CHAPTER I

INTRODUCTION

A phase is simply one of the states of matter that can be gas, liquid, or solid. A multiphase flow is the flow consisting of several phases. Two-phase flow is the simplest case of the multiphase flows. In fluid mechanics, a two-phase flow usually refers to a system containing gas and liquid with a meniscus separating into two phases. The most commonly investigated fluids are air and water.

It is impossible to understand the two-phase flow phenomena without a clear understanding of the flow regimes encountered. The major complexity in two-phase flows results from the growth and collapse of the gas-liquid interfaces that can give rise to various flow regimes.

Several flow regimes exist, depending on many factors, including the individual magnitudes of the liquid and gas flow rates, and physical properties such as density, surface tension, and viscosity. There are four principle flow regimes which occur successively at ever-increasing gas flow rates:

- Bubble flow
- Slug flow
- Annular flow
- Mist flow

It can be expected that the flow regimes influence the two-phase pressure drop, the holdup, the system stability, the exchange rates of momentum, heat and mass during the phase-change heat transfer processes. The ability to predict the flow regime accurately is necessary before the relevant calculation techniques can be developed.

Two-phase gas/liquid flows in vertical pipes have been investigated in more details because of their importance in simultaneous transport of oil and gas in wells, chemical industries, and nuclear power plant. Many industrial processes utilize pipe and equipment operated in two-phase flow regimes. Other two-phase flows are founding the production of steam and water in geothermal power plants, emergency core cooling of nuclear reactor, and the heat and mass transfer between gas and liquid in chemical reactors.

In order to predict the performance of a two-phase flow in vertical tubes, first we need to study the rate of rise velocity of single bubbles, which has been investigated by Peeble and Garber (1953). This velocity depends on the size of bubble and its Re_b (Reynold number of the bubble). The linear velocities of gas and liquid phases in each flow regimes are dictated by the system's thermohydraulic behavior.

A typical situation occurs when the gas and liquid volumetric flow rates G and L are specified, and the pressure gradient *dp/dz* and void fraction are calculated. Correlations for these last two variables are more likely to be successful if we can recognize the particular flow regime and develop relationships specifically for it.

In this study, flow patterns were produced by varying the inlet air and liquid flow rates. This research is focused on measuring pressure gradient, bubble size, bubble velocity and all flow regimes by using surfactant (SDS at 1 CMC) dissolved in water as the working liquid.