Sintesis dan Karakterisasi Hidrogel Responsif Temperatur Poli(N,N-dimetilakrilamida-ko-N-isopropilakrilamida) (P(DMA-ko-NIPAM)) serta Uji Aplikasinya Sebagai Adsorben Ion Logam Berat = Synthesis and Characterization of Temperature Responsive Hydrogels Poly(N,N-dimethylacrylamide-co-N-isopropylacrylamide) (P(DMA-co-NIPAM)) and Testing Its Application As Heavy Metal Ion Adsorbent

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Abstrak

Polimer responsif temperatur hidrogel poli(N,N-dimetilakrilamida-ko-N-isopropilakrilamida) (P(DMA-ko-NIPAM)) disintesis melalui polimerisasi radikal bebas dengan inisiator amonium persulfat (APS) dan agen pengikat silang N,N-metilen-bis-akrilamida (MBA). Hidrogel P(DMA-ko-NIPAM) dikarakterisasi, kandungan gelnya, serta keberhasilan polimerisasinya. Keberhasilan sintesis hidrogel P(DMA-ko-NIPAM) dibuktikan dengan tidak munculnya peak gugus vinil dari monomer pada spektra FTIR hidrogel P(DMA-ko-NIPAM). Hasil uji rasio swelling menunjukkan sifat responsif temperatur hidrogel P(DMA-ko-NIPAM), dengan tren menurunnya rasio swelling dengan peningkatan temperatur. Rasio swelling terbesar pada berbagai temperatur dimiliki oleh hidrogel dengan komposisi DMA dan NIPAM yaitu 35 dan 65 mol% dan pada konsentrasi MBA 3%. Pengaruh pH, konsentrasi awal larutan logam berat, dan temperatur terhadap kapasitas adsorpsi ion logam berat oleh hidrogel P(DMA-ko-NIPAM) diteliti. Ion logam berat Co(II) dan Pb(II) menunjukkan pH optimum kapasitas adsorpsi di pH 5,5, sedangkan Cu(II) di pH 4,5. Kehadiran ion logam berat dapat menurunkan titik temperatur transisi fasa (Tc) hidrogel P(DMA-ko-NIPAM) dari 40oC menjadi 35oC. Kapasitas adsorpsi ion logam berat meningkat dengan semakin besarnya konsentrasi awal larutan logam berat, dan dengan semakin rendahnya temperatur. Serta model Langmuir adalah model isoterm adsorpsi paling cocok untuk ketiga ion logam berat. Kapasitas adsorpsi hidrogel P(DMA-ko-NIPAM) untuk ion logam berat menurun dengan urutan sebagai berikut: Co(II) > Cu(II) > Pb(II).
.....The temperature-responsive polymer hydrogels poly(N,N-dimethylacrylamide-co-N-isopropylacrylamide) (P(DMA-co-NIPAM)) was synthesized via free radical polymerization with ammonium persulphate (APS) initiator and N,N-methylene-bis-acrylamide (MBA) crosslinking agent. The P(DMA-co-NIPAM) hydrogels were characterized for their gel content, and the success of their polymerization. The successful synthesis of P(DMA-ko-NIPAM) hydrogels was evidenced by the absence of vinyl group peaks from the monomer in the FTIR spectra of P(DMA-ko-NIPAM) hydrogels. The results of the swelling ratio test showed the temperature responsiveness of the P(DMA-co-NIPAM) hydrogels, with a trend of decreasing swelling ratio with increasing temperature. The largest swelling ratios at various temperatures belonged to hydrogel with DMA and NIPAM compositions of 35 and 65 mol% and at 3% MBA concentration. The effect of pH, initial concentration of heavy metal solution, and temperature on the adsorption capacity of heavy metal ions by P(DMA-co-NIPAM) hydrogel was investigated. Heavy metal ions Co(II) and Pb(II) showed optimum pH of adsorption capacity at pH 5.5, while Cu(II) at pH 4.5. The presence of heavy metal ions can lower the phase transition temperature (Tc) of P(DMA-co-NIPAM) hydrogel from 40oC to 35oC. The adsorption capacity of heavy metal ions increases with the increasing initial concentration of heavy metal solution, and with the lowering of temperature. In addition, Langmuir

model was the most suitable adsorption isotherm model for the three heavy metal ions. The adsorption capacity of P(DMA-co-NIPAM) hydrogel for heavy metal ions decreased in the following order: Co(II) > Cu(II) > Pb(II).