

CHAPTER VI

CONCLUSIONS

The experiments were carried out on the two-phase upward flows consisting gas and liquid in a vertical tube with three different inside diameters (10.75, 19, 53.15 mm) and 3 m in length for air-water, air-(C₈H₁₇-C₉H₁₃NCl) solution and air-(C₁₆H₃₃-C₉H₁₃NCl) solution in order to investigate the influence of pipe diameter and surfactant addition on the flow regimes, the corresponding pressure gradients, the bubble/slug size and the velocity.

The boundaries of the flow regimes for the same Re_{water} increase nonlinearly with increasing tube diameters. The boundaries of the bubble-slug and the slug flow regimes in (C₈H₁₇-C₉H₁₃NCl) solution (1CMC) shifted to the smaller values relative to those of pure water because of surface tension effect. $Re_{\text{air,critical}}$ for the bubble-slug flow regime of (C₈H₁₇-C₉H₁₃NCl) solution at 1 CMC is slightly lower than those of (C₈H₁₇-C₉H₁₃NCl) solutions at 2 CMC and 3 CMC because of the viscosity effect. And $Re_{\text{air,critical}}$ for the bubble-slug and the slug flow regimes increases slightly with increasing the carbon length.

The friction factors or the dimensionless pressure gradients are distinctively different depending on diameter and type of liquids used (water, (C₈H₁₇-C₉H₁₃NCl) and (C₁₆H₃₃-C₉H₁₃NCl)). The differences may be traced back to the differences in the bubble/slug sizes, the Eotvos number, and property parameter, Y .

The normalized bubble or slug dimension for pipe diameter of 10.75 mm is always greater than those of the pipe diameter of 19 mm and 53.15 mm at any Re_{air} and Re_{water} . The normalized bubble or slug sizes for pure water are greater than those of (C₈H₁₇-C₉H₁₃NCl) solution and (C₁₆H₃₃-C₉H₁₃NCl) solution because of the effect of adding surfactant can reduce the surface tension and the tendency to coalescence between air bubbles. The effects of surfactant concentrations and carbon tail length have no effect on the bubble sizes. At high Re_{air} , the slug height increases with increasing (C₈H₁₇-C₉H₁₃NCl) concentration implying the effect of reduced surface tension and the slug height increases with increasing carbon tail length due to the carbon tail length effect.

The normalized bubble and slug velocities for pipe diameter 10.75 mm are always greater than those of pipe diameter of 19 mm and 53.15 mm, again reflecting the conservation of air mass. The normalized bubble or slug velocities for (C₈H₁₇-C₉H₁₃NCl) for 1, 2 and 3 CMC are higher than those of pure water implying the surface tension effect. The bubble and slug velocities increase with increasing surfactant concentration. And the bubble or slug velocities increase slightly with increasing carbon tail length.