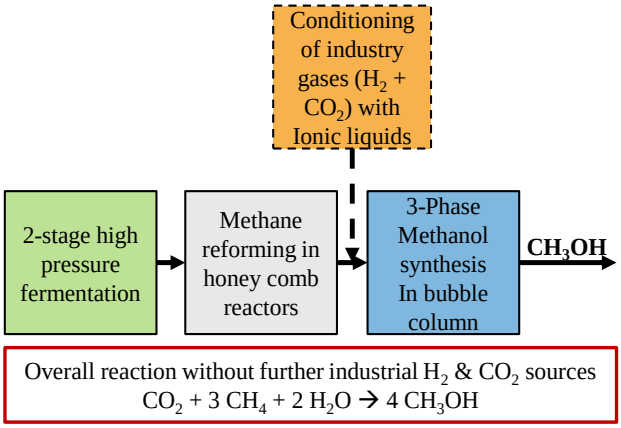

Figure 1. Flowchart of innovative OptiMeOH process chain to produce methanol

The first step of the process chain consists of a novel biomass conversion process (2-stage high pressure fermentation) which allows for a higher CH_4 to CO_2 ratio. An innovative reactor concept for methanol synthesis (3-phase bubble column methanol synthesis) allows for an energy and resource efficient methanol synthesis. The 2-stage high pressure fermentation and the 3-phase methanol synthesis are connected by a novel honey comb methane reforming reactor, which is adjusted to suit the demands of the methanol synthesis by considering the input from the high pressure fermentation. Additionally the possibility of subsequent integration of upgraded by-product gas streams incurred in industrial processes to expand the raw material base is given. The upgrading of the by-product CO_2 streams is done by the newly developed ionic liquids upgrading technology.
The innovative process chain is accompanied by a Life Cycle Assessment (LCA) which is performed in parallel to the development of the process chain by assessing the current status of development. Every single step of the process chain is evaluated by the LCA including all necessary energy and resource inputs as well as emissions and other outputs. The LCA information in terms of a Hot Spot analysis pointing out major contributors is provided to the developers to allow for an environmentally optimized methanol synthesis.
The presentation will give an overview of every part of the process chain and the overall picture. Special attention will be given to first results of the Life Cycle Assessment and the Carbon Balance.

Acknowledgments

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References

[1] http://www.methanol.org/the-methanol-industry/, last assessed on 19.03.2018