JACOBY·TARBOX®
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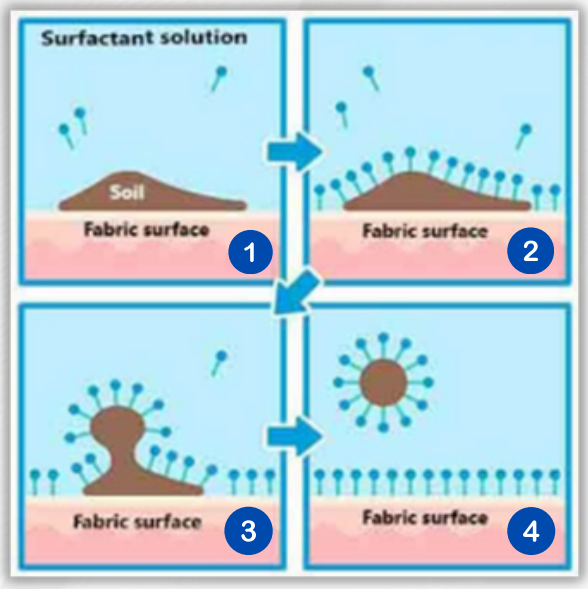
Mixing and Blending HLAS for Laundry Detergent Production

Mixing is an integral part of many chemical production processes. In addition to conventional mechanical, or bladed, mixers, there is another category. Venturi-based mixers, or tank mixing eductors, are low-shear mixing devices that uses the existing energy within fluids to move and mix material instead of physically impinging on the fluid like mechanical mixers. The low shear process is also referred to as blending. One example of an application using tank mixing eductors is in the production of laundry detergent.

Linear alkylbenzene sulfonic acid, often abbreviated as LABSA or HLAS, is essential in the production of laundry detergent for over 70 different brands. When combined with sodium carbonate particles, it becomes the most widely used anionic surfactant in the world. The reason why surfactants are essential in laundry detergent is illustrated below.

1. A surfactant is a chemical that lowers surface tension in which each surfactant molecule has either a hydrophilic (water-loving) or hydrophobic (water-fearing) component.
2. Soiled laundry is initially agitated with water and detergent. The surfactant molecules from the detergent cling to the soiled surface of the fabric.
3. As agitation occurs, more surfactant clings onto the soiled surface of the fabric.
4. Finally, the surfactant molecules are able to fully remove the dirt or oil from the fabric surface.



HLAS needs to be agitated to maintain its chemical efficacy prior to the addition of other chemicals for the production of laundry detergent. Tank mixing eductors are able to provide the low sheer agitation necessary to move HLAS product within the tank. If there is high sheer within the product, air is introduced in the chemical, which is undesirable.

According to a renowned manufacturer that produces laundry detergent, they prefer tank mixing eductors versus mechanical agitation due to their low cost and maintenance. Existing pumps used for filling and emptying tanks along with transferring chemicals from one process to another can be repurposed for mixing by adding a transfer valve to feed flow to the tank mixing eductors for the mixing they need, thus reducing electrical components. Tank mixing eductors not only reduce cost but time as well. If there are leaks from the connections from side entry mechanical mixers, operations are forced to shut down to remediate the situation. This reduces product output.

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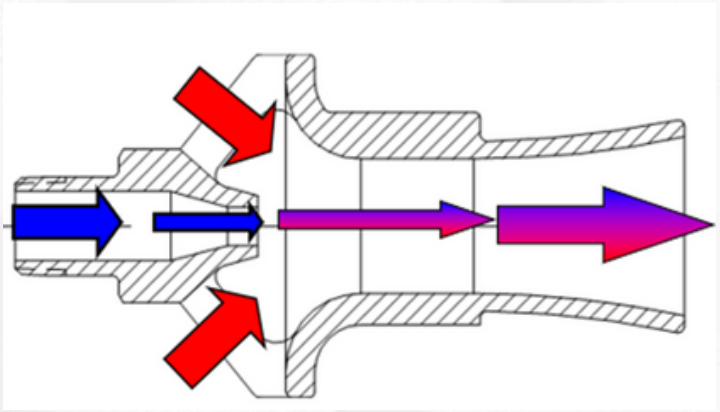
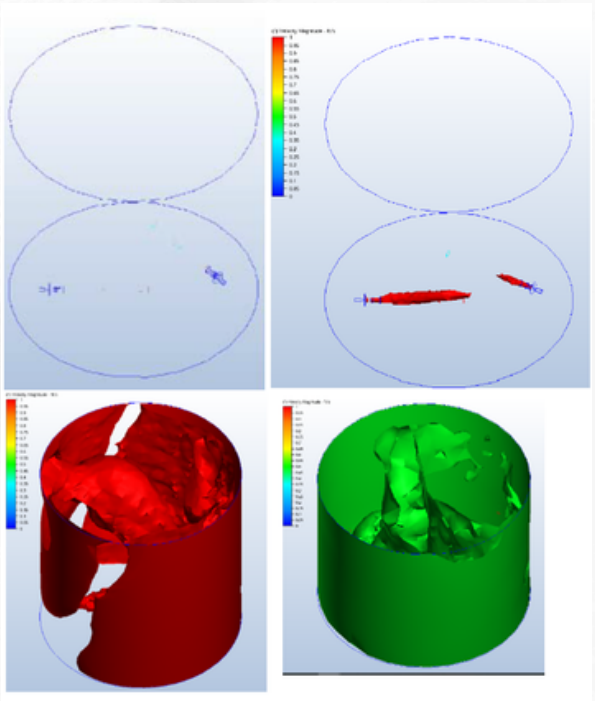
Since detergent touches our skin from the fabric that it's washed in, there needs to be a cleanability factor in how the chemical interacts with process instrumentation. The tank mixing eductor needs to be mechanically polished and electropolished, plus have hygienic connections that will not introduce bacteria within the system. The tank mixing eductor below has a mechanical to 20 Ra, is electropolished, has a 4" hygienic (tri-clamp) tank connection, and a 1.5" hygienic recirculation connection. Once the tank mixing eductor is submerged in the HLAS and other tank liquid, the tank chemical is pumped through the eductor, which will entrain the liquid surrounding the eductor, ultimately pumping four gallons for the cost of pumping one. This pump amplification device creates a flow field in where the pumped and entrained fluid create movement and circulation within the tank.



To ensure mixing efficiency, CFD (computational fluid dynamics) can be used to model the tank and mimic flow within the tank where the flow parameters are input into the software. The model breaks down velocities within the tank at various spots at various times. By combining the model information with system design experience for the goal of mixing requested, recommendations can be made for placement, quantity, and angle of the tank mixing eductors within the tank. The CFD example (right) shows the average velocities at specific times of agitation for this specific application.



In conclusion, tank mixing eductors can efficiently move liquid and keep temperature unified for HLAS. The tank mixing eductor can mix with low sheer while maintaining the necessary velocities within the tank to support the chemical reaction. Mixing systems with tank mixing eductors have a much higher return on investment (ROI) because they can use pumps that are already filling and emptying the tank and they also reduce maintenance time due to having no moving parts.

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