ABSTRACT

Hydrocyclones are getting more and more interest from various industries. They are widely used to separate particulates from liquid at high throughput because of their advantages like simple structure, low cost, large capacity and small volume, require little way of maintenance and support structure. Hydrocyclones have been used for chemical and metallurgical process industries for last few decades. However to achieve high efficiency fluid flow characteristics need to be investigated thoroughly. Current study involves experimental investigation of separation performance characteristics of the hydrocyclone using new design parameters. For experimental purpose, a new hydrocyclone is designed with insertion of solid rod, at central portion of conical section of hydrocyclone, inside the hydrocyclone, by which air core is eliminated effectively and hydrocyclone performance is improved. This effect may be observed due to reduction of radial and axial components of velocity and turbulence in the area near the entrance of the vortex finder. Therefore, the flow field characteristics inside the hydrocyclone with no air core become more suitable for separation. Also the effect of flow rate, vortex finder depths, air core and particle interaction are studied experimentally. A new arrangement is suggested to eliminate the air core formed inside the hydrocyclone. In this case, effect of diameter and height of solid rod inserted inside the hydrocyclone with changing total inlet flow rate is studied experimentally. The diameter of the air-core formed inside the hydrocyclone is predicted in the range of 0.9 to 1.2 cm. In the present study, an attempt had been made to develop a CFD model to predict the flow patterns in the hydrocyclone, including prediction of the air-core formation. The separation efficiency predicted by CFD simulation of the hydrocyclone is quite good agreement with the experimental values. The maximum separation efficiency of 40% without air-core and 34% with air-core is observed for lighter particles with vortex finder depth 6.3 cm. In this work an attempt has been made to augment the performance efficiency by using spiral ribs. Spiral ribs of 25.4 mm improved the efficiency of the hydrocyclone by nearly 15%.

Keywords: Separation Efficiency, Hydrocyclone, Air-Core, Particle Separation, Water Purification, Performance Evaluation, CFD Simulation, Flow Profile, Multi-Phase Flow