

Dished-base Tank as an Alternative Geometry for

Solid-Liquid Suspension

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Abstract Solid particles distribution for solid-liquid suspension is studied in flat-base and dished-base stirred tanks using fine lightweight particles of Poly Methyl Methacrylate (PMMA). The PMMA particles are spherical in shape with Sauter mean diameters of 18.0 μm , 75.3 μm and 195.5 μm as the solids phase was suspended in the water as the liquid phase. The solids concentration was varied from 5 to 40 percent by weight. The impellers used were a 4-bladed pitched paddle (4PP) and SATAKE novel impellers of a 3-bladed HR100 impeller and a 4-bladed HS604 impeller, all of diameters to tank diameter, $d/D = 0.5$. The HR100 is a three-blade impeller for which the blades are bent at various angles to create higher axial motion. The HS604 is a radial impeller with four large blades of unique design. The 4PP impeller and HR100 impeller were placed at a fixed clearance, $C/d = 0.5$, whereas the HS604 impeller was used at a single clearance, $C/D = 0.02$. The tanks with internal diameter of 155mm were equipped with four standard baffles at an aspect ratio of 1:1 with water. The sequence of particles suspended from the tank base until achieving just-suspension speed (N_{js}) is found to be dependent on the bulk flow pattern in the stirred tank, which is in turn predominantly governed by the impeller to tank geometry. The bulk flow pattern is similar for both tanks in a given reactor configuration and impeller geometry. A different shape of tank base interacts with impeller, producing slight differences in the flow close to base thus resulting in differences in energy efficiency for solids suspension. The results showed also that the flat-base tank is more energy efficient, in terms of power demand than the dished-base tank for attainment of complete suspension. However, it is interesting to note that by changing the impeller to HS604 impeller, energy efficiency in dished base tank is enhanced remarkably. The choice of a suitable impeller design, as well as its optimal mixing configuration is extremely important in regards to produce highly efficient flow pattern for attainment of complete suspension at minimum power input. Thus, the dished-base tank is a possible option to consider in solid-liquid suspension provided it is used with the right impeller geometry, diameter and very fine particle size.

Keywords Solid-liquid mixing, Particles distribution, Flow pattern, SATAKE impeller