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An experimental investigation on hydrocyclone underflow pumping

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Abstract

The efficiency of a hydrocyclone is highly affected by the inlet flow conditions. Any fluctuation in the feed flow rate or feed solid concentration directly changes the separation performance. The underflow is typically adjusted to overcome the variable conditions of the feed flow, thereby delivering desired performance. A pump in the underflow allows active control of the hydrocyclone separation performance through either providing back pressure or by pump suction.

The effects of underflow pumping at different inlet conditions are investigated experimentally. The ratio of the absolute underflow pressure to the overflow pressure is defined as pressure ratio P^* and is used to compare the results. The pressure ratio resulting from underflow pumping has a similar effect in hydrocyclones as changing the underflow pipe size. For instance, increasing the pressure ratio (less pumping in the underflow) is similar to decreasing the underflow pipe diameter. The operating parameters of flow ratio R_f and inlet solid volume concentration c are found to have significant effect on pressure ratio. A nonlinear model for predicting pressure ratio is found to be $P^* = R_f^{-0.2689} \exp(-0.0267c)$ and has a maximum uncertainty of $\pm 13\%$ for the conditions tested. This prediction could be useful for controlling the underflow to maintain the desired hydrocyclone performance under varying inlet conditions.

Keywords: hydrocyclone; underflow pump; pressure ratio; model; correlation;

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