Cleaning Performance of High Pressure Sprays at Short and Long Stand-off Distances

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Abstract

Utilization of high pressure aqueous sprays for various cleaning applications is usual practice in most process industries, for example for internal tank cleaning. Reducing energy costs and the downtime in production during cleaning, makes it desirable for the atomizer to be optimized for the cleaning application. Moreover, optimization leads to less water usage and minimizes the need to dispose of contaminated water. However such optimization cannot be currently achieved due to the relatively little experimental or modeling work on cleaning, and most of this has concentrated on the atomizer being close to the object that is being cleaned. There are cases within industry where efficient cleaning performance needs to be achieved at stand-off distance between 2m to 5m or more for cleaning relatively small and large storage tanks.

This paper describes a systematic experiment which characterizes the cleaning rates of a number of solid cone pressure jet atomizers with respect to impact force, mass flux and droplet size at stand-off distances up to 5m. Water pressures up to 80bar are used with water flow rates up to 40litres/min. Tests were carried out using both static and rotating sprays and the factors determining cleaning performance of the atomizers at different pressures and distances for removing various soils (e.g. toothpaste and hand cream) from a target plate were evaluated. It is concluded that, for static cleaning, soil removal rate correlates well with the product of peak impact pressure multiplied by water flow rate, and for rotating (transient) cleaning, the local cleaning rate has a more complex dependence on the structure of the impacting spray.

Key word: cleaning, high pressure sprays, stand-off distance

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