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# Influence of operating conditions and liquid phase viscosity with volume of fluid method on bubble formation process

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**Abstract**

In this paper, a numerical study of air bubble formation and detachment in water (S-1) and in glycerin solutions (S-2 and S-3) was investigated using the volume of fluid (VOF) method. The full formation process was studied under the effect of operating conditions such as wettability of the orifice plate (static contact angle $\theta_S$), orifice diameter and orifice air velocity. In addition, the influence of the viscosity of the liquid phase was examined. The numerical simulations were carried out for different orifice velocities satisfying the quasi-static bubble growth condition at low Capillary and Bond numbers. Under such conditions, the surface tension effect is dominant over viscous drag and buoyancy effects. The bubble growth at different instants predicted by the VOF simulation was experimentally validated in water. During the expansion/elongation stage significant bubble shape oscillations have been observed by the simulation. In water, bubble shape is mainly dominated by inertial and surface tension forces, and the influence caused by the viscous drag force could be neglected. However, when the viscosity of the solution increases, the bubble shape oscillations can be reduced due to the effect of viscous drag force.

*Keywords*: Bubble formation; Shape; Aspect ratio; Formation time; Volume of fluid.

## 1. Introduction