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Energypolis, Rue de l'Industrie 17, CH-1950 Sion, Switzerland

ENERGYPOLIS SEMINAR

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Conceptual design of a process to produce pyridine bases

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Pyridine bases play an important role in the fine chemical industry. These compounds are important intermediates in the production of vitamins, resins and agrochemicals. The aim of this work is to develop a new process to synthesize 2-Methyl-5-Ethylpyridine (MEP). MEP is currently produced by liquid phase reaction of paraldehyde (2,4,6-Trimethyl-1,3,5-trioxane) in the presence of ammonia and acetic acid. The reaction is characterized by long residence time and high operative pressure. Additionally, an increase in concentration decreases the selectivity to MEP. A new reaction scheme is developed starting from acetaldehyde ammonia trimer (Hexahydro-2,4,6-trimethyl-1,3,5-triazine), which allows reducing the residence time and does not require direct addition of ammonia solution in the reactor, while maintaining acetic acid as catalyst. Characterization and feasibility of the reaction were assessed and a kinetic model was developed in an ideal reactor, to have the base for a rational reactor design. The pilot reactor was developed considering the following model criteria: fast heating phase, effective temperature control, good distribution of the reactant and good contact between reactant and catalyst. The reaction was carried out in a continuous coil reactor to assess the possibility of process scale up. Although the requirements concerning heat management were achieved, the operation was limited by mass transfer effects. This happens because the reaction is completed before the solutions containing reactant and catalyst are fully mixed. The insertion of a specific mixing unit before the reactor resulted the best solution to prevent this mass transfer problem. The optimal management of mixing generates the best process conditions assuring the highest productivity.

References:

[1] E. Moioli, L. Schmid, P. Wasserscheid, H. Freund, "pH effects in the acetaldehyde ammonia reaction", *Reac. Chem. Eng,* 2017, 2, 382-389

[2] E. Moioli, L. Schmid, P. Wasserscheid, H. Freund, "A new reaction route for the synthesis of 2-Methyl-5-Ethylpyridine", *Reac. Chem. Eng,* paper submitted

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Born in 1990 in Monza, Italy, Emanuele Moioli graduated with a MSc in Chemical Engineering from the Politecnico di Milano in 2014. During this time, he worked as an undergraduate research assistant in the field of hydrogen production from catalytic partial oxidation of hydrocarbons. He then went on to pursue graduate studies as a Marie Curie Fellow at the Friederich-Alexander-Universität Erlangen, where he is in the final stage of his PhD. His doctoral thesis, partially developed in Lonza, Visp, focused on the model based design of a new process for pyridine base production.