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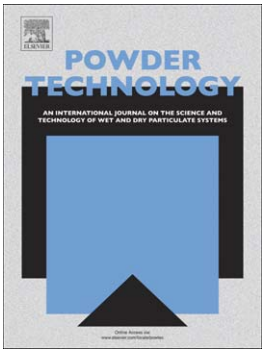

Development of a model for the prediction of hydrodynamics of a Liquid-Solid Circulating Fluidized beds: A full factorial design approach

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Development of a model for the prediction of hydrodynamics of a Liquid-Solid Circulating Fluidized beds: A full factorial design approach

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ABSTRACT

Hydrodynamics of a Liquid–Solid Circulating Fluidized Bed (LSCFB) system has a significant impact on the reactor design. In the present study, statistical design approach was adopted to model the hydrodynamic behaviour of an LSCFB in terms of average solids holdup and solids circulation rate. Primary liquid velocity, auxiliary liquid velocity, solids inventory and liquid viscosity are the input variables, called factors, which affects the system. Average solids holdup and solids circulation rate are called responses of the system. A full factorial design approach with four factors and three levels of the factors were considered. Various models such as linear, two factor interaction, quadratic, and cubic models were tested for the adequacy. Within the range of experiments conducted, for both responses, the quadratic regression model is suggested. The model shows that some of the interaction effects between the factors are dominant. The developed model was verified by using various statistical tests. Also, model was validated using various experimental data sets chosen at different conditions. Results based on 'R' value, and deviations in parity plot were falling within agreement level. This suggests that the proposed model can be adopted for various processing applications in the LSCFB unit.

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