

PENAMBAHAN SrO DAN HIDROKSIAPATIT PADA MINERAL TRIOKSIDA AGREGAT TERBUAT DARI SiO₂ ABU SEKAM PADI DAN CaCO₃ CANGKANG KERANG UNTUK PENINGKATAN KARAKTER SEBAGAI BAHAN PULPOTOMI GIGI

LENY YULIATUN
20/468184/SPA/00750

INTISARI

Dalam penelitian ini telah dikaji pembuatan mineral trioksida agregat (*mineral trioxide aggregate*, MTA) menggunakan silika (SiO₂) abu sekam padi (ASP) dan kalsium karbonat (CaCO₃) cangkang kerang, serta pengaruh penambahan SrO dan hidroksiapatit (HA) pada karakteristik MTA. Penelitian diawali dengan pembuatan SiO₂ dari ASP dan pemurnian CaCO₃ cangkang kerang. Material MTA dibuat dengan mencampur SiO₂ (20% b/b), CaO (60% b/b), Al₂O₃ (2,0% b/b), dan SrO+Bi₂O₃ (18% b/b). Bahan SrO dan Bi₂O₃ divariasikan dengan persentase total tetap 18%. Campuran dikalsinasi pada 1000 °C selama 3 jam. Kajian pengaruh HA dilakukan dengan penambahan HA (3, 6, dan 9% b/b) pada MTA-SrO5 sebelum hidrasi. Produk sebelum hidrasi dikarakterisasi dengan DTA-TGA, XRF, SEM, XRD, FTIR, dan uji sitotoksitas. Setelah hidrasi dilakukan pengujian XRD, FTIR, SEM, pH, kuat tekan, pelepasan Ca²⁺, pengurangan massa, radiopasitas, dan interaksi dentin.

Hasil menunjukkan bahwa SiO₂ yang dibuat dari ASP telah bebas natrium dan memiliki morfologi amorf yang beraglomerasi dengan ukuran partikel 0,44 µm. Material CaCO₃ dari cangkang kerang berhasil dipreparasi dengan kemurnian CaO 98,36% dan bentuk kristal vaterit bercampur kalsit dengan ukuran partikel 2,43 µm. Keberhasilan pembuatan MTA-SrO ditunjukkan oleh adanya komponen trikalsium silikat (Ca₃SiO₄, C₃S), dikalsium silikat (Ca₂SiO₄, C₂S), Ca(OH)₂, dan stronsium silikat. Penambahan SrO 5% dan HA 6% dalam MTA (MTA-SrO5/HA6) dapat meningkatkan kuat tekan (18,99±1,11 MPa) melebihi MTA kontrol (17,80±1,25 MPa), nilai pH, dan interaksi dentin setelah 14 hari hidrasi. SrO dan HA terbukti meningkatkan pelepasan ion Ca²⁺ setelah 1 hari hidrasi, menurunkan nilai pengurangan massa, mempertahankan nilai radiopasitas dan material bersifat non-toksik dengan IC₅₀ 13,13 mg/mL.

Kata kunci: MTA, SrO, Hidroksiapatit (HA), SiO₂, CaCO₃

ADDITION OF SrO AND HYDROXYPATITE TO MINERAL TRIOXIDE AGGREGATE MADE FROM RICE HUSK ASH SiO₂ AND CLAMSHELL CaCO₃ FOR INCREASING CHARACTER AS DENTAL PULPOTOMY MATERIAL

LENY YULIATUN
20/468184/SPA/00750

ABSTRACT

In this research, mineral trioxide aggregate (MTA) using silica (SiO₂) rice husk ash (RHA) and clamshell calcium carbonate (CaCO₃) have been synthesized and the effect of adding strontium oxide (SrO) and hydroxyapatite (HA) on MTA characteristics have been studied. The research was begun with the preparation of SiO₂ from RHA and purification of CaCO₃ clamshells. The MTA was prepared by mixing SiO₂ (20% w/w), CaO (60% w/w), Al₂O₃ (2.0% w/w), and SrO+Bi₂O₃ (18% w/w). The SrO and Bi₂O₃ were varied with a fixed total percentage of 18%. The mixture was calcined at 1000 °C for 3 hours. The study of the effect of HA was conducted by adding HA (3, 6, and 9% w/w) to MTA-SrO5 before hydration. The product before hydration was characterized by DTA-TGA, XRF, SEM, XRD, FTIR, and cytotoxicity assay. After hydration, XRD, FTIR, SEM, pH, compressive strength, Ca²⁺ release, mass loss, radiopacity, and dentin interactions were evaluated.

The results showed that SiO₂ prepared from RHA was sodium-free and had an amorphous morphology that agglomerated with a particle size of 0.44 μm. The CaCO₃ from clamshell was successfully made with a purity of 98.36% and a crystalline form of vaterite and calcite with a particle size of 2.43 μm. The success of making MTA-SrO was indicated by the presence of components of tricalcium silicate (Ca₃SiO₄, C3S), dicalcium silicate (Ca₂SiO₄, C₂S), Ca(OH)₂, and strontium silicate. Addition of 5% SrO and 6% HA particles in MTA (MTA-SrO5/HA6) could increase the compressive strength (18.99±1.11 MPa) exceed the control MTA (17.80±1.25 MPa), pH value, and dentin interaction after 14 days of hydration. The SrO and HA were shown to increase the release of Ca²⁺ ions after 1 day of hydration, reduce mass loss, maintain radiopacity and non-toxic material with IC₅₀ of 13.13 mg/mL

Keywords: MTA, SrO, Hydroxyapatite (HA), SiO₂, CaCO₃