BIOPLASTIK KARBOKSIMETIL SELULOSA/ASAM MALAT TERISI BISMUT/KAOLIN DAN $MTiO_3$ (M= Sr, Ba) SEBAGAI MATERIAL KOMPOSIT PENAHAN RADIASI SINAR-X DAN GAMMA

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INTISARI

Komposit dari karboksimetil selulosa/asam malat terisi kaolin/$Bi(NO_3)_3$, $SrTiO_3$, dan $BaTiO_3$ sebagai bahan penahan radiasi sinar-X dan gamma telah berhasil disintesis menggunakan teknik *solvent casting.* Komposit disintesis dengan variasi konsentrasi penaut silang asam malat 0; 1,5; 2; 4; 6; 8; dan 10% (b/v) dan variasi konsentrasi bahan pengisi kaolin/$Bi(NO_3)_3$, $SrTiO_3$, dan $BaTiO_3$ 0,1; 0,5; 1,0; 1,5; dan 3,0 M. Karakterisasi komposit dilakukan menggunakan spektrofotometer inframerah, difraktogram sinar-X dan SEM-EDX *mapping.* Analisis sifat fisik komposit dilakukan melalui uji kuat tarik dan elongasi, kapasitas serapan air. Uji radiasi sinar-X dilakukan dengan menggunakan alat X-Ray Apparatus 554 800 Leybold dan sinar gamma menggunakan alat spektrometer gamma yang dilengkapi surveimeter *Ranger* No. seri 05126.

Hasil penelitian menunjukkan bahwa komposit dengan sifat fisik terbaik diperoleh pada asam malat 2% (b/v). Multi lapis memiliki pengaruh signifikan terhadap kemampuan serap radiasi, peningkatan ketebalan berbanding lurus dengan penurunan nilai ln (I/I_0). Bioplastik KMS/AM/$Bi(NO_3)_3$ 3,0 M memiliki kemampuan menahan radiasi sinar-X optimal dengan nilai HVL sebesar 0,1378 mm karena struktur mikro dan KMS/AM/$BaTiO_3$ 0,1 M dengan nilai HVL sebesar 0,1595 mm pada sinar gamma karena densitas bahan pengisi.

Kata Kunci: komposit, radiasi, apron, perovskit, kaolin

BIOPLASTIC COMPOSITES OF CARBOXYMETHY CELLULOSE/MALIC ACID FILLED WITH BISMUTH/KAOLIN AND $MTiO_3$ (M = Sr, Ba) AS FILLER FOR X- AND GAMMA RAYS SHIELDING MATERIALS

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ABSTRACT

Composites of carboxymethyl cellulose/malic acid with kaolin/$Bi(NO_3)_3$, $SrTiO_3$, and $BaTiO_3$ as filler for x- and gamma rays shielding materials have been successfully synthesized using the solvent casting technique. The composites synthesis were carried out by variations in the concentration of malic acid as crosslinker at 0; 1.5; 2; 4; 6; 8; and 10% (w/v) and variations in the concentration of kaolin/$Bi(NO_3)_3$, $SrTiO_3$, and $BaTiO_3$ as filler at 0.1; 0.5; 1.0; 1.5; and 3.0 M. Infrared spectrophotometer, x-ray diffractometer, and SEM-EDX mapping were used to characterize of composite. Its physical strength was analyzed through tensile strength, elongation tests, and water absorption capacity. X-ray radiation tests were analyzed with X-ray apparatus 554 800 Leybold, and gamma radiation was used with a gamma spectrometer equipped with a Ranger survey meter (Serial No 05126).

Results showed that the best physical properties of the composite was obtained at malic acid 2% (w/v). Multilayer showed a significant effect on the radiation absorption capability, where increased thickness correlated with a proportional decrease in ln (I/I_0) values. KMS/MA/$Bi(NO_3)_3$ 3.0 M bioplastic at HVL of 0,1378 mm exhibited optimal X-ray radiation shielding ability due to its microstructure, and KMS/MA/$BaTiO_3$ 0.1 M at HVL of 0,1595 mm showed optimal gamma radiation shielding due to the density of the filler material.

Keywords: composite, radiation, apron, perovskite, kaolin