

Compartment modeling of high pressure LDPE autoclave reactor: combined CFD model of hydrodynamics and kinetics of polymerization

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LDPE, a low-density polyethylene that is a synthetic resin produced by ethylene polymerization is one of the most commonly used plastics in everyday life. The high pressure autoclave reactor, one of the processes for the production of polyethylene, ensures valuable polymer properties and prevents runaway decomposition when it is explicitly modeled on the comprehension of hydrodynamics and free-radical polymerization. In this study, the compartment model of LDPE autoclave reactor employing the CFD-based mixing effect of the stirring device simplified by cell aggregation and the polymerization kinetic mechanism with moment method. The proposed model is verified through comparison of the predicted product properties and locally distributed temperatures and the industrial plant data with less than 5.0% errors. The proposed model capable of dealing with simulation of the complex system with low computational load can be applied to achieve the consistent product quality, prevent undesired temperature acceleration and optimize the conversion and production rate.