

# Computational Fluid Dynamics Simulation of Laboratory Scale Reactor of Fast Pyrolysis Fluidized Bed

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## ABSTRACT

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The application of fluidized bed has emerged since the past decade as one of the most potential and promising solution to a relatively wide spectrum of engineering field, particularly on the biochemical processing industry. Fast pyrolysis has gained its huge popularity in the biofuel and bio-oil industry due to its high production rate using the technology of fluidized bed. Even though an enormous number of academic studies have been performed experimentally to improve and understand more on the fluidization process; however, the complex hydrodynamics and interaction of the fluidized particles are still not largely understood. Therefore, computational fluid dynamics (CFD) has turned out to be a useful tool to predict and solve for the particles interaction and flow behaviour in the fluidized bed. Among the CFD techniques and module available on the market, Euler-Eulerian Two-Fluid Model (EE-TFM) have been chosen as to study and obtain the operational parameters required for the fluidization of different materials and different particle diameters. In the present work, the effect of the material, namely stainless steel and sand and the respective diameters of 0.5 and 1 millimetre have been investigated with the aid of Ansys FLUENT 15. From the simulation, it has found that the minimum fluidization velocities of steel beads are 0.7 m/s and 1.4 m/s respectively for diameter of 0.5 millimetres and 1.0 millimetre. On the other hand, the minimum required velocities to fluidize the less dense sand beads are 0.3 m/s and 0.7 m/s for particle diameter of 0.5 millimetres and 1.0 millimetre respectively. It has also discovered that the minimum fluidization velocity will increase as the density of the particle material increases; while it will also increase when the particle diameter increases. Therefore, it can be concluded that the drag force required to fluidize the specific solid bed material is proportional to both the density and the diameter of the particle chosen.