Kopolimerisasi cangkok akrilonitril pada selulosa bakteri termodifikasi hidroksilamin menggunakan teknik pra-iradiasi : karakterisasi dan aplikasinya sebagai adsorben ion logam Cu2 dan Pb2 = Graft copolymerization of acrylonitrile onto bacterial cellulose modified by hydroxylamine using pre irradiation technique characterization and its application as adsorbent for Cu2 and Pb2 metal ion

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Abstrak

Film selulosa bakteri telah berhasil dibuat dari air kelapa sebagai sumber mikronutrien menggunakan biakan Acetobacter xylinum. Film selulosa bakteri selanjutnya diiradiasi dengan mesin berkas elektron pada rentang dosis 15-120 kGy, laju dosis 15 kGy/ pass dan temperatur ruang. Setelah diiradiasi, selulosa bakteri tersebut dikopolimerisasi cangkok dengan monomer akrilonitril. Kondisi optimum untuk kopolimerisasi cangkok akrilonitril pada selulosa bakteri adalah pada dosis 75 kGy, temperatur 600C, waktu 3 jam, dan konsentrasi akrilonitril 30% b/b. Derajat pencangkokan tertinggi yang diperoleh adalah sebesar 56,03 %. Selulosa bakteri tercangkok akrilonitril (SB tercangkok PAN) selanjutnya diamidoksimasi. Amidoksimasi dilakukan dengan penambahan hidroksilamin hidroklorida 6 % b/v dalam pelarut metanol : air = 50 : 50 v/v pada pH 7, dan diperoleh waktu optimum selama 2 jam dengan densitas gugus amidoksim yang diperoleh sebesar 5,425 mmol/ gram. Karakterisasi gugus fungsi film selulosa bakteri sebelum dan sesudah kopolimerisasi cangkok dengan akrilonitril, serta setelah diamidoksimasi dilakukan dengan menggunakan Fourier Transform Infra Red (FTIR), analisis mikrostruktur dengan Scanning Electron Microscopy (SEM), analisa derajat kristalinitas menggunakan X-ray diffraction (XRD), serta uji ketahanan terhadap panas diukur dengan Thermal Gravimetry Analysis (TGA) dan Differential Scanning Calorimetry (DSC). Hasil karakterisasinya mengindikasikan bahwa SB tercangkok PAN dan selulosa bakteri teramidoksimasi (SB-Am) telah berhasil disintesis pada penelitian ini. Film tersebut selanjutnya diuji kemampuan adsorpsinya terhadap ion logam Cu2+ dan Pb2+. Nilai koefisien distribusi selulosa bakteri, SB tercangkok PAN, dan SB-Am pada pH 6 terhadap ion logam Cu2+ masing-masing sebesar 0,26, 0,23, dan 0,37 L/gram adsorben, sedangkan terhadap ion logam Pb2+ masing-masing sebesar 0,41, 0,405, dan 0,52 L/gram adsorben.
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Bacterial cellulose films have been successfully synthesized from coconut water as a source of micronutrients using Acetobacter xylinum. Bacterial cellulose film irradiated using electron beam machine at a dose range of 15-120 kGy and dose rate 15 kGy/ pass in room temperature. After irradiated, the bacterial cellulose grafted with acrylonitrile monomer. The optimum conditions for graft copolymerization condition were at the dose of 75 kGy, temperature 600C ,3 hours time of reaction, and the concentration of acrylonitrile was 30 % w/w. The highest degree of grafting obtained was 56,03 % . Amidoximation then performed by the addition of hydroxylamine 6 % w/v in methanol : water = 50 : 50 v/v solvent under pH 7 and obtained the optimum time for amidoximation reaction was 2 hours. Amidoxime density obtained was 5.425 mmol/ gram. Characterization of functional groups in bacterial cellulose films before and after graft copolymerization with acrylonitrile, as well after amidoximation performed by Fourier Transform Infrared (FTIR), microstructure was analyzed by Scanning Electron Microscopy (SEM), analysis of the degree of

crystallinity using X-ray diffraction (XRD), thermal resistance properties was measured by Thermal Gravimetry Analysis (TGA) and Differential Scanning Calorimetry (DSC) .The results show that bacterial cellulose-g-polyacrylonitrile (BC-g-PAN) and amidoximated bacterial cellulose films (Am-BC) have been synthesized successfully. Subsequently, Cu2+ and Pb2+ metal ion adsorption studies were conducted using those films. Coeficient distribution of bacterial cellulose, BC-g-PAN, and Am-BC under pH 6 toward Cu2+ions respectively were 0,26, 0,23, dan 0,37 L/gram of adsorbent, while toward Pb2+ions, respectively were 0,41, 0,405, and 0,52 L/gram of adsorben.