

Concept development from ionic liquid solvent evaluation to miniplant design for homogeneous Friedel-Crafts alkylation reaction

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Electrophilic aromatic substitution reactions - especially Friedel-Crafts reaction groups – are among the most important reactions for the preparation of alkylated arenes at industrial scale. The reaction is known to be catalysed by Lewis acids such as AlCl_3 , FeCl_3 , TiCl_4 etc. as well as Brønsted acids like HCl , H_2SO_4 , H_3PO_4 etc. A major drawback with existing homogeneous Friedel-Crafts alkylation processes is the requirement to hydrolyse the catalyst phase at the end of reaction and thus producing large amounts of wastewater. Due to this fact, developing a sustainable Friedel-Crafts alkylation process is of course of highly technical and environmental interest.

In this work we present the development of highly acidic ionic liquids' application in aromatic isopropylation reactions from the first screening, performed in a 50 ml flask to a scaled-up continuous, stationary and long-term stable miniplant with 250 ml liquid hold-up and up to 70 l productivity per day.

Exemplified for the continuous isopropylation of toluene we have proved that the acidic catalyst layer is successfully immobilised over at least 18 h in our loop reactor. After 8 h time-on-stream, a steady state has been reached followed by at least 10 h time-on-stream without any loss of activity or change in selectivity. Our results reveal the high potential of acidic ionic liquids in continuous arene functionalisation reactions.

The technical applicability of the biphasic catalytic reaction involving acidic ionic liquids, the stability of the system and the influence to the selectivity within the product isomers are discussed.