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Experimental and CFD Simulation of the Jet Pump for Air Bubbles Formation

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Abstract : A jet pump is a type of pump that accelerates the flow of a secondary fluid (driven fluid) by introducing a motive fluid with high velocity into a converging-diverging nozzle. Jet pumps are also known as adductors or ejectors depending on the motivator phase. The ejector's motivator is of a gaseous nature, usually steam or air, while the educator's motivator is a liquid, usually water. Jet pumps are devices that use air bubbles and are widely used in wastewater treatment processes. In this work, we will discuss about the characteristics of the jet pump and the computational simulation of this device. To find the optimal angle and depth for the air pipe, so as to achieve the maximal air volumetric flow rate, an experimental apparatus was constructed to ascertain the best geometrical configuration for this new type of jet pump. By using 3D printing technology, a series of jet pumps was printed and tested whilst aspiring to maximize air flow rate dependent on angle and depth of the air pipe insertion. The experimental results show a major difference of up to 300% in performance between the different pumps (ratio of air flow rate to supplied power) where the optimal geometric model has an insertion angle of 60⁰ and air pipe insertion depth ending at the center of the mixing chamber. The differences between the pumps were further explained by using CFD for better understanding the reasons that affect the airflow rate. The validity of the computational simulation and the corresponding assumptions have been proved experimentally. The present research showed high degree of congruence with the results of the laboratory tests. This study demonstrates the potential of using of the jet pump in many practical applications.

Keywords : air bubbles, CFD simulation, jet pump, applications
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