ABSTRACT

The introduction of hydrocyclones to the industries has found tremendous importance in mineral processing applications due to its simplicity and effectiveness in classifying fine-particles based on the difference in their respective sizes. It is used as a size classifier while treating fine run-of-mine (ROM) ore samples. Particles of ROM sample can exhibit wide variations in their density along with size. Notwithstanding, the efficiency of a hydrocyclone is commonly evaluated in terms of cut size (d_{50}), determined from the separation efficiency curve drawn based on the experimental data, ignoring the effect of density differential between the particles. Even the popular mathematical models used for either predicting the selection of hydrocyclone for specific purpose or optimising the various parameters of new ore sample, expressed in terms the particle size as a function of density along with other variables. But factually, the particles in a hydrocyclone are separated based both on their size as well as density. In the present work, an attempt has therefore been made to evaluate the hydrocyclone performance by a unique parameter which will combine both particle size and density. In this regard, Reynold's number of particle (Re_P) is proposed for assessing the performance of a hydrocyclone using the partition curve based approach.

A well-planned and systematic set of experiments were carried out taking artificial mixtures of magnetite and silica sand(quartz) at different experimental conditions in a laboratory model 2-inch Mozley hydrocyclone connected to a closed-circuit test rig. The experimental investigations revealed a strong dependence of the characteristics of the performance curves on the individual densities of particles being treated. It was also demonstrated that the partition curve of individual particles differing in densities differ from each other as well as from their mixtures. It is also demonstrated that feed particle size and density distribution can be combined in terms of Reynolds number (Re_P) while assessing the performance of the hydrocyclone using the partition curve based approach. In this regard, a Re_P based efficiency curve was proposed. Advantages of using Re_{50} in place of d_{50} while selecting the appropriate dimension of a hydrocyclone for specific industrial applications have also been discussed. An empirical model based on Re_P has been retrofitted in the popular model proposed by Plitt.

Keywords: Hydrocyclone, Classifier, Partition curve, Reynold's Number, Settling Velocity, Cut size (d_{50})