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Experimental and Numerical Analysis of Wood Pellet Breakage during Pneumatic Transport

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Abstract : Wood pellets belong to the most established trade formats of wood-based fuels. Especially, because of the transportability and the storage properties, but also due to low moisture content, high energy density, and the homogeneous particle size and shape, wood pellets are well suited for power generation in power plants and for the use in automated domestic firing systems. Before they are thermally converted, wood pellets pass various transport and storage procedures. There they undergo different mechanical impacts, which leads to pellet breakage and abrasion and to an increase in fines. The fines lead to operational problems during storage, charging, and discharging of pellets, they can increase the risk of dust explosions and can lead to pollutant emissions during combustion. In the current work, the dependence of the formation of fines caused by breakage during pneumatic transport is analyzed experimentally and numerically. The focus lies on the influence of conveying velocity, pellet loading, pipe diameter, and the shape of pipe components like bends or couplings. A test rig has been built, which allows the experimental evaluation of the pneumatic transport varying the above-mentioned parameters. Two high-speed cameras are installed for the quantitative optical access to the particle-particle and particle-wall contacts. The particle size distribution of the bulk before and after a transport process is measured as well as the amount of fines produced. The experiments will be compared with results of corresponding DEM/CFD simulations to provide information on contact frequencies and forces. The contribution proposed will present experimental results and report on the status of the DEM/CFD simulations. The final goal of the project is to provide a better insight into pellet breakage during pneumatic transport and to develop guidelines ensuring a more gentle transport.

Keywords : DEM/CFD-simulation of pneumatic conveying, mechanical impact on wood pellets during transportation, pellet breakage, pneumatic transport of wood pellets
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