# Sintesis dan Karakterisasi Nanogel Responsif pH dan Temperatur Poli(N-vinilkaprolaktam-ko-2-(dimetilamino)etil metakrilat) = Synthesis and Characterization of pH and Thermo-responsive Nanogels of Poly(N-vinylcaprolactam-co-2-(dimethylamino)ethyl methacrylate)

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Abstrak

Serangkaian nanogel responsif pH dan temperatur poli(N-vinilkaprolaktam-ko-2-(dimetilamino)etil metakrilat) (P(NVCL-ko-DMAEMA)) telah disintesis melalui polimerisasi emulsi radikal bebas. Dalam proses sintesis, komposisi monomer N-vinilkaprolaktam (NVCL) dan 2-(dimetilamino)etil metakrilat (DMAEMA) serta konsentrasi agen pengikat silang N,N'-metilenbisakrilamida (MBA) dibuat bervariasi yang ditujukan untuk menginvestigasi pengaruhnya terhadap responsivitas pada perubahan pH dan temperatur. Berdasarkan hasil karakterisasi FTIR dan 1H-NMR, ditunjukkan bahwa reaksi polimerisasi yang terjadi berhasil membentuk nanogel. Karakterisasi menggunakan spektrofotomer UV-Vis terhadap nanogel hasil sintesis menunjukkan bahwa setiap nanogel bersifat responsif terhadap pH dan temperatur dimana diketahui bahwa nanogel P(NVCL75-ko-DMAEMA25) 8% MBA yang memiliki temperatur transisi fasa (Tc) sebesar 50°C pada pH 7,4 menunjukkan responsivitas yang paling signifikan dibanding nanogel dengan variasi komposisi monomer dan variasi konsentrasi agen pengikat silang lainnya. Berdasarkan karakterisasi PSA, ditunjukkan bahwa ukuran partikel nanogel P(NVCL75-ko-DMAEMA25) 8% MBA meningkat seiring dengan meningkatnya temperatur. Hasil penelitian juga menunjukkan bahwa terdapat pengaruh komposisi monomer nanogel terhadap nilai Tc dimana Tc nanogel meningkat seiring dengan bertambahnya komposisi monomer DMAEMA dalam struktur nanogel. Sebaliknya, seiring dengan meningkatnya konsentrasi MBA dalam nanogel P(NVCL-ko-DMAEMA), diamati Tc nanogel menurun. Selain itu, nanogel yang dihasilkan dengan komponen polibasa berupa PDMAEMA memiliki nilai Tc yang cenderung rendah pada pH tinggi atau lingkungan basa.

.....A series of pH and temperature-responsive nanogels poly(N-vinylcaprolactam-co-2-(dimethylamino)ethyl methacrylate) (P(NVCL-co-DMAEMA)) was synthesized by free-radical emulsion polymerization. In the synthesis process, the composition of the monomers N-vinylcaprolactam (NVCL) and 2-(dimethylamino)ethyl methacrylate (DMAEMA), as well as the concentration of the crosslinking agent N,N'-methylenebisacrylamide (MBA), were varied to investigate their effect on responsiveness to changes in pH and temperature. Based on the results of FTIR and 1H-NMR characterization, it was shown that the polymerization reaction that occurred succeeded in forming nanogels. The UV-Vis spectrophotometer characterization of the synthesized nanogels showed that each nanogel was responsive to pH and temperature in which P(NVCL75-co-DMAEMA25) 8% MBA nanogel had a phase transition temperature (Tc) of 50°C at pH 7.4 and showed the most significant responsiveness compared to another nanogels with variations in monomer composition and variations in crosslinker concentrations. Based on PSA characterization, it was shown that the particle size of the P(NVCL75-co-DMAEMA25) 8% MBA nanogel increased with the increase of temperature. The results also showed that there was an effect of the composition of the nanogel monomer on the Tc value where the Tc of the nanogel increased with the increase of the composition of the DMAEMA monomer in the nanogel. On the other hand, as the

concentration of MBA in the P(NVCL-co-DMAEMA) nanogel increased, it was observed that the Tc of the nanogel decreased. In addition, the resulting nanogel with polybasic components in the form of PDMAEMA has a Tc value that tends to be low in high pH or alkaline environments.