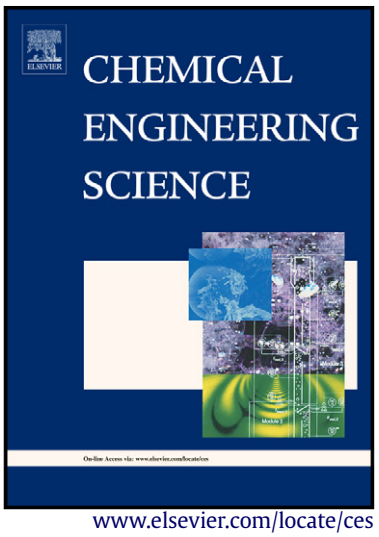

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Ligament-Type Liquid Disintegration by a Spinning Wheel

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Abstract. In this paper, liquid disintegration by a spinning wheel was investigated experimentally. The mechanism of ligament formation on a spinning wheel was studied using photographs taken by a high-speed camera. Three different liquids with Newtonian properties were used at various flow rates and the wheel rotational speed was varied in a wide range. The atomization process was found to be significantly different from the spinning disc and cups atomization due to the highly non-uniform circumferential ligament distribution and the absence of the direct drop formation mode. Nevertheless, the dependence of ligament number and diameter on the input process parameters is similar as with other types of centrifugal atomizers due to the same underlying hydrodynamic instabilities.

Keywords: Spinning wheel, Disintegration, Ligament formation, Drop, Flow visualization, Fluid dynamics

1 Introduction

A spinning wheel atomizer where a stream of liquid flows onto the mantle surface of the wheel has important applications in industry, especially in the production of mineral wool and other fibers [1] and for robust atomization of highly viscous or non-homogenous liquids.

While not as widely used as the spinning disc and cup atomizers, spinning wheel atomizers have several advantages. First of all, a much higher flow rate of liquid can be atomized or fiberized on a single wheel. Also, rotation about the horizontal rather than vertical axis allows for a geometrically less complicated set-up when liquid droplets or solidified fibers are transported by the air flow. On the other hand, spinning wheel atomizers are significantly more difficult to model than the rotary (also known as centrifugal) atomizers with central liquid feed, namely the spinning discs, cups and vanes, due to the disintegration process being inherently unsteady and asymmetric, leading to very complex boundary conditions. For this reason, experimental as well as

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