



# Technical Paper

## Mixers

### Session 5-3

## Influence of aeration on the operating conditions of mixers in activated sludge tanks

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## Summary

The activated sludge tanks used in some waste water treatment plants have extremely large volumes, so that pertinent numerical studies have to be reduced to the essentials.

The aeration equipment needed for the waste water treatment process is placed on the tank floor. The flow induced by the buoyancy of the air bubbles is superimposed on the base flow generated by the mixers in the tank, hence resulting in a complex flow pattern.

Nowadays, mixer manufacturers have to warrant that their product is capable of producing a specific base-flow velocity in the tank and that it will operate reliably under any given operating conditions, e.g., when the aeration system is in operation.

Compliance with these requirements presupposes an understanding of the quality of the flow produced. Due to the large tank volumes, even the most intricate measuring set-ups can only capture part of the information that is needed to understand the resultant flow conditions.

Numerical flow modelling, by contrast, makes it possible to fully illustrate the flow structure under changing conditions. Provided that all major physical factors are taken into account, experience has shown that the numerical results obtained are very accurate.

Within the existing range of computational fluid dynamic (CFD) programs, a multi-phase model suggests itself for use. Multi-phase models, however, require substantial computing effort and are unstable due to the large tank volumes involved. This makes them accordingly difficult to use. To prevent this, a user-defined function (UDF) has been added to the software "Fluent" required for calculating the air-induced flow.

The resultant increase in computing effort is minimised by concentrating on the physically necessary program extension.

To demonstrate the efficiency of this method, its results are compared with actual measurements and observations. The characteristic flows obtained in the CFD analysis are illustrated and their effects on tank selection and on the operating conditions of the mixers are analysed. The calculations have yielded insight into the complexity of sub-surface flow patterns in large activated sludge tanks.