ABSTRACT

Centrifugal pumps, because of their inherent advantages of high and consistent flow rate, low cost, ease of maintenance and operational stability are being increasingly used for pumping slurries through pipes. The effects of suspended particles of solid materials on the centrifugal pumps are the major consideration in the slurry handling system design. The optimum design and operation of the slurry handling system require a good level of confidence in predicting the effects of suspended solids on the pump performance.

In the present investigation, the individual effect of concentration of solids, particle size of solids, particle size distribution of solids and specific gravity of solids on the centrifugal pump performance have been made. The solid materials used for slurry preparation were sand, mild steel, coal, iron ore and zinc and the specific gravity of materials were 2.65, 6.238, 1.49, 4.348 and 5.51 respectively. A new correlation to predict the head loss for centrifugal pumps handling solids has been developed which takes into account the effects of specific gravity of solids, size and size distribution of particles and concentration of solids. The range of validity of the equation has been verified by experimental data obtained after conducting experiments on a especially designed and fabricated test rig and also using the experimental data available in the literature. The new correlation implicitly takes care of the effects of the geometry of the pump and the shape factor of the solid particles as well as the effect of particle Reynold's number in a unique manner. Attempt has also been made to investigate the effect of the pump speed on the head ratio and the efficiency ratio of the pump.

Cavitation characteristics is another important feature for designing a pumping unit. Hence, experiments have been conducted to get an insight into the dependence of the net positive suction head requirement for different slurry conditions.

There are several water soluble long chain high molecular weight polymers and soap solutions, which have the ability to reduce the frictional resistance in the turbulent flow regime. Keeping this fact in mind, the effects of "guar-gum" and "surf-ultra" on the centrifugal pump performance has been investigated. The degradation characteristics of the "guar-gum" have also been investigated.

KEY WORDS: Centrifugal, Transportation, Pump, d_{50}, d_{Wn}, Particle, Density, Solids, Slurry, Concentration, Performance, Characteristics, Head, Efficiency, Discharge, NPSH, H_R (Head ratio), E_R (Efficiency ratio), K (Head reduction factor), Polymer, Guar-gum, Surf-ultra, Degradation, Turbulent.