ABSTRAK

Perkembangan teknologi fluida kini difokuskan untuk mendukung efisiensi energi dan efektivitas proses, termasuk dalam pengembangan *microbubble generator* tipe venturi. Penelitian ini mengkaji pengaruh debit air, debit udara, dan diameter *throat* terhadap penurunan tekanan, daya hidraulik, efisiensi pembentukan gelembung serta kadar oksigen secara eksperimental. Hasil penelitian menunjukkan bahwa penurunan tekanan meningkat secara linier dengan bertambahnya debit air, sementara debit udara hanya sedikit berpengaruh. Debit air mempengaruhi peningkatan daya hidraulik dibanding debit udara. Visualisasi menunjukkan debit air yang tinggi menghasilkan gelembung yang lebih kecil dan seragam Sebaliknya debit udara yang tinggi menghasilkan gelembung lebih besar. Diameter *throat* paling kecil lebih efektif menghasilkan gelembung mikro seragam dibandingkan diameter yang besar. Penemuan ini menunjukkan bahwa kombinasi debit aliran dan dimensi *throat* sangat mempengaruhi karakteristik aliran dan kualitas gelembung. Hubungan antara efisiensi pembentukan gelembung mikro dan peningkatan kadar *dissolved oxygen* menunjukkan bahwa semakin kecil dan seragam ukuran gelembung, semakin tinggi kemampuan transfer oksigen ke dalam air. Pemahaman ini dapat diterapkan untuk mengoptimalisasi proses aerasi dan pengolahan air, menjadikan desain *microbubble generator* lebih efisien dan tepat guna sesuai kebutuhan aplikasi.

Kata kunci: *Microbubble generator*, venturi, diameter throat, penurunan tekanan, daya hidraulik, Efisiensi, *dissolved oxigen*

ABSTRACT

Fluid technology developments are now focused on supporting energy efficiency and process effectiveness, including in the development of venturi-type microbubble generators. This study examines the influence of water flow rate, air flow rate, and throat diameter on pressure drop, hydraulic power, bubble formation efficiency, and oxygen content through experimental means. The results show that pressure drop increases linearly with increasing water flow rate, while air flow rate has only a minor effect. Water flow rate also contributes more significantly to hydraulic power increase compared to air flow rate but increases as water flow rate increases. Visualization indicates that high water flow rate produces smaller and more uniform bubbles, whereas high air flow rate produces larger bubbles. The smallest throat diameter is more effective in producing uniform microbubbles compared to larger diameters. These findings indicate that the combination of flow rate and throat dimensions significantly influences flow characteristics and bubble quality. The relationship between microbubble formation efficiency and dissolved oxygen concentration increase shows that smaller and more uniform bubble sizes enhance oxygen transfer efficiency into water. This understanding can be applied to optimize aeration and water treatment processes, making microbubble generator designs more efficient and tailored to specific application needs.

Keywords: Microbubble generator, venturi, throat diameter, pressure drop, hydraulic power, efficiency, dissolved oxygen