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A NUMERICAL ANALYSIS OF THE XYLEM FLOW BIO-MIMIC BUBBLE REMOVAL TECHNIQUE

Abstract

Fluid dynamics' two-phase flow is a complex subject that is crucial for engineering applications. Gas-liquid fluxes are the type of two-phase flows that are most frequently encountered. Bubble formation in such flows is an undesirable occurrence in many critical systems such as active thermal control, bacteria culture using microfluidics, lab-on-chip devices of various applications, etc.

The current study has been aimed at solving the issue of bubbles in microfluidics by geometrical modifications. Angiosperm xylem conduits have the capacity to clear bubbles from congested channels. The analogy of the same used to trap and saturate the bubbles in a microfluidic flow has been experimented with by Guo et al. [1] The current study presents the numerical analysis of the bio-mimic in the bubble removal process. The fact that this type of bubble removal process is dependent on the solubility of a gas in the given liquid medium; the effect of the same would be reflected in the quality of the fluid after the dissolution of the gas. The effect of different pit geometry on the quality of fluid through diverging channels where the flow can be considered compressible has been analyzed. The analysis has been carried out with different pit sizes and their effects on the quality. The effect of channel (and hence the effect of flow rate at constant velocity inlet) width on the effectiveness i.e time required for the dissolution of bubbles has been enquired. The effect of microgravity on the quality and bubble removal time has also been analyzed in this research.