Sintesis dan karakterisasi kopolimer blok PNIPAM-b-PDMAEMA menggunakan RAFT serta studi responsivitasnya terhadap pH dan temperatur = Synthesis and characterization of block copolymer PNIPAM-b-PDMAEMA using RAFT and study of its responsivity toward pH and temperature

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Abstrak

Kopolimer blok responsif pH dan temperatur poli(N-isopropilakrilamida)-blok-poli(2- (dimetilamino)etil metakrilat) (PNIPAM-b-PDMAEMA) disintesis menggunakan polimerisasi reversible addition-fragmentation chain transfer (RAFT) dengan variasi panjang rantai blok PDMAEMA, untuk mengetahui pengaruhnya terhadap temperatur transisi fasa (Tc). Karakterisasi menggunakan instrumen proton nuclear magnetic resonance (1H-NMR) dan fourier transform infrared (FTIR) menandakan produk berhasil terbentuk, didapatkan kopolimer blok PNIPAM21-b-PDMAEMA2 dan PNIPAM21-b-PDMAEMA7. Analisis makro-CTA PNIPAM menggunakan instrumen gel permeation chromatography (GPC) menunjukkan Mn dan PDI sebesar 3475 g/mol dan 1,15 serta dihasilkan distribusi berat molekul yang sempit. Perilaku responsif pH dan temperatur kopolimer blok diamati dalam larutan buffer fosfat pada variasi pH dan temperatur menggunakan instrumen spektrofotometer UV-Visible, hasil menunjukkan gugus ujung karboksil yang bersifat hidrofilik dan gugus ujung dodesil yang bersifat hidrofobik turut serta memberikan pengaruh terhadap Tc yang dihasilkan. Terjadi tren peningkatan Tc saat pH meningkat dari pH 5 ke pH 7,4 sementara dihasilkan Tc yang konstan pada pH 7,4 dan 9 akibat pengaruh blok PNIPAM dan PDMAEMA yang responsif pH. Pengujian menggunakan particle size analyzer (PSA) pada kopolimer blok PNIPAM21-b-PDMAEMA2 pH 5 dan 9 menunjukkan terjadi peningkatan diameter partikel seiring meningkatnya suhu. Kopolimer blok PNIPAM21-b-PDMAEMA7 menunjukkan responsivitas terbaik pada pH 5 dengan Tc 42 °C berpotensi untuk dimanfaatkan dalam bidang pengobatan penyakit kanker.
.....Stimuli responsive block copolymers of poly(N-isopropylacrylamide)-block-poly(2-dimethylamino)ethyl methacrylate) (PNIPAM-b-PDMAEMA) were successfully synthesized using reversible addition-fragmentation chain transfer (RAFT) polymerization by varying the chain length of the second block (PDMAEMA), and studied its effect on the phase transition temperature (Tc) as well as pH- and thermo- responsive behavior. Characterization using proton nuclear magnetic resonance (1H- NMR) and fourier transform infrared (FTIR) instruments indicate the product of block copolymers PNIPAM21-b-PDMAEMA2 and PNIPAM21-b-PDMAEMA7 were successfully formed. Analysis using gel permeation chromatography (GPC) showed Mn 3475 g/mol and PDI 1.15 corresponding to PNIPAM macro-CTA with narrow molecular weight distribution. Thermo- and pH-responsive behavior of block copolymers was investigated in phosphate buffer of varying pH and temperature using UV-Visible spectrophotometer. The results showed that the hydrophilic carboxyl end group and the hydrophobic dodecyl end group had an effect on the resulting Tc. There was an increasing trend of Tc when pH increased from pH 5 to pH 7.4 while Tc was constant at pH 7.4 and 9 due to the effect of pH-dependent PNIPAM and PDMAEMA blocks. Diameter particle of block copolymers PNIPAM21-b-PDMAEMA2 in pH 5 and 9 increased along with heating based on particle size analyzer (PSA) results. Moreover, block copolymers PNIPAM21-b-

PDMAEMA7 with Tc 42 °C at pH 5, has the potential to be used in cancer treatment.