

CLEANING SMALL DIAMETER PIPES WITH ICE PIGS

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ABSTRACT

Pumping high fraction ice slurries through ducts results in high pressure losses and accompanying high wall shear. High local wall shear aids cleaning and removal of fouling from the wall. This process, known as ice pigging, has been investigated in relatively small diameter ducts (from 4 to 8 mm internal diameter). Small bore tubes are common in the beverage sector, especially in vending machines and in retail outlets such as public houses, cafeterias and clubs. One of the challenges with such small bore pipes is that the rate of melting is proportionally higher than in larger diameter pipes because of the high surface area to volume ratio.

This paper presents experimental work investigating the thermo-hydraulic performance of 'ice pigs' in small bore tubes, whose outer wall temperatures are maintained at ambient temperatures. Data are presented giving pressure loss and heat transfer characteristics for these tubes, as a function of velocity of the ice pig and ice fraction. A simple numerical model is presented which is able to reproduce some of the characteristic of the work, but which appears to leave some outstanding questions associated with the coupling of phase change and hydraulic performance unanswered. Limited experimental qualitative data indicating the cleaning value of the ice pig relative to water flushing are also presented.