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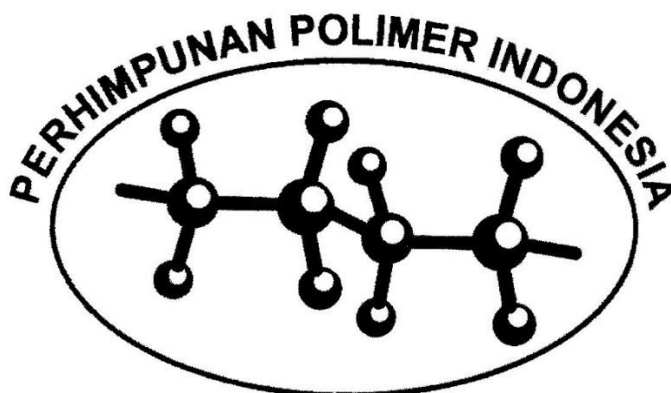
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MAJALAH POLIMER INDONESIA

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MAJALAH POLIMER INDONESIA, terbit secara berkala, dua kali setahun.

MAJALAH POLIMER INDONESIA menyajikan informasi hasil penelitian di bidang polimer.

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KATA PENGANTAR

Majalah Polimer Indonesia (MPI) merupakan majalah ilmiah yang diterbitkan oleh organisasi profesi, Perhimpunan Polimer Indonesia (HPI) sejak 1998. Penerbitan MPI ini merupakan bentuk kontribusi HPI dalam meningkatkan pengetahuan masyarakat di bidang ilmu pengetahuan dan teknologi polimer yang diharapkan berperan aktif meningkatkan perkembangan iptek di Indonesia.

MPI Vol. 19, No. 1, 2016 menerbitkan 6 (enam) artikel ilmiah yang berjudul : 1) *Synthesis of DOTA-TOC Conjugate as a Precursor of ¹⁷⁷Lu-DOTA-TOC Radiopharmaceutical for Therapy and Diagnosis of Somatostatin Receptor Positive Cancer*; 2) *Emulsion Stability with PLA as Co-Surfactant*; 3) Sintesis dan Pencirian Nanopartikel Fe₃O₄ dalam Hidrogel Kitosan; 4) Pengaruh Perendaman Membran Komposit Hidroksiapatit-Kitosan-Poli(Vinil Alkohol) dalam Larutan Simulated Body Fluid (SBF) terhadap Karakteristiknya; 5) *The Effect of Plasticization on Properties of Polymer Electrolyte PVDF Incorporated with LiPF₆*; dan 6) *An Effort on Homogenizing Size Distribution of Magnetic Nanosphere (MN) Fe₃O₄-Poly-Lactic Acids (PLA) for Hyperthermia Treatment*.

Pada edisi ini dipaparkan hasil penelitian tentang sintesis konjugat DOTA-tyr3-octreotide (DOTA-TOC), prekursor dari ¹⁷⁷Lu-DOTA-Tyr3-Octreotide sebagai kandidat radiofarmaka yang bermanfaat untuk terapi kanker positif reseptor somatostatin dan penggunaan poly lactic acid (PLA) untuk stabilitas emulsi stirena sebagai ko-surfaktan hidrofobik. Pada edisi ini juga dibahas tentang sintesis hidrogel kitosan menggunakan penaut-silang glutaraldehida (GLA) untuk menginduksi ion-ion Fe membentuk ferrogel sebagai nanopartikel magnetik Fe₃O₄. Pengaruh perendaman membran komposit hidroksiapatit-kitosan-poli(Vinil Alkohol) dalam larutan simulated body fluid (SBF) terhadap karakteristiknya dan upaya meningkatkan homogenisasi distribusi ukuran nanosfer magnetik (MN) Fe₃O₄-Poli Asam Laktat untuk Terapi Hipertermia merupakan bagian dari edisi ini. Hasil penelitian yang dipublikasikan di MPI ini diharapkan menjadi sumber informasi terhadap perkembangan ilmu pengetahuan dan teknologi di bidang polimer. Media publikasi ini diharapkan sebagai media informasi dan komunikasi publik untuk mendiseminasikan iptek dan wawasan tentang polimer.

Hasil penelitian yang dipublikasikan di MPI ini diharapkan menjadi sumber informasi terhadap perkembangan ilmu pengetahuan dan teknologi di bidang polimer. Media publikasi ini diharapkan sebagai media informasi dan komunikasi publik untuk mendiseminasikan iptek dan wawasan tentang polimer.

Komentar, kritik dan saran atas penerbitan jurnal ini, sangat berharga bagi peningkatan mutu dan kemajuan Majalah Polimer Indonesia.

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Rien Ritawidya, Sutari, Sri Setiyowati, Mochamad Subur, Yunilda Alwi, Veronika Yulianti Susilo, Titis Sekar Humani, and Martalena Ramli

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Synthesis of DOTA-TOC Conjugate as a Precursor of ^{177}Lu -DOTA-TOC Radiopharmaceutical for Therapy and Diagnosis of Somatostatin Receptor Positive Cancer

Sintesis Konjugat DOTA-TOC sebagai Prekursor ^{177}Lu -DOTA-TOC untuk Terapi dan Diagnosis Kanker Positif Reseptor Somatostatin

Majalah Polimer Indonesia 19 (1) 2016: 1-14

Somatostatin receptor is overexpressed in some cancers such as neuroendocrine, breast cancers, etc. Somatostatin analog, octreotide, which is labelled as lutetium-177 (^{177}Lu), can act as a ligand that serves as both diagnostic and therapeutic agent of cancer. The chosen of ^{177}Lu is mainly due to its favourable characteristic. It emits gamma and beta particles that are useful for the above mentioned purposes. This research aims to prepare a conjugate of N,N',N'',N'''-tetraazacyclododecane tetra acetic acid (DOTA)-tyr₃-octreotide (DOTA-TOC) a precursor of ^{177}Lu -DOTA-Tyr₃-Octreotide, a candidate of radiopharmaceutical for diagnosis and therapy of somatostatin receptors positive cancers. The DOTA-TOC conjugate was synthesised using two-step reactions: conjugation of ester NHS-DOTA to BOC-TOC and hydrolysis to form DOTA-TOC. The chromatogram of the DOTA-TOC conjugate gave peaks with retention time (tR) of 11.2 mins. ESI-MS analysis revealed +2 charge of the DOTA-TOC conjugate gave a peak at 711.32 Da which indicated the formation of the DOTA-TOC with m/z of $(1420.616 + 2\text{H})/2$ Da (exact mass of literature 1420.616 Da). The radiolabel of conjugate with ^{177}Lu resulted in of ^{177}Lu -DOTA-TOC with radiochemical purity of 87%. These results showed that the DOTA-TOC conjugate was a promising precursor for preparation of the ^{177}Lu -DOTA-TOC.

Keywords: ligand, analog, targeted, radionuclide, chromatogram

Yenny Meliana and Melati Septiyanti

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Emulsion Stability with PLA as Co-Surfactant

Stabilitas Emulsi Menggunakan PLA sebagai Ko-Surfaktan

Majalah Polimer Indonesia 19 (1) 2016: 15-22

Polystyrene emulsion based plastic raw material requires emulsion surfactant stabilizer to control its stability. Sometimes, single surfactant is not enough to reduce surface tension to the required value, hence co-surfactant is added into the system to reduce the particle size and narrow the size distribution. However, surfactant and co-surfactant concentration affect stability of the droplets by preventing Ostwald ripening. This study investigated styrene emulsion stability using Poly Lactic Acid (PLA) as hydrophobic co-surfactant and Sodium Dodecyl Sulfate (SDS) as the surfactant. PLA concentration was ranged from 1 to 5wt%, while SDS concentrations were 5 and 10 wt%. Emulsion stability was monitored by droplet size which was analyzed for 2 h and the data were recorded for every 10 min. The best condition resulted from this research is emulsion system with concentration PLA 5 wt% and SDS 10 wt%, with the particle size range 59-97.5 nm.

Keywords: miniemulsion polymerization, co-surfactant, biopolymer, nanomaterial, poly lactic acid (PLA)

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Sintesis dan Pencirian Nanopartikel Fe_3O_4 dalam Hidrogel Kitosan

Synthesis and Characterization of Fe_3O_4 Nanoparticles within Chitosan Hydrogel.

Majalah Polimer Indonesia 19 (1) 2016: 23-39

Nanopartikel Fe_3O_4 telah berhasil disintesis melalui proses perakitan ion-ion Fe dalam hidrogel kitosan (*iron ions assembly*). Hidrogel kitosan disintesis menggunakan penaut-silang glutaraldehid (GLA) dan direndam dalam larutan garam Fe^{2+} dan Fe^{3+} dengan nisbah konsentrasi 1:2 untuk menginduksi ion-ion Fe membentuk ferrogel. Nanopartikel magnetik Fe_3O_4 selanjutnya dibentuk dengan menambahkan basa NaOH, dan produk dikeringkan pada suhu 60 °C. Peragaman konsentrasi larutan garam dan waktu pengeringan menunjukkan sifat magnet terbaik pada penggunaan Fe^{2+} 0,15 M dan Fe^{3+} 0,30 M serta waktu pengeringan 16 jam. Pencirian produk dengan difraktometer sinar-X menunjukkan telah terbentuk fase magnetik Fe_3O_4 . Pencirian sifat magnet menggunakan *vibrating sample magnetometer* menunjukkan sifat superparamagnetik dengan nilai saturasi magnetik tertinggi 26,87 emu/gram yang setara dengan induksi nanopartikel magnetik Fe_3O_4 mencapai 30% berat dalam hidrogel kitosan. Pencirian dengan penganalisis ukuran partikel dan mikroskop elektron transmisi menunjukkan distribusi ukuran ~ 10 nm dari Fe_3O_4 tersalut oleh hidrogel kitosan. Terjadinya taut-silang kitosan oleh GLA terpantau pada spektrum inframerah dengan keberadaan serapan baru pada bilangan gelombang 1710 cm^{-1} . Hadirnya Fe_3O_4 terpantau dari munculnya serapan pada bilangan gelombang 632 cm^{-1} .

Kata Kunci : kitosan, hidrogel, glutaraldehid, nanopartikel, Fe_3O_4

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Pengaruh Perendaman Membran Komposit Hidroksiapatit-Kitosan-Poli(Vinil Alkohol) dalam Larutan Simulated Body Fluid (SBF) terhadap Karakteristiknya

The Effect of Immersion of Hydroxyapatite-Chitosan-Poly(Vinyl Alcohol) Composite Membranes in Simulated Body Fluid (SBF) Solutions on Their Properties

Majalah Polimer Indonesia 19 (1) 2016: 40-53

Telah dilakukan perendaman membran komposit hidroksiapatit-kitosan-poli(vinil alkohol) dalam larutan *simulated body fluid* (SBF) dengan variasi waktu perendaman. Larutan SBF digunakan untuk menguji bioaktivitas dari biomaterial. Kemampuan material membentuk ikatan dengan tulang dievaluasi dengan memeriksa apatit yang terbentuk pada permukaan material dalam larutan SBF. Karakterisasi setelah perendaman dalam SBF antara lain pengukuran pH larutan perendam, uji sifat mekanis, identifikasi gugus fungsi menggunakan *Fourier Transform Infra Red Spectroscopy* (FTIR) dan analisis struktur morfologi permukaan membran menggunakan mikroskop optik serta *Scanning Electron Microscope* (SEM). Hasil yang diperoleh menunjukkan pH larutan perendam berubah menjadi basa dari semula 7,4 setelah dilakukan perendaman. Hal tersebut dikonfirmasi dengan analisa FTIR kontrol M10-320 (PVA-kitosan) dimana PVA larut seiring dengan bertambahnya waktu perendaman dan menyisakan kitosan yang memiliki gugus NH₂. Uji sifat mekanis menunjukkan pengurangan nilai kekuatan tarik dan perpanjangan putus untuk komposisi M3-323 setelah 12 minggu perendaman, yaitu 41,85% dan 52,54%. Analisis morfologi struktur permukaan membran menunjukkan terbentuknya lapisan apatit sebagai indikator sifat bioaktivitas dari material. Penelitian ini menghasilkan komposisi membran yang prospektif untuk dikembangkan lebih lanjut sebagai bahan biomaterial untuk aplikasi klinis.

Kata Kunci: hidroksiapatit-kitosan-PVA, bioaktivitas, *Simulated Body Fluid* (SBF), membran komposit

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The Effect of Plasticization on Properties of Polymer Electrolyte PVDF Incorporated with LiPF₆

Pengaruh Plastisizer terhadap Sifat Polimer Elektrolit PVDF yang telah Ditambah Garam LiPF₆

Majalah Polimer Indonesia 19 (1) 2016: 54-67

The effect of plasticization on properties of polymer electrolyte PVDF incorporated with LiPF₆ has been studied. Ethylene carbonate with high dielectric constant was used as the plasticizer and added with various compositions (0-60% w/w). The polymer electrolyte thin films were prepared by solution casting technique. The successful of doping of the polymer with lithium salt and plasticizer has been confirmed by Fourier transformation infra red spectroscopy (FTIR) by analyzing the C-F vibration region of the polymer. Microstructure and surface morphology were studied by X-ray diffractometer (XRD) and Scanning Electron microscope (SEM), respectively. The thermal properties of polymer electrolytes studied by Differential Scanning calorimeter has shown that the plasticizer addition to PVDF promotes a decreasing in the crystallinity degree. The electrical property studies revealed that the highest conductivity was $3.46 \times 10^{-4} \text{ Scm}^{-1}$ obtained with addition of 60% w/w plasticizer. The study of tangent loss suggests that there are relaxing dipoles in the polymer electrolyte that shift towards higher frequency region.

Keywords: PVDF, LiPF₆, plasticizer, ethylene carbonate

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An Effort on Homogenizing Size Distribution of Magnetic Nanosphere (MN) Fe₃O₄-Poly-Lactic Acids (PLA) for Hyperthermia Treatment

Upaya Homogenisasi Distribusi Ukuran pada Nanosfer Magnetik Fe₃O₄-Poly-Lactic Acids (PLA) untuk Perlakuan Hipertermia

Majalah Polimer Indonesia 19 (1) 2016: 68-79

An effort on homogenizing the size distribution of magnetic nanosphere (MN) based on iron oxide nanoparticle coated with Poly-lactic acid (PLA) has been carried out. MN synthesis parameters were optimized to obtain MN with narrow size distribution but still maintaining other properties especially its magnetic property. The synthesis process was then followed by sequential centrifugation with different speed for selective separation of MNP with different size distribution. The size distribution characteristics of the magnetic nanosphere-poly lactic acid (MNP) were evaluated by Scanning Electron Microscopy (SEM), Transmission Electron Microscope (TEM), and Particle Size Analyzer (PSA). As a result, fractional MNPs having different size distribution smaller than 400 nm were successfully obtained. The highest fraction was achieved for MNP with size distribution <150 nm which almost reached 73% of total weight. However, the colloidal stability was still rather poor due to agglomeration tendency of MNP which were observed clearly in its SEM and TEM images. The magnetic properties were analyzed by VSM which gave the M_s values. These values were slightly affected by the MNP size distributions with maximum M_s value of 15.3 emu/gr. Considering the composition used within the experiment and from the M_s values, the iron oxide nanoparticle loading efficiency of around 78.9% could be determined. Referring to these results, the colloidal stability problem could be overcome by co-polymer grafting on PLA surface, hence the MNP could be expected to be applied for magnetic hyperthermia based therapy.

Keywords: magnetic nanosphere, iron oxide, poly-lactic acid, size distribution, magnetic hyperthermia