Formulasi hidrogel polivinil Alkohol-Pektin untuk pelepasan lambat obat anti tuberkulosis rifampicin : karakterisasi dan optimasi = Formulation of hydrogels from polyvinyl Alcohol-Pectin for extended release of anti tuberculosis drug rifampicin : characterization and optimization

Irsa Septiawan, author

Abstrak

ABSTRAK
Indonesia merupakan salah satu negara dengan populasi terbanyak yang terinfeksi tuberculosis (TB), termasuk infeksi TB ekstrapulmonal yang merusak tulang belakang. Berdasarkan aturan WHO, pengobatan tuberkulosis tulang belakang membutuhkan pemberian obat antituberkulosis setiap hari selama 6 bulan . Untuk mengatasi kemungkinan kepatuhan pasien yang rendah dan kesulitan pengantaran obat menuju jaringan yang rusak, diperlukan sediaan
pelepasan obat terkendali dalam bentuk implan polimer. Polimer PVA memiliki sifat tidak toksik, biodegradable, dan sifat mekanisnya dapat disesuaikan untuk meniru berbagai macam jaringan lunak. Pada penelitian ini digunakan hidrogel PVA-pektin, dibuat menggunakan
metode freeze thaw, yang termuati obat anti tuberkulosis rifampicin. Pektin ditambahkan untuk mengatur laju pelepasan obat karena pektin dapat berinteraksi dengan rifampicin. Pembuatan hidrogel PVA-pektin sebagai penghantar rifampicin dioptimasi menggunakan metode respon permukaan dengan empat variabel bebas: loading rifampicin (20%, 30%, 40%), konsentrasi larutan PVA (10%, 15%, 20%), konsentrasi larutan pektin (0%, 0,5%, 1%), dan jumlah siklus freeze thaw (2, 4, 6 kali). Data pelepasan hasil pengamatan selama 90 hari menunjukkan bahwa profil rilis rifampicin mengikuti kinetika rilis orde nol. Penambahan loading rifampicin, pengurangan konsentrasi PVA dan konsentrasi pektin, serta pengurangan jumlah siklus freeze thaw meningkatkan baik rilis kumulatif rifampicin maupun swelling hidrogel PVA. Formulasi dengan jumlah siklus freeze thaw 6 kali menghasilkan jaringan kristal yang lebih teratur berdasarkan pengamatan pada uji SEM. Hasil FTIR menunjukkan adanya interaksi PVA dengan pektin. Rifampicin telah berhasil berinteraksi dengan hidrogel PVA-pektin berdasarkan hasil DSC dan ketahanan termal rifampicin meningkat ketika berada dalam hidrogel PVApektin. Uji XRD menyatakan ukuran kristal meningkat dengan bertambahnya siklus freeze thaw dari 2 kali (9,58 nm) menjadi 6 kali (23,79 nm) dan dengan penurunan loading rifampicin dari 40% (9,09 nm) menjadi 20% (9,58 nm). Kondisi optimum matriks hidrogel diperoleh pada 39,7% loading rifampicin, 10,3% PVA, 0,3% pektin, dan 2 kali siklus freeze thaw yang menghasilkan rilis rifampicin sebanyak 74,2% selama 3 bulan.
<hr>
ABSTRACT
Indonesia is one of the countries with the largest population infected with tuberculosis (TB), including extrapulmonary TB infection which damages the spine. Based on WHO regulations, treatment of spinal tuberculosis requires the provision of anti-tuberculosis drugs every day for 6 months. To overcome the possibility of low patient adherence and the difficulty of delivering the drug to the damaged tissue, a controlled release of the drug in the form of a polymer implant is needed. PVA polymers have non-toxic,

biodegradable properties and their mechanical properties can be adjusted to mimic a variety of soft tissue tigers. In this study the PVA-pectin hydrogel, made using the freeze thaw method, is loaded with the anti-tuberculosis drug rifampicin. Pectin is added to regulate the rate of drug release because pectin can interact with rifampicin. The making of PVA-pectin hydrogel as an agent for rifampicin is optimized using the response surface method with four independent variables: rifampicin loading (20%, 30%, 40%), concentration of PVA solution (10%, 15%, 20%), concentration of pectin solution (0 %, 0,5%, 1%), and the number of freeze thaw cycles (2, 4, 6 times). The release data of observations for 90 days showed that the rifampicin release profile followed the zero-order release kinetics. The addition of rifampicin loading, reduction of PVA concentration and pectin concentration, as well as reduction in the number of freeze thaw cycles increase both the cumulative release of rifampicin and swelling hydrogel PVA. The formulation with 6 times of freeze thaw cycles produces more regular crystal network based on observations in the SEM test. FTIR results show the interaction of PVA with pectin. Rifampicin has successfully interacted with the PVA-pectin hydrogel based on DSC results and the thermal resistance of rifampicin increased when it was in the PVA-pectin hydrogel. The XRD test revealed that the
crystal size increased with increasing freeze thaw cycle from 2 times (9,58 nm) to 6 times (23,79 nm) and with a decrease in rifampicin loading from 40% (9,09 nm) to 20% (9,58 nm). The optimum condition of hydrogel matrix was obtained at 39,7% loading of rifampicin, 10,3%
PVA, 0,3% pectin, and 2 freeze thaw cycles which resulted in rifampicin release of 74,2% for 3 months.