Chemical Engineering Science (2003), 58(10), 2123-2140

Solids Suspension in Stirred Tanks with Pitched Blade Turbines

Sharma, Rajendra N.; Shaikh, Abdullah A

Department of Chemical Engineering, King Fahd University of Petroleum & Minerals, Dhahran, Saudi Arabia

Abstract

In view of developing a universal correlation for critical speed of suspension, extensive suspension experiments were conducted with tank scales in the range of 15-121 cm, D/T from 0.083-0.625, by using four different sizes of spherical glass beads and employing pitched blade turbines with four and six blades as the impellers, where D is the impeller diameter and T is the tank diameter. The periphery of the tank bottom was modified to include a permanent fillet in order to eliminate the effect of induced recirculation loop, which account for the formation of peripheral fillets of unsuspended solids. The critical speed of suspension, Nc, and power, Pc, were observed to vary independently both with D and T to give two correlations for each of the variables, Nc and Pc; one for the close proximity impeller operation where both Nc and Pc remained invariant with off-bottom impeller clearance and the second for the region where Nc and Pc were affected significantly by the impeller position. The effects of the physical characteristics of the solids were also included in the four correlations so proposed. It was clearly noticed that the correlations were valid up to a critical value of D/T beyond which the trapped particles in the stagnant zone below the impeller needed extra energy to be raked out and suspended, thus breaking the log-linear relation between Nc (or Pc) and D/T hitherto maintained. Comparisons of the suspension speed and power were made with open literature. More importantly, the reasons why the earlier studies differed with each other in Nc-predictions were identified.