

INTISARI

Air bersih dan sanitasi merupakan kebutuhan dasar bagi makhluk hidup, khususnya manusia. Namun, seiring dengan pertambahan jumlah populasi masyarakat terutama di daerah perkotaan menyebabkan kebutuhan air bersih dan sanitasi kian meningkat. Salah satu cara untuk meningkatkan akses air bersih adalah melalui perangkat *microbubble generator* (MBG).

Microbubble generator (MBG) merupakan perangkat yang mampu meningkatkan kadar oksigen terlarut dalam air dan mampu mempercepat penjernihan air. Prinsip kerja perangkat ini melalui penggenerasian *bubble* yang berukuran sangat kecil berorde mikro. Penelitian ini menggunakan *microbubble generator* tipe aliran *swirl* dengan ukuran diameter *nozzle* 1,2 mm pada jarak 1 mm terhadap *outlet*. Dengan memanfaatkan tekanan negatif dan *self-suction*, *microbubble generator* tipe aliran *swirl* mampu menghisap udara tanpa bantuan alat lain. Aspek yang ditinjau dalam penelitian ini adalah distribusi ukuran diameter *microbubble* serta unjuk kerja *microbubble generator* berupa *pressure drop*, *hydraulic power* dan efisiensi. Pengambilan data dilakukan menggunakan *high speed camera* untuk mendapatkan gambar distribusi ukuran diameter *microbubble* serta *pressure transducer* untuk mendapatkan nilai *pressure drop* dan perhitungan unjuk kerja *microbubble generator*. Kombinasi variasi debit air (Q_L) dan debit udara (Q_G) dilakukan pada penelitian ini.

Hasil pengolahan data menunjukkan bahwa *pressure drop*, *hydraulic power*, dan efisiensi dipengaruhi oleh perubahan variasi debit air dan debit udara. Analisa *pressure drop* yang ditinjau menggunakan metode *power spectral density* (PSD) dan dilihat persebarannya melalui *probability density function* (PDF). Kenaikan *hydraulic power* dan *pressure drop* terjadi seiring peningkatan debit air dan debit udara, hal ini menyebabkan perangkat *microbubble generator* semakin tidak efisien. Pada distribusi ukuran diameter *microbubble*, terlihat bahwa semakin besar debit air dan semakin kecil debit udara maka distribusi ukuran diameter *microbubble* akan semakin seragam. Pengamatan distribusi ukuran diameter *microbubble* dianalisis menggunakan metode *image processing* dengan bantuan *software* MATLAB dan dinilai berdasarkan *probability density function* (PDF).

Kata kunci: *Microbubble Generator* (MBG), *Microbubble*, *Swirl*, *Image Processing*, *Hydraulic Power*, *Pressure Drop*, Debit Air (Q_L), Debit Udara (Q_G), *Power Spectral Density* (PSD), *Probability Density Function* (PDF)

ABSTRACT

Clean water and sanitation are basic needs for living things, especially for the humans. However, along with the growth of citizen population, especially in urban areas, the need for clean water and sanitation is also rose up. One possible way to improve the clean water access is through microbubble generator (MBG).

Microbubble generator (MBG) is a device to increase the level of dissolved oxygen in the water and has capability to improve water purification. The concept of this device is through the generation of very small micro-sized bubbles. In this research, a swirl flow type microbubble generator with a nozzle diameter of 1.2 mm at a distance of 1 mm from the outlet has been used. By utilize negative pressure and self-suction, the swirl flow type microbubble generator is able to suck air without the aid of other tools. The aspects reviewed in this research are microbubble diameter size distribution and microbubble generator performance in the form of pressure drop, hydraulic power, and efficiency. Data collection is conducted using a high speed camera to obtain the image of microbubble diameter distributions and pressure transducer module to obtain the value of pressure drop and the calculation of the microbubble generator performance. Several combinations of variations in water discharge (Q_L) and air discharge (Q_G) are added in this study.

The experimental results indicate that the pressure drop, the hydraulic power, and the efficiency are affected by the changes of both water and air discharges. Pressure drop analysis reviewed through the power spectral density (PSD) method and its distribution is seen through the probability density function (PDF). The increase in hydraulic power and pressure drop occurs as water flow and air flow increase, this causing the microbubble generator performance to become more inefficient. For the microbubble diameter distribution, the greater the water flow rate and the smaller the air flow applied, then the microbubble diameter distribution will be more uniform. Observation of the microbubble diameter distribution was analyzed by image processing method using MATLAB and assessed based on the probability density function (PDF).

Keyword: Microbubble Generator (MBG), Microbubble, Swirl, Image Processing, Hydraulic Power, Pressure Drop, Water Flow Rate (Q_L), Air Flow Rate (Q_G), Power Spectral Density (PSD), Probability Density Function (PDF)