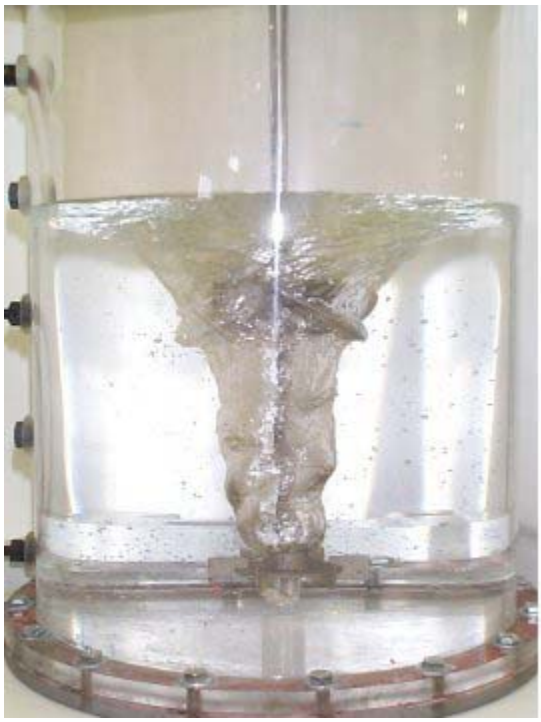
The Importance of Being Properly Baffled

Two recent applications demonstrate the importance of correct tank baffling to optimize the process results. The first example involves air entrainment from the fluid surface and the second is a heat transfer problem.

Eaglebrook Chemicals, a manufacturer of ferric & ferrous chlorides, ferric sulfates and aluminum-based coagulants, were investigating the viability of producing a new product.

The process would require gas to be absorbed into a liquid. In addition to a mixer and gas compressor, a system to disperse the gas into the vessel and the associated ancillary equipment would be required. If their R&D lab could prove a simplified system would produce the product to specification, this would ensure full-scale production would proceed.

In our lab we demonstrated that with the right size, speed and combination of impellers, in conjunction with the correct tank baffling, a mixer could draw a significant amount of gas from the surface and distribute it uniformly throughout the tank. This eliminated the need for a gas dispersion and feed system.



Upper AH with lower RDC impeller in an unbaffled tank creating a very large vortex but providing very little dispersion.

Same system with fully baffled vessel showing good gas incorporation and dispersion.

The demonstration convinced Eaglebrook to build a pilot system based on this model.

We then scaled-up the lab size (5 gal) mixer for the pilot reactor vessel of 60 gal. After 2 months of operation, the pilot system proved itself successful and the go ahead was given to build a plant size system. The mixer was then scaled up for the 8000 gal reactor, which resulted in a 50 HP unit with an upper 4AH45 hydrofoil and a lower 6RDC90 radial impeller.

The system not only proved to be simplified with lower capital and operating costs, but also more dependable

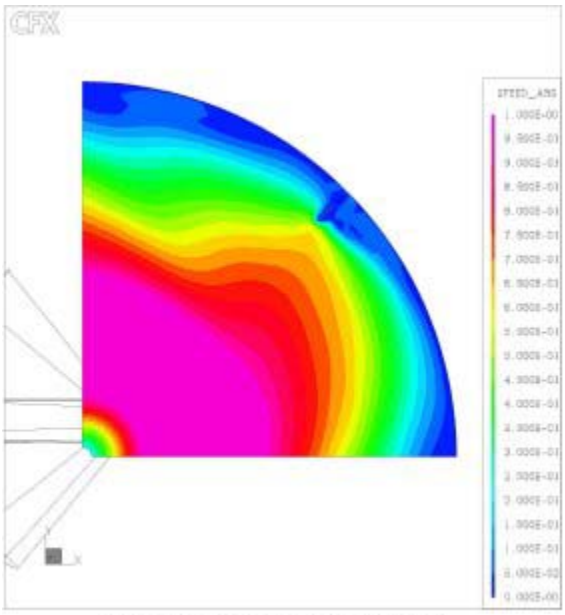
due to a less complicated assembly, i.e. fewer pieces of equipment.

The second application involved a heat transfer problem a large tobacco company was experiencing. The steam jacketed flavor tank and mixer were to ensure quick even heating of the product.

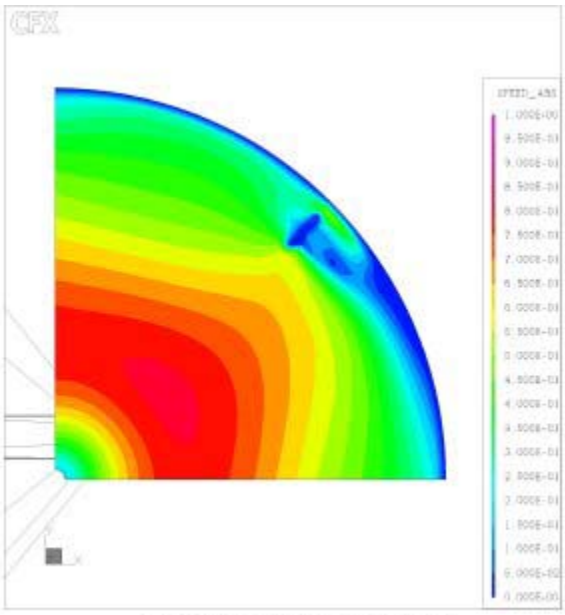
However, due to a lack of fluid movement at significant sections of the walls, the product was “cooking” onto the interior. Every 3-4 months the system was forced down because the “cooked” product was preventing heat transfer from occurring. The tank was drained and the walls were manually scraped down.

Putting our CFD to work, we initially modeled the existing situation and then compared a number of mixer and baffle modifications.

One modification considered was to simply move the four baffles further off the tank wall. By increasing the clearance from 0.5” to 2.5”, a dramatic improvement of wall velocity was predicted.



5" Baffle with 0.5" Wall Clearance



5" Baffle 2.5" off the tank wall showing increased wall velocities

While this alone would have proved to be very beneficial, we also replaced the single 52” axial flow impeller with dual 43” radial flow impellers to improve fluid flow around the protruding tube bundle, which was also part of the heating system.

All indications are that the modifications were a definite success, we just need to know by how much. After approximately 4 months of operation (the time of this article) the tank had not yet been shut down for cleaning.