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Prediction of water aeration efficiency in high turbulent flow

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ABSTRACT

This paper presents the study of a complex turbulent flow with disperse gas–liquid flow with adverse pressure gradient, where the mass transfer through the interface is a dynamic process associated with the interface' dynamics, and the interface's aria varies along the flow. The experimental setup is equipped with a disperse aeration device, fitted with interchangeable perforated plate. The air flow is injected as disperse bubbles of different sizes at different air flow rates through the performed plates. This paper presents the aeration performances of four disperse aeration devices, mounted non-invasive on the wall of a pipeline. The water flow corresponds to Reynolds number in the range 1×10^5 to 5×10^5. The objective is to find the optimal aeration device to increase the transfer of the dissolved oxygen content in water, with a minimum power and volume of injected air. The following parameters are considered: the dissolved oxygen deficit from the water, the air–water interface area, pressure losses of the aerator, aerator design and the contact time of the two phases. The aeration devices are tested for different void fraction and the following parameters are obtained: volumetric mass transfer, standard oxygen transfer rate, standard oxygen transfer efficiency, power consumption for air injection and standard aeration efficiency. Finally, a comparative study on the *kLa* performance of several types of aerators is presented.

Keywords: Air injection; Disperse aeration device; Aerator; Dissolved oxygen; Oxygen transfer; Rotational biphasic flow; Turbine aeration

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