ABSTRAK

Aliran dua fasa merupakan salah satu contoh aliran multi fasa, aliran dua fasa dapat kita jumpai di berbagai aplikasi industri. Contoh aliran dua fasa di peralatan industri adalah reaktor nuklir, sistem pembangkit tenaga (*power plant*), sistem *boiler*, dan lain sebagainya. Salah satu *flow regime* pada aliran dua fasa air-udara yakni aliran *slug*. Dengan karakteristik aliran gelembung panjang berselang dengan *slug* cair. Terbentuknya aliran *slug* sangat komplek, begitu pula berkembangnya, serta lenyapnya pola aliran *slug* tersebut. Hal ini dapat menimbulkan perubahan tekanan yang besar dan mendadak serta dapat menyebabkan kerusakan pada sistem perpipaan.

Pada eksperimen kali ini dilakukan pengamatan visual dengan menggunakan *high speed camera* untuk melihat karakteristik visual pola aliran *slug,* dan pengukuran beda tekanan menggunakan *standard Valydine static pressure transducer*. Dilanjutkan dengan analisis data berupa *Probability Distribution Function* (PDF) dan *Power Spectral Density* (PSD). PDF digunakan untuk mengetahui karakteristik distribusi dari gradien tekanan sedangkan PSD digunakan untuk menggambarkan sinyal dalam membaca frekuensi gelombang. Pipa uji berupa pipa *acrylic* horizontal dengan diameter dalam 26 mm dan panjang pipa 9m. Material *acrylic* dipilih karena memudahkan pengamatan visual. Air dan udara sebagai fluida kerja di campur melalui *mixer* dengan jenis *simple* T. Seksi uji dilengkapi dengan adanya *correction box* supaya hasil eksperimen tidak menghasilkan indeks bias. Eksperimen dilakukan pada tekanan atmosfir dan kondisi adiabatis dengan variabel pada eksperimen ini meliputi kecepatan *superficial* air (J_L) dari 0,2 m/s sampai 0,77 m/s dan kecepatan *superficial* udara (J_G) dari 0,31 m/s sampai 6 m/s.

Hasil pengamatan secara visual menunjukkan bahwa aliran slug dapat dibagi menjadi empat *sub-regime*, yaitu: aliran *less aerated slug*, aliran *slug and plug*, aliran *highly aerated slug*, dan aliran *slug and wavy.* Hasil pengukuran beda tekanan dan pengolahan sinyal menunjukkan aliran *slug* akan menimbulkan fluktuasi gradien tekanan yang semakin besar seiring bertambahnya kecepatan *superficial* air dan udara. Beberapa perbedaan terdapat juga pada perhitungan gradien tekanan hasil eksperimen dan hasil prediksi diakibatkan oleh perbedaaan variabel uji.

Kata kunci: Aliran dua fasa, aliran air udara, pipa *horizontal,* aliran *slug,* visualisasi*,* gradien tekanan, *sub-regime.*

ABSTRACT

Two-phase flow is one example of multi-phase flow, we can find two-phase flow in various industrial applications. The examples of two-phase flow in industrial applications are nuclear reactors, power plants, boiler systems, and so on. One of the flow regimes in the two-phase air-flow is the slug flow. With the characteristic long flow of bubbles intermittently with liquid slug. The formation of the slug flow is very complex, so is the development, as well as the disappearance of the slug flow pattern. This can cause a large and sudden change in pressure and can cause damage to the piping system.

In this experiment, visual observations were carried out using high speed cameras to see the visual characteristics of the slug flow pattern, and measurement of pressure differences using a standard Valydine static pressure transducer. Followed by analysis of data in the form of Probability Distribution Function (PDF) and Power Spectral Density (PSD). PDF is used to determine the distribution characteristics of pressure gradients while PSD is used to describe signals in reading wave frequencies. The test pipe is a horizontal acrylic pipe with a diameter of 26 mm and a pipe length of 9 m. Acrylic material was chosen because it facilitates visual observation. Water and air as working fluids are mixed through mixers with simple type T. The test section is equipped with a correction box so that the experimental results do not produce a refractive index. Experiments were carried out at atmospheric pressure and adiabatic conditions with the variables in this experiment covering the superficial speed of water (JL) from 0.2 m / s to 0.77 m / s and superficial air velocity (JG) from 0.31 m / s to 6 m / s.

Visual observations show that slug flow can be divided into four sub-regimes, namely: less aerated slug flow, slug and plug flow, highly aerated slug flow, and slug and wavy flow. The measurement results of pressure difference and signal processing indicate that the slug flow will cause a pressure gradient fluctuation which is greater as the superficial velocity of water and air increases. Some differences also occur in the calculation of the pressure gradient of the experimental results and the results of the predictions are caused by differences in the test variables.

Keywords: *Two-phase flow, air flow, horizontal pipe, slug flow, visualization, pressure gradient, sub-regime.*