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PROCEEDINGS

Study on the Flow Dead Zone in the Shell of an Industrial Tubular Fixed Bed Reactor

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ABSTRACT

The tubular fixed bed reactor is widely used in industrial production because of its strong applicability, high stability and easy maintenance. The flow dead zone in the shell of the reactor will significantly affect the overall performance of the reactor. Reducing the flow dead zone in the shell is the main way to optimize the performance of tubular fixed bed reactor. At present, most of the research on the flow dead zone of the reactor is based on the simplified reactor model, the number and size of tubes are far from the industrial requirements. In this paper, the residence time distribution method combined with numerical simulation is used to quantitatively analyze the flow dead zone in the shell of an industrial tubular fixed bed reactor with different baffle structure parameters. Based on the flow model and the residence time distribution theory, species transport model was established to track and monitor the tracer. Secondly, the flow dead zone volume was derived by monitoring the tracer concentration distribution after treatment. Then, the structural parameters of the baffle are changed, including the notch height, plate spacing and notch direction of the baffle, and the influence of these parameters on the flow dead zone is analyzed. Finally, the influence of different working medium and different flow rates on the flow dead zone is analyzed, and the recommended design range of each parameter is given. The results show that the baffle notch height and baffle spacing are not completely independent variables. By optimizing the baffle layout, the minimum volume fraction of flow dead zone is reduced from 8.9% to 0.048%. Moreover, it is found that working medium has great influence on the flow dead zone under different material state, and the flow dead zone is almost unaffected by the inlet flow rate. The research results provide a theoretical basis for structural optimization of industrial tubular fixed bed reactors.

KEYWORDS

Tubular fixed bed reactor; flow dead zone; industrial size; residence time distribution

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