466h Jet Mixers in Preventing Runaway Reactions – a CFD Based Review

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Runaway reactions are continuing to be a major problem in the chemical industry. A recent study showed that 26.5 % of the major chemical plant accidents are due to runaways. One of the major reasons for runaways is power failure. The loss of agitation triggers the loss of temperature control, which leads to the heating of the reactor content and to the runaway of the reaction. Runaway reactions could be inhibited in two ways namely by the addition of cold diluents and by the addition of an inhibitor (chemical reaction stopper). This technology is called shortstopping. In an advent of power failure, the process of adding an inhibiting agent and mixing it with the reactor contents becomes a major concern in the shortstopping process.

Actual laboratory experimentation with runaway reactions is prohibitively hazardous. Recent developments with CFD make it possible to carry out virtual experiments. In this work, we use CFD based models to understand the use of jet mixers in preventing runaway reactions. The computational model is solved using FLUENT 6.2 (of Fluent Inc., USA). The CFD model is used in designing the jet mixed vessel for effective mixing. Shortstopping studies via the addition of reaction inhibitor and the cold diluent are discussed in detail. Influence of inhibition kinetics on the shortstopping process is also investigated. Results discussed in this work identify feasible methods for preventing runaway reactions.

Key word: Jet Mixer, CFD, Mixing, Runaway Reaction, Shortstopping.