Sintesis Nanopartikel MnFe2O4 Menggunakan Ekstrak Buah Lada Hitam (Piper nigrum L.) yang Dikonjugasikan dengan Nimotuzumab Bertanda Yodium-131 = Synthesis of MnFe2O4 Nanoparticles Using Black Pepper Fruit Extract (Piper nigrum L.) Conjugated with Nimotuzumab Iodine-131

Amal Rezka Putra, author

Abstrak

Nanopartikel (NP) Mangan ferit (MnFe2O4) telah menyediakan platform serbaguna untuk mengembangkan sistem nano multifungsi untuk Magnetic Resonance Imaging (MRI) dan modalitas Single Photon Emmision Computed Tomography (SPECT). Di sini, kami mengembangkan NP Yodium-131 (131I)-bertanda nimotuzumab-MnFe2O4 baru sebagai MRI multimodalitas dan SPECT untuk diagnosis penyakit seperti kanker. Sintesis NP MnFe2O4 dilakukan dengan menggunakan ekstrak Piper nigrum (EPN). EPN berperan sebagai bahan sumber basa lemah dan zat penstabil yang menunjukkan adanya alkaloid, polifenol, serta terpenoid yang dikonfirmasi dari uji fitokimia. NP MnFe2O4 kemudian dikonjugasikan ke Epidermal Growth Factor Receptor (EGFR) nimotuzumab melalui PEG-linker heterobifungsional. Radiolabeling NP MnFe2O4 terkonjugasi nimotuzumab dengan Yodium-131 dilakukan dengan metode oksidasi iodobead. NP MnFe2O4 hasil sintesis dikarakterisasi dengan DRS, FTIR, XRD, SEM, TEM, dan EDX. NP MnFe2O4 yang dikonfirmasi memiliki bentuk bulat, dengan ukuran rata-rata sekitar 21 nm dengan bentuk kristal kubik fase tunggal. Nanopartikel menunjukkan sifat magnetisasi 23,4 emu/g sebagaimana dikonfirmasi oleh analisis VSM. Hasil konjugasi MnFe2O4 -nimotuzumab berhasil dilakukan dengan linker SH-PEG-NHS. Nanopartikel 131I-bertanda nimotuzumab-MnFe2O4 yang disiapkan memberikan kemurnian radiokimia yang sangat baik sebesar 93,57 ± 0,52%. Investigasi biologis di masa depan dari NP MnFe2O4-nimotuzumab-131I baru ini sebagai nanoprobe MRI dan SPECT baik in vitro dan in vivo masih diperlukan .....Manganese ferrite (MnFe2O4) nanoparticles (NPs) has provided versatile platform to develop multifunctional nanosystem for magnetic resonance imaging (MRI) and single-photon emission computed tomography (SPECT) modalities. Herein, we develop novel iodine-131-labeled-nimotuzumab-MnFe2O4 NPs as multimodalities MRI and SPECT nanoprobe for diagnosis of disease such as cancer. The synthesis of MnFe2O4 NPs were done using Piper nigrum extract (PNE). PNE plays role as a weak base source material and stabilizing agent which showed the presence of alkaloids, polyphenols, as well as terpenoids as confirmed from the phytochemical test. MnFe2O4 NPs were then conjugated to anti-epidermal growth factor receptor (EGFR) nimotuzumab via heterobifunctional PEG-linker. The radiolabeling of nimotuzumab-conjugated MnFe2O4 NPs with iodine-131 was performed using iodobead oxidizing method. The synthesized MnFe2O4 NPs were characterized by DRS, FTIR, XRD, XRD, SEM, TEM, and EDX. The confirmed MnFe2O4 NPs have a spherical shape, with an average size of about 21 nm with a single-phase cubic crystal form. The NPs showed magnetization properties of 23.4 emu/g as confirmed by VSM analysis. The results of the conjugation of MnFe2O4-nimotuzumab were successfully carried out with the SH-PEG-NHS linker. The prepared iodine-131-labeled-nimotuzumab-MnFe2O4 NPs gave an excellent radiochemical purity of 93.57 ± 0.52 %. Future biological investigations of this novel iodine-131-labeled-nimotuzumab-MnFe2O4 NPs as MRI and SPECT nanoprobe both in vitro and in vivo are required.