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for sustainable water technology

Vortex treatment of water in a hyperbolic geometry

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Motivation

Over recent years, the ideas of the Austrian forester and bionics pioneer Viktor Schauberger about water and vortices have gained renewed attention. Many individuals and companies are building devices for various purposes and making claims regarding water quality, gas intake and alike. Scientifically, the vortex is still an poorly understand phenomenon. Solving Navier-Stokes equations directly only works for the simplest of geometries, like the flow in a rotating cylindrical container [1].
In a hyperbolic funnel the gas-liquid interface is of special interest. The interface can extend all the way to the outlet resembling a helix or standing wave pattern (fig. 1). In addition a hyperbolic vortex can be created using special rotors in otherwise stagnant water. In both cases the combination of rapid mixing and large interface may indeed make this type of vortex suitable as an efficient aeration device. Currently, 50-70% of the energy of wastewater treatment plants is used for this purpose. Vortices may also be used for particle separation purposes, as heavy particles move to the center, where they can be removed.

Fig 1. High speed camera image of air-water interface in hyperbolic funnel

Technological challenge

PIV measurements will be performed to study the flow structure of a vortex in a hyperbolic funnel. The existence of an Ekman boundary layer will be determined and the tangential velocity is compared to viscous theoretical models.
Furthermore, we want to study the effects of viscous heating and the time evolution of quantities like pH, conductivity, evaporation and gas intake. We are interested in the possibilities for vortex cavitation and its effects on the water.
Parallel to these measurements, numerical simulations will be performed on these geometries using the ANSYS software (fig. 3). This may help us understand the link between theory and observation.

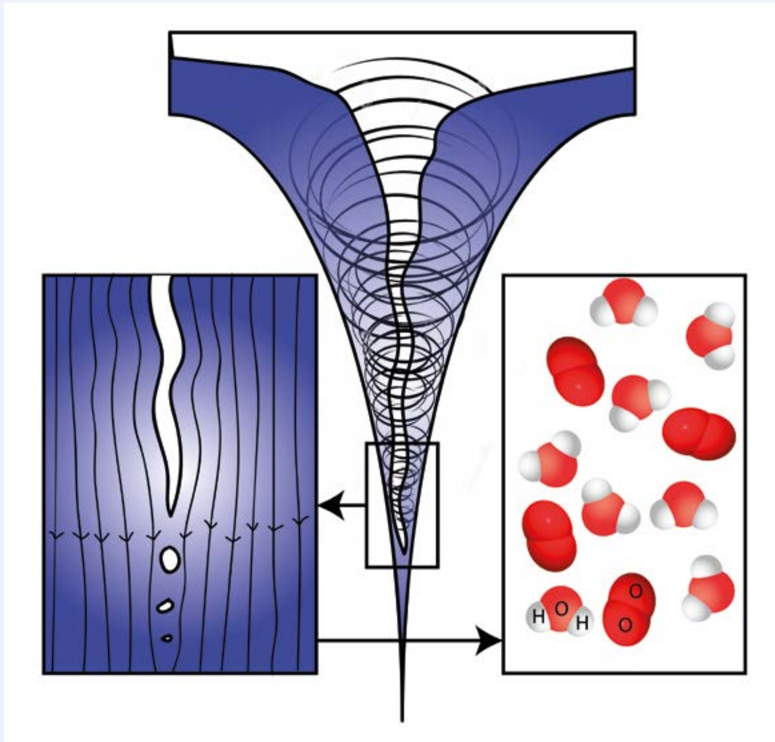

Fig 2. Air bubbles may get detached from the central column and are efficiently dissolved in the water

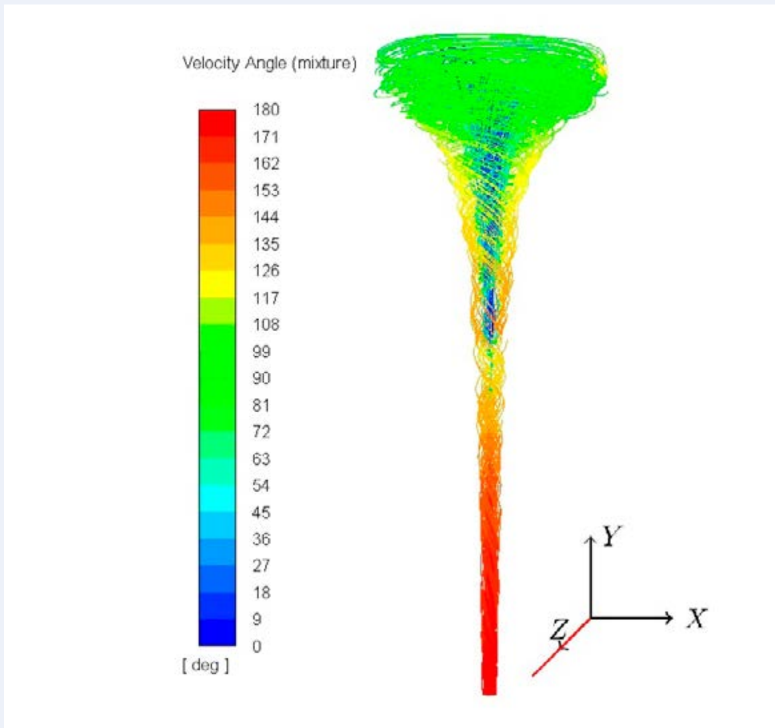

Fig 3. ANSYS Simulation result for velocity angle in degrees between flowlines and y-axis.

Research goals

- Create, measure, calculate and simulate the flow pattern in a hyperbolic vortex
- Investigate influence of the vortex on physical and chemical properties of water
- Investigate the applicability of hyperbolic vortexing as aeration mechanism
- Understand the importance of the hyperbolic geometry (if any)

[1] A. Andersen et al., Phys. Rev. Letters (2003)

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