“Next Generation Impeller Configuration to Address Phos Acid Reactor Foaming”

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Abstract:

Philadelphia Mixing Solutions, Ltd has previously developed and presented (AIChE 2017, AIChE 2014, Symphos 2011) an impeller configuration that addresses the crystallization of gypsum and other minerals on the inside of Phosacid Reactor walls and floors. Tin addition to keeping the tanks clean the configuration has proven to last more than 14 years without the need to replace or repair the impellers. The Mixer Drive life has also been extended to beyond 14 years. The next challenge to address is the removal of the foam generated as a byproduct of the reaction. Operating a reactor with a layer of foam can make controlling liquid levels challenging and act as a boundary for entrained gas from escaping. Traditional Reactor designs often use what is known as a foam breaker operating at the surface of the liquid level in conjunction with a defoaming agent. From our field investigations foam breakers do have some success with keeping the surface free of foam however they do introduce splashing resulting in gypsum being deposited on the walls and ceilings of the Reactor above the liquid level.

Computational Fluid Dynamic (CFD) modeling will be used to show how the next generation impeller configuration was developed to address surface foaming and subsurface gas entrainment while maintaining the subsurface performance. Reduced scale lab testing has been performed to reproduce the chemistry taking place in a reactor. The testing showed the next generation impeller configuration was able to remove the surface foam and subsurface entrainment gas with the use of a defoaming agent. There was no evidence of splashing therefor gypsum buildup on the walls above the liquid level would no longer be a concern. Testing was repeated however this time without the addition of the defoaming agent. The results showed the next generation impeller configuration effectively removed the surface foam and the subsurface entrained gas.

Chemistry is not dependent on size of the reactor. With proper scale up rules being followed a full scale reactor would perform with the same results as the lab scale. The results would be a reactor that is free of unwanted ceiling, wall and floor crystallization and can operate without the addition of defoaming agent.