Particle Breakage using Wet Mill, Ultrasonic and Hydrodynamic Cavitation

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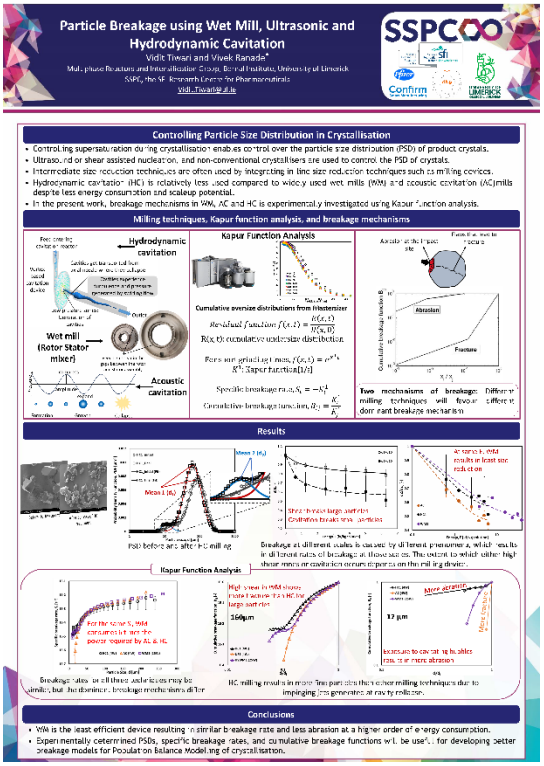

Abstract

In-line fluidic devices and mills are often used for controlling crystal size distribution during crystallisation. In this work, we have investigated the breakage of organic crystals in three particle breakage devices. Paracetamol was selected as a model API (active pharmaceutical ingredient). In order to focus the investigation on particle breakage, we have used paracetamol suspended in its saturated solution and eliminated possible changes in particle size because of crystallisation or dissolution. Particle breakage in a wet mill (WM), which is one of the commonly used particle breakage devices, is compared with the two cavitation-based devices: one based on ultrasonic or acoustic cavitation (AC) and the other on hydrodynamic cavitation (HC). The particle size distributions (PSD) were measured using laser diffraction. Kapur function analysis was used to study the effect of various conditions, such as rotational speed, intensity or pressure drop on the specific breakage rates and breakage mechanisms. The vortex-based HC device used in this work was found to generate more fine particles than any other technique at a power consumption that was 1/16th of that of the WM.