SINTESIS DAN KARAKTERISASI *NANOMATERIAL HIDROKSIAPATIT* (HAp) BERBAHAN BATU KAPUR BUKIT JIMBARAN DENGAN METODE PRESIPITASI

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ABSTRAK

Permintaan material implan tulang yang aman bagi jaringan biologis mendorong pengembangan *nanohidroksiapatit* (HAp). Penelitian ini memanfaatkan batu kapur Bukit Jimbaran, Badung-Bali, sebagai prekursor kalsium dalam sintesis *nanohidroksiapatit* ($Ca_{10}(PO_4)_6(OH)_2$) melalui metode presipitasi. Karakterisasi XRF menunjukkan dominasi CaO sebesar 99,62%, menegaskan kemurnian sumber kalsium. Spektrum FTIR memperlihatkan pita khas gugus fosfat (PO_4^{3-}), karbonat (CO_3^{2-}), serta vibrasi hidroksil, yang mengkonfirmasi terbentuknya fase HAp. Hasil XRD menunjukkan pola difraksi yang selaras dengan standar JCPDS 09-0432 melalui kemunculan bidang (211), (112), dan (300), dengan parameter kisi a = b = 9,45 Å dan c = 6,85 Å. Perhitungan Scherrer menghasilkan ukuran kristal rata-rata 8,70 nm dan tingkat kristalinitas 92,88%. Analisis SEM-EDX menggambarkan morfologi partikel yang saling menggumpal dan komposisi Ca sebesar 32,0 wt.% serta P sebesar 14,0 wt.%. Kombinasi kristalinitas tinggi dan ukuran kristal nanometrik menunjukkan bahwa HAp hasil sintesis berpotensi memiliki bioaktivitas yang baik, sehingga layak dipertimbangkan untuk berbagai aplikasi regeneratif dalam bidang biomedis.

Kata kunci : Implan tulang, HAp, batu kapur Jimbaran, metode presipitasi.

SYNTHESIS AND CHARACTERIZATION OF HYDROXYAPATITE (HAp) NANOMATERIALS FROM JIMBARAN LIMESTONE USING PRECIPITATION METHOD

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ABSTRACT

The demand for bone implant materials that are safe for biological tissues encourages the development of nanohydroxyapatite (HAp). This study utilizes limestone from Bukit Jimbaran, Badung-Bali, as a calcium precursor in the synthesis of nanohydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) through a precipitation method. XRF characterization shows a dominance of CaO of 99.62%, confirming the purity of the calcium source. The FTIR spectrum shows typical bands of phosphate (PO_4^{3-}), carbonate (CO_3^{2-}), and hydroxyl vibrations, confirming the formation of the HAp phase. The XRD results show a diffraction pattern that is in accordance with the JCPDS 09-0432 standard through the appearance of planes (211), (112), and (300), with lattice parameters a = b = 9.45 Å and c = 6.85 Å. Scherrer calculations yielded an average crystallite size of 8.70 nm and a crystallinity level of 92.88%. SEM-EDX analysis depicted agglomerated particle morphology and a Ca composition of 32.0 wt.% and P of 14.0 wt.%. The combination of high crystallinity and nanometric crystallite size indicates that the synthesized HAp has the potential to have good bioactivity, making it worthy of consideration for various regenerative applications in the biomedical field.

Keywords: Bone implant, HAp, Jimbaran limestone, precipitation method.