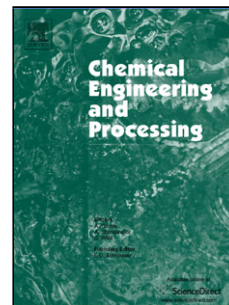


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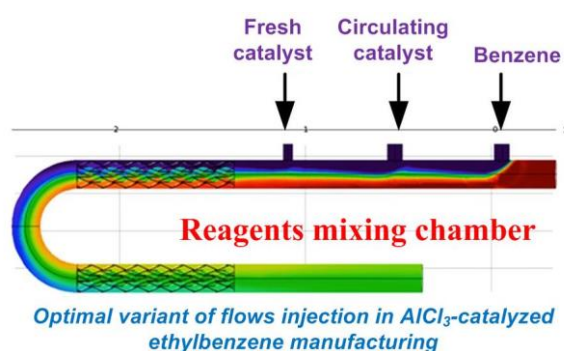
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Benzene alkylation with ethylene: the way to increase the process efficiency

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Graphical abstract



Highlights

- The possibility to improve alkylation performance by means of mixing intensifying was studied.
- Intensifying the mixing process will bring the alkylation from diffusion into kinetic region.
- Changing the way of reagents injection into the mixing chamber is reasonable.

Ethylbenzene is the main ingredient to obtain textile fabric, plastics, detergents, etc. The current industrial ethylbenzene production method includes mainly zeolite catalyst. However, liquid acidic catalysts such are also still used. In contrast to zeolite alkylation technology, there is much less information on how to improve the alkylation unit performance. The present research investigates the possibility of obtaining this goal by intensifying the reagents mixing before the alkylation reactor. We present the results of the mixing chamber hydrodynamic modeling clearly showing that it is reasonable to change the way of reagents injection: benzene-into the first, circulating catalyst into the second and fresh catalyst into the third pipe branch along the ethylene flow. This will intensify the mixing process and reduce the size of the catalyst droplets bringing the alkylation from diffusion into kinetic region. This variant of reagents injection will also ensure the uniformity of reagents distribution. The possibility to decrease the circulating catalyst flow rate from 8000 to 5000 ($kg\ h^{-1}$) without changing the mixing efficiency also demonstrates the feasibility of the proposed solution.

Keywords: Hydrodynamics; mixing; optimization; droplets; mixers; simulation.

Introduction

The alkylation of aromatic hydrocarbons with alkenes is of industrial interest as a method to obtain intermediate products in the chemical industry [1–3]. These products are necessary to obtain

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