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Shear in Mixing

Shear is a widely misunderstood and often a misrepresented principle component of fluid mixing. Many of the misconceptions are routinely passed along from generation to generation of users. Shear rate is defined as velocity gradient. Particles in fluids or just fluids put under stress as a result of differing velocities. Throw a rock at a can sitting on a fence. If the rock hits the can, the can gets knocked off its perch. If the can was moving at the same velocity and same direction as the can, there can be no stress imparted to the can. It is pretty simple.

Now let's examine how some users of 'high shear mixers/dispersers' apply their equipment. The majority of times, the operator puts the mixer in position to create the maximum vortex of the fluid. Once the fluid is put into a vortex, all fluid and particles are moving in the same direction at the same velocity with the only exception being at the wall of the tank and near the mixer shaft where minimal interference is created.

This approach and mis-application accounts for the reason that many high shear mixing devices seem to defy the laws of physics. Users routinely increase rpm of the mixer or the impeller blade diameter with little effect on power draw or on process results. However the vortex gets 'bigger' and/or faster. Psychologically it's great. In reality there is little to no effect on process results. I've learned from dealing with thousands of users in dozens of industries that this message is often not welcome news. The myth of the vortex has been carried down for generations and the truth of its uselessness is simply too much for users to bear.

Be that as it may, the fact is, shear is velocity gradient. If there is no gradient, but only velocity there is no shear.

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