

## STUDI PEMBUATAN PERISAI RADIASI TEMBUS PANDANG DENGAN PADUAN BARIUM ACRYLIC SEBAGAI ALTERNATIF PENGGANTI KACA TIMBAL

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### INTISARI

Perisai radiasi tembus pandang umumnya terbuat dari paduan kaca dan timbal. Kaca timbal digunakan pada jendela ruang kontrol pada instalasi radiodiagnostik maupun kedokteran nuklir di rumah sakit, pada lemari penyimpanan sumber radiasi dan *glove box*. Tingginya harga kaca timbal dan sifat kaca timbal yang masih mudah pecah, menuntut adanya alternatif untuk menggantikan peran kaca timbal sebagai perisai radiasi tembus pandang. Pada penelitian ini digunakan resin bening *acrylic* sebagai pengganti kaca, garam yang digunakan adalah *Barium Chloride Dyhydrate* ( $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ). Sampel dibuat dengan variasi komposisi 100% *acrylic*, 10% Ba, 20% Ba dan 30% Ba. Sampel diuji menggunakan sinar-X 42 kV,  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ , dan uji densitas. Berdasarkan penelitian yang dilakukan, didapatkan hasil nilai koefisien atenuasi sampel dengan sumber  $^{90}\text{Sr}$  komposisi: 100% *acrylic*  $9,336 \pm 0,966 \text{ cm}^{-1}$ , 10% Ba  $9,685 \pm 0,984 \text{ cm}^{-1}$ , 20% Ba  $9,923 \pm 0,996 \text{ cm}^{-1}$ , dan 30% Ba  $11,748 \pm 1,083 \text{ cm}^{-1}$ . Nilai koefisien atenuasi sampel dengan sumber  $^{137}\text{Cs}$  komposisi: 100% *acrylic*  $1,843 \pm 1,029 \text{ cm}^{-1}$ , 10% Ba  $1,861 \pm 1,028 \text{ cm}^{-1}$ , 20% Ba  $2,030 \pm 1,037 \text{ cm}^{-1}$ , dan 30% Ba  $2,112 \pm 1,033 \text{ cm}^{-1}$ . Nilai koefisien atenuasi pada eksposi sinar-X 42 kV komposisi: 100% *acrylic*  $2,178 \pm 0,1214 \text{ cm}^{-1}$ , 10% Ba  $3,701 \pm 0,1386 \text{ cm}^{-1}$ , 20% Ba  $3,643 \pm 0,1294 \text{ cm}^{-1}$ , dan 30% Ba  $4,087 \pm 0,0880 \text{ cm}^{-1}$ . Nilai densitas terukur pada komposisi: 100% *acrylic*  $1,08 \pm 0,01 \text{ g.ml}^{-1}$ , 10% Ba  $1,09 \pm 0,01 \text{ g.ml}^{-1}$ , 20% Ba  $1,10 \pm 0,02 \text{ g.ml}^{-1}$ , dan 30% Ba  $1,08 \pm 0,01 \text{ g.ml}^{-1}$ . Dari hasil pengujian tidak ada yang memenuhi standar untuk bisa menggantikan kaca timbal sebagai perisai radiasi.

**Kata kunci :** perisai radiasi tembus pandang, barium acrylic, densitas, atenuasi

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## MAKING A TRANSPARENT RADIATION SHIELDING USING BARIUM ACRYLIC COMPOUND AS AN ALTERNATIVE MATERIAL TO REPLACE LEAD GLASS

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### ABSTRACT

Commonly, a transparent radiation shielding are made from lead and glass compound. Lead glass are used as a control room windows in radiodiagnostic and nuclear medicine installation, in radiation source storage, and glove box. Lead glass has disadvantages such as, it has very expensive price and brittle, so it can be easily broken. Those disadvantages are the reason to find another material to replace lead glass as a transparent radiation shielding. In this study, transparent acrylic resin is choosen to replace glass, and the type of Pb that used in this study are Barium Chloride Dyhydrate ( $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ ). Compositions that is used in this study are 100% acrylic, 10% Pb, 20% Pb and 30% Pb. Samples that have been made, were tested with 42 kV of X-ray,  $^{90}\text{Sr}$ ,  $^{137}\text{Cs}$ , density, and compression strength testing. Increase the lead composition can make value of attenuation coefficient and density increase too, but decrease the value of compression strength from that sample. Based on the study that have been done, value of attenuation coefficient from  $^{90}\text{Sr}$  source with composition: 100% acrylic  $9.336 \pm 0.966 \text{ cm}^{-1}$ , 10% Ba  $9.685 \pm 0.984 \text{ cm}^{-1}$ , 20% Ba  $9.923 \pm 0.996 \text{ cm}^{-1}$ , and 30% Ba  $11.748 \pm 1.083 \text{ cm}^{-1}$ . Value of attenuation coefficient from  $^{137}\text{Cs}$  source with composition: 100%  $1.843 \pm 1.029 \text{ cm}^{-1}$ , 10% Ba  $1.861 \pm 1.028 \text{ cm}^{-1}$ , 20% Ba  $2.030 \pm 1.037 \text{ cm}^{-1}$ , and 30% Ba  $2.112 \pm 1.033 \text{ cm}^{-1}$ . Value of attenuation coefficient from X-ray 42 kV with composition: 100% acrylic  $2.178 \pm 0.1214 \text{ cm}^{-1}$ , 10% Ba  $3.701 \pm 0.1386 \text{ cm}^{-1}$ , 20% Ba  $3.643 \pm 0.1294 \text{ cm}^{-1}$ , and 30% Ba  $4.087 \pm 0.0880 \text{ cm}^{-1}$ . Value of sample density with composition: 100% acrylic  $1.08 \pm 0.01 \text{ g.ml}^{-1}$ , 10% Ba  $1.09 \pm 0.01 \text{ g.ml}^{-1}$ , 20% Ba  $1.10 \pm 0.02 \text{ g.ml}^{-1}$ , and 30% Ba  $1.08 \pm 0.01 \text{ g.ml}^{-1}$ . Base on experiment, all sample of Barium Acrylic composition can not be used as an altenative way to replace lead glass as transparent radiation shielding.

**Keywords** : transparent radiation shielding, barium acrylic, density, attenuation

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