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Mechanical Dispersion of a Semi-Solid Binder in a Wet Granulation Process

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ABSTRACT

High viscosity surfactant pastes have recently gained popularity in the production of high efficiency laundry detergents due to their ability to increase surfactant loading in granules. When using high viscosity semi-solid binders a unique challenge is presented because it forces granules to be formed primarily by mechanical dispersion; a relatively poorly understood process. Developing mechanistic models of this process will enhance knowledge of mechanical dispersion processes and improve process development for granules produced using this method. Experiments to determine the effect of three process parameters; paste temperature, impeller RPM, and time were carried out in a lab-scale granulator. Binder temperature was varied between 40-60 degrees Celsius to cover paste temperatures from solidification to decomposition. Impeller RPM was varied between 600 -1200 RPM to capture the full range of potential industrial impeller velocities. Mixing time was varied from zero to ten seconds; the time scale of the industrial process. The particle size distribution for the process was determined to rely primarily on mixing time especially at impeller speeds above 900 RPM where fully developed annular flow occurs in the mixer. The Sauter mean diameter of particles was determined to be linearly related to mixing RPM, while temperature was shown to have little effect on the Sauter mean diameter. Experimental data was in relatively good agreement with values predicted by an existing breakage simulation, but could be improved upon. These conclusions will be used in developing a breakage kernel for the process based on material properties.

KEYWORDS

Wet granulation, mechanical dispersion, detergent, semi-solid binder,