Gas Handling and Power Consumption of High Solidity Hydrofoils: Philadelphia Mixing Solution's HS and Lightnin's A315 Impellers

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Abstract

Gas-Liquid mixing and mass transfer is very important in many chemical processes. When solids are present and need to be suspended, axial flow impellers are usually used. Because of the large amount of solids that need to be processed in the mining industry, gassed applications tend to be very large. For example, the BIOX process has some of the largest aerators in the world. Knowledge of the effect of gas on the impeller power, and the impeller's ability to handle the gas is so important, because mistakes can be very costly at this very large industrial scale. Tank volumes of 1 million gallons are not uncommon and with mixer powers as low as 1 Hp/1000 gallons, gearboxes and motors need to be designed for 1000 Hp and more. Being too conservative with sizing is not a very competitive option. Unlike the Rushton and Smith Turbines, very little is known about the power characteristics of gassed axial flow impellers. Axial flow impellers seem to have constant flood point aeration numbers. This may be due to the limited published studies on axial flow impellers.

The present study evaluates the applicability of using functionality in Acusolve (a CFD program from Acusim http://acusim.com/) for approximating the gas/liquid mixing problem with comparison to actual experimental data. The functionality in Acusolve that is being used is scalar transport equations, full variable density formulation, variable density model as a function of scalar concentration, and variable viscosity as a function of scalar concentration. The ultimate objective is to evaluate impeller power variations, gas flooding, etc as a function of operating conditions involving impeller speed and gas flow rates and compare the approximation to actual experimental data.

Comparison of the Philadelphia Mixing Solution's HS and Lightnin's A315 impeller is made experimentally and by CFD. Examples will include K-Factor and flood point determinations. Then by using CFD we will show one example how CFD is used to predict the performance of a large scale industrial aerator.

keywords: Gas-liquid mixing, aeration, K-Factors, flood point, Acusolve, CFD, HS, A315, high solidity axial flow impellers, scale-up

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Do you anticipate submitting a full paper to the special Mixing issue of the Canadian Journal of Chemical Engineering? No - If we did, when would that be do?