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PREFACE

The 6th Engineering International Conference on Education, Concept, and Application of Green Technology, held at Grand Candi Hotel in Semarang, Central Java, Indonesia on 11th October 2017. It is the sixth international conference organized by the Engineering International Committee (EIC) of Engineering Faculty, Universitas Negeri Semarang which included several countries: Indonesia, Malaysia, Thailand, Australia, and Philippines. More than 100 participants from those countries attended the conference and took part in the activities to make this conference as a media for information exchange, communication and discussion to develop science and technology alongside with improvement of learning methodology. Moreover this conference provides a discussion forum to establish research relations and to find global partners for future collaboration. Previous International Conferences organized by EIC were also held in Semarang on January 2013, November 2013, September 2014, September 2015, and October 2016.

In this conference, participants are also welcomed to take a part in mini symposium. The works of the mini symposium participants are served in this mini symposium proceeding. This proceeding contains of several articles that were presented in parallel sessions during the conference that covered engineering areas which opens the opportunity for the participants to share their research results, exchange new ideas, information, and application related to the theory, design, development, implementation, testing or evaluation in all areas of technology.

Finally, we are grateful for all participation and cooperation provided by all parties to make this International Conference successfully took place. The organizers of the 6th Engineering International Conference and the editors of the proceedings also thank all the authors who made a huge effort in preparing papers to this conference. We are expecting feedback and suggestion for improvement of publication, article admission, conference and related processes to upgrade proceeding quality in the future.

Thank you,
Adhi Kusumastuti, Ph.D

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Effect of Superficial Velocity on the Characteristics and Parameters of Plug Flow Pattern in a Horizontal Pipe

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ABSTRACT: In a two-phase gas-liquid flow, as part of an intermittent flow, has many flow pattern phenomena. The flow pattern occurs because differential superficial velocity of gas and liquid, and also the pressure fluctuation. Therefore, the study about plug flow is very important to obtain its parameters and characteristic data. Image processing method was applied to obtain the parameters, and characteristic of plug flow. In this experiment, horizontal transparent acrylic pipes with internal diameter of 19 mm was applied. A high-speed video camera (400 frame per seconds) was also used to visualize the pattern. Those observed videos were converted by Aisesoft Total Video Converter. After that the videos were changed into images with VirtualDub to analyze the parameters and characteristic of plug flow. The parameters of plug flow includes liquid superficial velocity and gas superficial velocity fraction whereas the wave characteristics consists of wave velocity and wave frequency. The results showed that a more apparent gas-liquid interface could be determined through this technique and the pattern of plug flow was also explained with the characteristics. The present results were also supported by the available previous studies.

Key words: Superficial velocity, image processing, parameters of plug flow, characteristics of plug flow.

1. INTRODUCTION

The simultaneous flow between gas and liquid inside the pipelines requires more intricate analysis then single phase flow due to the different physical properties of the two phase, gas or liquid flow rates, and pipe geometry [1]. Plug flow is known as elongated bubble flow without dispersed gas bubble. For a reason, a good understanding on parameters and characteristics on plug flow is truly needed to make database for a more clearly description on the slugging mechanisms.

Measuring techniques on the two-phase flows are still producing many data and challenges to complete database in two-phase flows. The previous techniques to know about two-phase flow by using flow measurement and image processing [1]. Visualization techniques for horizontal flow was used by Van Hout et al. [5], Majid et al. [1,3], Widharmiko [2].

2. EXPERIMENTAL METHODS

In this experiment used transparent acrylic pipes with 19mm internal diameters. Air and water were used as working fluid. A depth visual observation of gas-liquid flow behavior was conducted by a high-speed camera, while the capture video of process plug flow in 200D internal from the start gas-liquid out from mixer. A schematic layout of the experimental in Fig. 1.

This present work is involving 25 experimental data which covers the liquid superficial velocity (J_L) from 0,883 m/s to 2,061 m/s and that of gas superficial velocity (J_G) from 0,118 m/s to 0,589 m/s. The experimental data ranger is presented in Fig. 2 in the form of co-current horizontal flow pattern of Mandhane et al [4]. (1974).

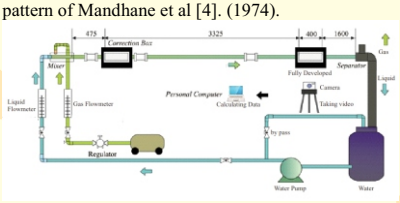

Fig. 1. Schematics of Experimental

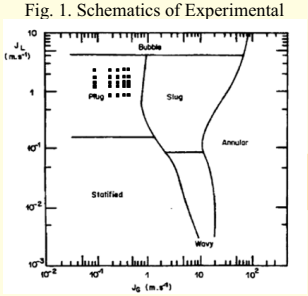

Fig. 2. Flow Pattern Maps using Mandhane et al.

2.1 Steps of digital image processing

Each video was extracted into sequence image, through Virtual Dub software, this software changed video into images.

The proceesed of image processing are:

1) Image selection

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First steps is selection image from frame-frame.

2) Cropping image
Then, input to CorelDraw X7 and cropp the image until the plug flow see clearly.

3) Calculating Data
The next step is calculating data in characteristics of plug flow.

3. RESULT AND DISCUSSION

1) Plug Wave Velocity

To calculate plug wave frequency, used the equation of Van Hout et al (2002) [5]:

$Utr = \frac{Œ???? - ????|}{?\ ??????}$???????????? (400fps)

The data of plug wave velocity can be show in Fig. 3.

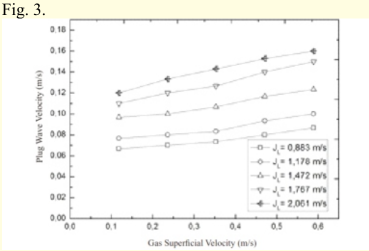

Fig. 3. The effect of gas superficial velocity on the average plug wave velocity

Fig. 3 is revealed that the average plug wave velocity increased as the increased of gas superficial velocities (J_G) and liquid superficial velocity (J_L) [3].

2) Plug Frequency

Plug frequency is total of plug flow per second. In Fig. 4 show the result of plug frequency. Under the constant J_L, the plug frequency decreases as the increase of J_G. For intances, the plug frequency can be obtained as the wave frequency [1].

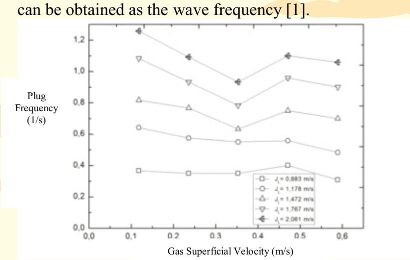

Fig. 4. Relationship between the gas superficial velocity and the plug frequency.

3.1 Matrix of Experiment

Data retrivial is done in three times in each research matrix. The final data is taken from an average of three times the results of experimental data on image processing. Table 1 is the matrix of this experiment.

Table 1. Matrix of Experiment

Q_L (Lpm)	J_L (m/s)	Q_G (Lpm)				
		0,25	0,96	2,33	4,13	6,56
		J_G (m/s)				
		0,118	0,236	0,353	0,471	0,589
15	0,883	v	v	v	v	v
19	1,178	v	v	v	v	v
21	1,472	v	v	v	v	v
27	1,767	v	v	v	v	v
34	2,061	v	v	v	v	v

4. CONCLUSION

1. Under a constant J_L, plug wave velocity increase with increase of J_G .
2. Under a constant J_L, plug frequency decrease with increase of J_G.

NOMENCLATURE

$?_{frames}$: delta frame		-
J_G :Gas Superficial Velocity		(m/s)
J_L : Liquid Superficial Velocity		(m/s)
pix_1 : start of plug body enter in the acrylic pipe.		m
pix_2 : end of plug body enter in the acrylic pipe.		m

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