ABSTRAK

Karakterisasi kinerja pencitraan fotoakustik cahaya tampak 450 nm telah dilakukan melalui rangkaian eksperimen pengujian kapabilitas sistem dalam mencitrakan *phantom* bahan kontras larutan pewarna metilen biru (MB), metil jingga (MJ) dan metil merah (MM). Objek *phantom* yang dimaksud terbuat dari tabung nilon 6,6 berdiameter 5.0 mm (luar) dan 4.6 mm (dalam) dengan tinggi 2.0 mm beserta media latar berupa plat *galvanized aluminium* hitam berukuran 6×6 cm. Tabung nilon terkait diisi oleh masing-masing dari tiga jenis larutan dengan variasi konsentrasi molekul sebesar 10, 25, 50 dan 100 ppm. Dua belas (12) objek *phantom* tersebut dicitrakan dalam luas daerah 10×10 cm dengan waktu pencitraan tiap piksel ~ 250 ms. Puncak absorbsi cahaya tampak yang diketahui dari spektroskopi UV-Visible untuk setiap jenis larutan berada di panjang gelombang 664 nm (metilen biru; 25 ppm), 465 nm (metil jingga, 25 ppm) dan 522 nm (metil merah; 25 ppm). Selain itu, diketahui pula bahwa amplitudo emisi fotoakustik akan meningkat sebanding dengan kandungan konsentrasi molekul pewarna di dalam larutan. Secara keseluruhan, larutan metil jingga (MJ) mempunyai distribusi amplitudo emisi fotoakustik yang paling tinggi. Hasil analisis menunjukkan rasio *inner diameter* (ID) dan *wall thickness* (WT) antara citra *phantom* MB dan MJ terhadap objek asli masing-masing sebesar 1: 0.83 dan 1: 0.74 (ID) dan 1: 3 dan 1: 1.5 (WT). Di sisi lain, rasio ukuran *outer diameter* (OD) yang dimiliki citra phantom MM terhadap objek asli berada di angka 1: 1.28.

Kata kunci: pencitraan fotoakustik; cahaya tampak; absorpsi; *phantom*; bahan kontras fotoakustik; larutan pewarna

ABSTRACT

Performance characterization of 450 nm visible light photoacoustic imaging has been carried out through phantom imaging of methylene blue (MB), methyl orange (MO), and methyl red (MR) dye solutions. The phantom object was made of a 6,6 nylon tube with a diameter of 5.0 mm (outside) and 4.6 mm (inside) having a height of 2.0 mm along with a 6×6 cm black galvanized aluminum plate as the background media. The nylon tube was filled with each of three types of solutions with varying molecular concentrations of 10, 25, 50 and 100 ppm. Twelve (12) phantom objects were imaged in an area of 10×10 cm with pixel scanning time of $\sim$250 ms. The visible absorption peak known from UV-Visible spectroscopy for each type of solution is at 664 nm (methylene blue; 25 ppm), 465 nm (methyl orange, 25 ppm), and 522 nm (methyl red; 25 ppm). It was also known that the amplitude of photoacoustic emissions would increase in proportion to the concentration of dye molecules in the solution. Overall, the methyl orange (MO) solution had the highest photoacoustic emission amplitude distribution. The analysis showed that the ratio of inner diameter (ID) and wall thickness (WT) between the MB and MO phantom images to the original object were 1: 0.83 and 1: 0.74 (ID) and 1: 3 and 1: 1.5 (WT), respectively. On the other hand, the ratio of the outer diameter (OD) of the MR phantom image to the original object is 1: 1.28.

Keywords: photoacoustic imaging; visible light; absorption; phantom; photoacoustic contrast agent; dye solution