



Technical Paper

Mixers

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Design of submersible mixers for highly viscous fluids in ponds of any shape

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Summary

The typical application of submersible mixers is in the agitation of sludge in waste water treatment. In the case of a high dry substance fraction in the sewage sludge, a high-viscosity rheology can strongly influence the stirring process in a mixing pond. The structural consistence of the sludge leads to non-Newtonian (shear-thinning) flow properties which additionally complicate the design of such a process.

The Institute of Fluid Machinery and Fluid Mechanics of the Kaiserslautern Technical University has developed and put into operation a test facility which enables the examination of submersible mixers in non-Newtonian fluids. The stirring success is quantified by measuring the velocity distribution in the pond. The measuring system includes an acoustic Doppler velocimeter and a linear positioning system which allows the collection of velocity data as a vectorial flow field in any plane of the pond. Xanthan gum, a shear-thinning biological thickening agent applied in cosmetics and pharmaceutical industries, is used for modelling the sewage sludge in the tests. The conceptual design of the test facility makes it possible to change the pond shape from rectangular to circular. The loading of the mixer is identified by measuring the axial thrust and the torque.