Effect of Geometric Variations on the Performance Of Gas Dispersion Impellers with Semicircular Blades

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Abstract

For the most part, impellers have fixed, standard geometric dimensions; however, there are times when impeller geometry is altered to optimize performance. Variations in impeller geometry are most commonly encountered in gas dispersion applications for which process success relies heavily on agitator design. The best gas dispersion impellers currently available are those with concave blades, and because of the complex nature of gas dispersion, effects of changes in impeller geometry are not always intuitive.

Although impeller diameter and rotational speed are the primary parameters used to manipulate agitator torque and power input, it is also possible to impact gas dispersion performance by varying blade width and blade number. An example of applying this approach occurs when it is not possible to increase speed or impeller diameter, but higher power input is required to increase the rate of interphase mass transfer. In this instance, higher power input can be achieved by increasing the blade width and/or number. Conversely, lower torque may be desired to reduce the capital expense of an agitator, and narrower or fewer blades may be used at a higher speed to meet process objectives with a lower torque agitator. Variations in gas dispersion impeller geometry may be encountered under different circumstances:

- Optimization of a new agitator design
- Retrofitting an existing installation to improve performance
- And altering an existing impeller (gas dispersion impellers are often built with blades that can be moved radially to change the impeller diameter which also changes the blade width to diameter ratio as well as the disc diameter to impeller diameter ratio).

This work reports the effects of blade number, blade width to impeller diameter ratio, and disc diameter on the performance of impellers with semicircular blades. The performance parameters studied include ungassed power number, gassed to ungassed power draw ratio, and gas dispersion speed, torque, and power requirements.

keywords: concave disc impeller, gas dispersion, gassed power, disc impeller geometry effects

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