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Mechanical Helminth Eggs Separation for Wastewater Purification: Analysis of the Fluid Dynamics

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Extended Abstract

Around 900 million people in developing countries now live without access to clean drinking or industrial water. Water-borne pathogens cause particularly high death rates in children and immunocompromised people. In this context, the helminth eggs are of particular importance. Sedimentation is a widely used method for mechanical cleaning of wastewater. In order to use the sedimentation principle effectively, the sinking behavior of the particles should be known. In the case of the small sewage treatment plants, the question is more complex, as the residence times are shorter and the existing, possibly turbulent flow fields play a greater role for the movement of the pathogens. An overview on the problematic of parasites in wastewater solution methods was presented by Cornel and Kneidl [1]. The aim of the present research is the development of a validated computer simulation model to determine the sinking behavior of helminth eggs and its application to predict the separation characteristics of a small sewage treatment plant with a subsequent optimization of the separation behavior of helminth eggs in this plant. Experimental and numerical investigations are carried out. The numerical work is based CFD procedures. The experiments comprise measurements on a small sewage treatment plant.

Different sedimentation processes have been numerically investigated in many different areas of application by different authors [2]. A possibility of a detailed numerical modeling of the separation process within a CFD framework is given by the formulation of the wastewater as a two-phase mixture, where the trajectories of the particles are calculated by a Lagrangian formulation, whereas the water is treated by an Eulerian formulation [3].

In previous studies of this type, no special attention was paid to an accurate consideration of the shape of the particles. In calculating sink velocities, the well-known Stokes law was used, which is valid for spheres. However, helminth eggs have different shapes and the Stokes law is not necessarily sufficiently accurate for them. Thus, a focus of the present work is the determination and use of more accurate laws for the sink velocity (or drag coefficient) for helminth eggs, depending on their specific properties. To this purpose, the experimental data provided by Sengupta et al. [4] is taken as basis.

References

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