Gas phase polymerization in a fluidized bed reactor is a well-recognized and well-utilized process for the production of polyolefins, with more than 80% of the world’s polypropylene and polyethylene produced using this method. While most polymerization processes involve two phases (gas and solid), three-phase systems (gas, liquid and solid) are often utilized when liquid is recycled to operate the system in condensing mode to increase capacity. The application of multiphase flow computational fluid dynamics (CFD) in this important reactor system has gained popularity in the past few years. The commercial CFD code, Barracuda®, has the potential to be a useful tool for modelling fluidized bed polymerization reactors to make engineering decisions. Barracuda Virtual Reactor® was utilized in this study to provide fundamental insight into the system behaviors in three-phase fluidized bed reactors. The effects of operating conditions on the performance of the reactor were studied. The models incorporated three-dimensional geometry, non-isothermal conditions, and reaction kinetics for polymerization, evaporation and condensation. The distributor plate in the bottom head of the reactor that comprises annular disk was simulated using point source injection, and a unique method was utilized to translate the output from the bottom head to the inlet of the reactor.

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