# ASSESSMENT OF NEW SCALE-UP METHODOLOGY OF HYDRODYNAMICS SIMILARITY IN GAS-SOLID FLUIDIZED BEDS USING ADVANCED NON-INVASIVE MEASUREMENT TECHNIQUES (CT AND RPT)

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The present study assesses and validates a new mechanistic scale-up approach proposed in our laboratory. The proposed hypothesis takes into account both global as well as local hydrodynamics, which based on maintaining similar radial or diameter profiles or cross-sectional distribution of gas holdup in two different gas-solid fluidized beds at different conditions and sizes with similar design and configuration in order to achieve hydrodynamics similarity since the gas dynamic dictates the bed hydrodynamics. The experimental conditions were based on Al-Dahhan et al., (2014). They identified the conditions that provided them with closer or similar radial profiles of gas or solids holdups (gas holdup + solid holdup = 1) by implementing computational fluid dynamic (CFD) as an enabling tool to search for these conditions. In this work the experimental validity was performed by utilizing advanced non-invasive measurement techniques, computed tomography technique (CT) was used to measure gas and solid holdups at different axial levels and radioactive particle tracking (RPT) was also used to measure particle velocity field and turbulence parameters (Reynolds stress, normal stresses, turbulent kinetic energy, turbulent eddy diffusivities, etc.). It is experimentally demonstrated that similarity based only on global hydrodynamics does not necessarily ensure similar flow patterns and mixing intensities. The two systems can have similar overall gas holdups but different flow patterns and mixing intensities. This indicates that two systems can be globally similar in nature, but have different local hydrodynamics. Additionally the global parameters should not be used primarily to assess scale-up methodology

REFERENCES

1. Muthanna Al-Dahhan , Shreekanta Aradhya, Faraj Zaid, Neven Ali , Thaar Aljuwaya., Scale-up and on-line monitoring of gas-solid system using advanced and non-invasive measurement techniques, Symphos 2013, 2nd International Symposium on Innovation and Technology in the Phosphate Industry, (2014).