

PENGARUH PENAMBAHAN PARTIKEL SILIKA PADA SIFAT *WHITE MINERAL TRIOXIDE AGGREGATE* YANG DIBUAT DARI SILIKA ABU SEKAM PADI DAN KALSIMUM KABRONAT BATU KAPUR

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INTISARI

Pembuatan *White Mineral Trioxide Aggregate* (WMTA) menggunakan bahan awal silika ekstraksi abu sekam padi dan kalsium karbonat batu kapur dengan pengaruh penambahan partikel silika pada sifat WMTA telah dilakukan. Penelitian ini diawali dengan kalsinasi abu sekam padi pada temperatur 700 °C selama 3 jam. Ekstraksi silika dilakukan menggunakan NaOH 2M dan HCl dengan perlakuan penambahan HCl diikuti sonifikasi dan tanpa sonifikasi. Hasil ekstrak dicuci menggunakan air deionisasi. Kalsium karbonat dibuat dari batu kapur dengan menggunakan HNO₃ 1 M dan NH₃ serta dilanjutkan karbonasi. Pembuatan WMTA dimulai dengan mencampurkan SiO₂, CaCO₃ dan Al₂O₃. Campuran tersebut dihomogenasi dengan air deionisasi dan dipanaskan, selanjutnya dibuat pelet dikalsinasi pada temperatur 1000 °C, produk kalsinasi, ditambahkan Bi₂O₃ dan modifikasi dengan penambahan *filler* silika sonifikasi dan silika *fume*. Karakter WMTA yang dihasilkan dibandingkan dengan WMTA komersial (WMTA ProRoot).

Hasil dari ekstraksi silika dengan perlakuan sonifikasi SiO₂ 99,96% dan Kalsium karbonat dapat disintesis dengan metode karbonasi setelah penambahan HNO₃ dan NH₃ 25%. WMTA dan WMTA termodifikasi, memiliki fase Ca₃SiO₅, Ca₂SiO₄ dan Ca₃Al₂O₆ yang serupa WMTA ProRoot. Setelah hidrasi, WMTA dengan *filler* silika *fume* 10% menunjukkan karakter uji *diameter tensile strength* 3,64 ± 0,12 MPa nilai pH dan pelepasan Ca²⁺ yang cenderung stabil pada variasi hari ke-1, 3, dan 7, serta kelarutan 20,06 ± 2,21%. Uji radiopasitas menunjukkan sifat radiopak dengan tingkat radiopasitas 1,70 ± 0,80 mmAl.

Kata kunci: SiO₂, CaCO₃, silika *fume*, *White Mineral Trioxide Aggregate* (WMTA), Ca₃SiO₅, Ca₂SiO₄ dan Ca₃Al₂O₆

***THE EFFECT OF ADDITION SILICA PARTICLES ON THE PROPERTIES
OF WHITE MINERAL TRIOXIDE AGGREGATE MADE OF RICE HUSK
ASH SILICA AND LIMESTONE CALCIUM CARBONATE***

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ABSTRACT

The preparation of White Mineral Trioxide Aggregate (WMTA) using the starting material of silica extraction of rice husk ash and limestone calcium carbonate and the effect of adding silica particles on the WMTA properties have been conducted. This research was started with calcination of rice husk at 700 °C for 3 hours. Silica extraction was carried out using 2M NaOH and HCl with the addition of sonification HCl and without sonification. The extract was washed using deionized water. Then the calcium carbonate was extracted using 1 M HNO₃ and NH₃ by carbonation. Preparation of WMTA was started by mixing the mass ratio of SiO₂ extracted, CaCO₃ extracted and Al₂O₃. The mixture was homogenized, then made pellets. The pellets were calcined at a temperature of 1000 °C, the calcined and Bi₂O₃ was added, then modified with the addition of filler extracted from sonicated silica and silica fume. The resulting WMTA characters are compared to commercial WMTA (WMTA ProRoot).

Results show that silica and calcium carbonate have succeeded as the basic precursors for WMTA preparation. Silica containing 99.96% of SiO₂ and free of sodium was produced from extraction of rice husk ash by sonification treatment. Calcium carbonate was synthesized by carbonation method with the addition of HNO₃ and NH₃ 25%. WMTA and aWMTA modified with sonicated silica filler and silica fume successfully made, contained Ca₃SiO₅, Ca₂SiO₄ and Ca₃Al₂O₆ phases which are similar to WMTA ProRoot. Hydrated WMTA with the addition of 10% silica fume filler showed a tensile strength test character of 3.64 ± 0.12 MPa, the pH value and the release of Ca²⁺ tended to be stable on the variations of days (1, 3, and 7) The solubility value was 20.06 ± 2.21%; and the radiopacity test showed radiopaque properties with a radiopacity level of 1.70 ± 0.80 mmAl.

Keywords: SiO₂, CaCO₃, silica fume, White Mineral Trioxide Aggregate (WMTA), Ca₃SiO₅, Ca₂SiO₄ and Ca₃Al₂O₆