MIKROENKAPSULASI β-KAROTEN DALAM MATRIKS PATI-KITOSAN/TRIPOLIFOSFAT MENGGUNAKAN METODE PRESIPITASI

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INTISARI

Aplikasi β-karoten pada bidang pangan, obat, dan kosmetik terbatasi oleh sifatnya, yaitu tidak larut dalam air, labil, dan memiliki bioavailabilitas rendah. Masalah ini dapat diatasi dengan cara mengenkapsulasi β-karoten dalam matriks pati-kitosan/tripolifosfsat (TPP). Tujuan penelitian ini adalah mempelajari pengaruh komposisi matriks terhadap efisiensi enkapsulasi (EE) dan *loading capacity* (LC), kestabilan penyimpanan, kelarutan dan *swelling power*, pelepasan, dan aktivitas antioksidan produk enkapsulasi.

Tahapan penelitian ini diawali dengan sintesis pati terhidrolisis asam menggunakan HCl 0,15 M selama 8 jam pada suhu 50 °C. Selanjutnya, pati asli dan pati terhidrolisis asam digunakan dalam enkapsulasi β-karoten. Proses enkapsulasi dilakukan dengan metode presipitasi sebagai berikut: Campuran matriks disiapkan dengan mencampurkan dispersi pati dengan larutan TPP dan ditambahkan larutan kitosan. Campuran matriks dipanaskan pada suhu 90 °C selama 10 menit. Larutan β-karoten dalam etanol ditambahkan tetes demi tetes dalam campuran matriks. Campuran didinginkan dan disentrifugasi 7000 x g selama 20 menit. Endapan dicuci dengan etanol, disentrifugasi dan dikeringkan dalam *freeze-dryer* selama 13 jam. Produk yang terbentuk ditentukan EE dan LC-nya menggunakan spektrofotometer UV-Vis dan dikarakterisasi menggunakan metode *Dynamic Light Scattering* (*DLS) Analysis*, *Scanning Electron Microscopy* (SEM), *Transmission Electron Microscopy* (TEM), spektroskopi *fourier Transform InfraRed* (FTIR), *X-Ray Difraction* (XRD), *Thermo Gravimetry Analysis* (TGA), dan *Differential Scanning Calorymetry* (DSC). Selanjutnya dilakukan uji stabilitas penyimpanan produk enkapsulasi, uji kelarutan dan *swelling power*, uji pelepasan β-karoten pada media pencernaan *in vitro* dan etanol, serta uji antioksidan.

Hasil penelitian menunjukkan bahwa EE dan LC cenderung meningkat dengan meningkatnya fraksi polimer dalam matriks dan berat penambahan β-karoten, serta menurunnya berat penambahan TPP. Penambahan kitosan dan penggantian pati asli dengan pati terhidrolisis cenderung meningkatkan EE, LC, dan stabilitas penyimpanan. Produk enkapsulasi dengan pati terhidrolisis memiliki kelarutan yang lebih tinggi dan *swelling power* lebih rendah dibandingkan dengan produk enkapsulasi berbasis pati asli. Pelepasan β-karoten mengikuti model Korsmeyer-Peppas dengan n kurang dari 0,45. Aktivitas antioksidan produk enkapsulasi lebih tinggi daripada β-karoten takterenkapsulasi. Hasil ini mempromosikan penggunaan pati asli-kitosan/TPP dan pati terhidrolisis-kitosan/TPP sebagai matriks enkapsulasi senyawa lipofilik seperti β-karoten.

Kata kunci: mikroenkapsulasi, β-karoten, pati, kitosan, tripolifosfat

MICROENCAPSULATION OF β-CAROTENE IN STARCH-CHITOSAN/TRIPOLYPHOSPHATE MATRICES BY USING PRECIPITATION METHOD

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SUMMARY

Applications of β-carotene in the fields of food, medicine, and cosmetics are limited by its nature, which is insoluble in water, labile, and having low bioavailability. This problem can be overcome by encapsulating β-carotene in the starch-chitosan/tripolyphosphate (TPP) matrix. The objectives of this study are to investigate the effect of matrix composition on the encapsulation efficiency (EE) and loading capacity (LC), storage stability, solubility and swelling power, release, and antioxidant activity of the encapsulation products.

The steps of this research were began with the synthesis of acid hydrolyzed starch using HCl 0.15 M for 8 hours at 50 °C. Then, the native starch and acid hydrolyzed starch were used in the encapsulation process. The encapsulation process was carried out by the precipitation method with the following steps: A matrix mixture was prepared by mixing starch dispersion with a TPP solution then chitosan solution was added. The mixture was heated at 90 ° C for 10 minutes. The β-carotene solution in ethanol was added dropwise in the matrix mixture. The mixture was cooled and centrifuged at 7000 x g for 20 minutes. The precipitate was washed with ethanol, centrifuged and dried in a freeze-dryer for 13 hours. The products formed were determined its EE and LC using a UV-Vis spectrophotometer and were characterized using Dynamic Light Scattering (DLS), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Fourier Transform InfraRed spectrometer (FTIR) spectroscopy, X-Ray Difraction (XRD), Thermo Gravimetry Analysis (TGA), and Differential Scanning Calorymetry (DSC) methods. Furthermore, the storage stability, solubility and swelling power, release of β-carotene, and antioxidant activity were investigated.

The results showed that EE and LC tended to increase with the increasing polymer fraction and weight of β-carotene addition, and decreasing the weight of TPP addition. The addition of chitosan and the replacement of native starch with hydrolyzed starch tended to increase EE, LC, and storage stability. Encapsulation products using hydrolyzed starch have higher solubility and lower swelling power compared to the native one. The release of β-carotene follows the Korsmeyer-Peppas model with n less than 0.45. The antioxidant activity of the encapsulated product is higher than the one of the nonencapsulated product. These results promote the use of native starch-chitosan/TPP and hydrolyzed starch-chitosan/TPP as matrices for encapsulation of lipophilic compounds such as β-carotene.

Keywords: microencapsulation, β-carotene, starch, chitosan, tripolyhosphate