Sintesis nanokomposit berbasis kalsium alginat ganggang coklat-TiO2/SiO2 sebagai katalis untuk konversi glukosa menjadi senyawa turunannya = Synthesis of nanocomposite based on calcium alginate-TiO2/SiO2 as a catalyst for the conversion of glucose to its derivative compound

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Abstrak

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Natrium alginat yang berasal dari ganggang coklat Sargassum sp. telah berhasil diisolasi pada variasi suhu, yaitu 30°C, 45°C dan 60°C. Rendemen tertinggi didapatkan pada suhu 30°C, dengan nilai sebesar 62.9%. Hasil isolasi menunjukkan massa natrium alginat dipengaruhi oleh suhu. Natrium alginat hasil isolasi dikarakterisasi dengan FTIR, XRD dan SEM-EDX. Natrium alginat digunakan untuk membentuk nanokomposit kalsium alginat-TiO2/SiO2 dengan metode enkapsulasi TiO2/SiO2. Proses enkapsulasi dilakukan dengan konsentrasi larutan natrium alginat rendah dan penambahan ion Ca2+ dari CaCl2.2H2O, sehingga terbentuk gel halus kalsium alginat. TiO2/SiO2 dibentuk dari proses sol-gel prekursor tetraetil ortosilikat (TEOS) dan titanium isopropoksida (TTIP) dalam keadaan asam. Nanokomposit kalsium alginat-TiO2/SiO2 dikarakterisasi dengan FTIR, XRD, SEM-EDX dan TEM. Hasil pengukuran SEM menunjukkan bentuk partikel TiO2/SiO2 dengan permukaan berserat yang mengkonfirmasi keberhasilan pembentukan nanokomposit kalsium alginat-TiO2/SiO2. Nanokomposit kalsium alginat-TiO2/SiO2 yang bersifat asam dan berserat dimanfaatkan sebagai katalis dalam proses konversi glukosa menjadi 5-hidroksimetilfurfural dengan pelarut dimetilsulfoksida (DMSO). Rendemen 5-hidroksimetilfurfural didapatkan pada suhu 140°C dan waktu 4 jam, sebesar 12.832%. Kinetika reaksi glukosa menjadi 5-hidroksimetilfurfural mengikuti persamaan laju reaksi orde satu dengan energi aktivasi sebesar 253.949 kJ/mol.
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ABSTRACT
The sodium alginate from Sargassum sp. brown seaweed was isolated at varied temperatures which are 30°C, 45°C dan 60°C. The highest yield is obtained at 30°C which the value is 62.9%. The yield obtained showed that a sodium alginate's mass affected by a temperature. The isolated sodium alginate was characterized by FTIR spectra, XRD spectra and SEM-EDX imaging. The sodium alginate was used to form calcium alginate-TiO2/SiO2 nanocomposite with an encapsulation method of calcium alginate-TiO2/SiO2. The encapsulation process was done with the low concentration of alginate solution and Ca2+ ion from CaCl2.2H2O, thereby calcium alginate pragel was formed. The TiO2/SiO2 was synthesizing by sol-gel process of tetraethyl orthosilicate (TEOS) and titanium isopropoxide precursors (TTIP) in acid condition. The calcium alginate-TiO2/SiO2 nanocomposite was characterized by FTIR spectra, XRD spectra, SEM-EDX imagings and TEM imagings. The SEM images showed the morphology of TiO2/SiO2 particle with a fibrous surface which confirmed that the calcium alginate-TiO2/SiO2 nanocomposite was synthesized. The calcium alginate-TiO2/SiO2 nanocomposite which has acidity and fibrous properties was utilized as a catalyst for the conversion process of glucose to its derivative compound in dimethylsulfoxide (DMSO) solvent. The result of the conversion process showed that glucose's mass decreased to the elevation of oil

bath's temperature. The highest yield of 5-hydroxymethylfurfural is achieved at 140°C for 4 hours which the value is 12.832%. The reaction kinetic of glucose into 5-hydroxymethylfurfural is according to a first-rate equation with the activation energy was 253.949 kJ/mol.