

ABSTRACT

Carbon nanotube (CNTs) have been known as an efficient drug carrier. In this present work, multi-walled carbon nanotube (MWCNTs) functionalized with acid, chitosan and gelatin were prepared as carrier for curcumin (CUR). Firstly, pristine MWCNTs were modified with acid solutions (nitric and sulfuric acid), followed by functionalization with chitosan and gelatin to obtain well-dispersed nanocomposites. The synthesized materials were characterized by Fourier transform infrared (FTIR) spectrophotometer, thermogravimetric analysis (TGA), BET surface area analysis, and dispersion test. The batch adsorption of CUR in the nanocomposites were determined using adsorption kinetic and isotherm studies at various temperature, room temperature, 40⁰ C and 50⁰ C, respectively.

The results showed that pseudo-second-order exhibits the best fit for kinetic studies. The adsorption isotherms were fitted well by Langmuir and Freundlich model, depending on the adsorption temperature. The maximum capacity (q_m) obtained from the data at room temperature, 40⁰ C and 50⁰ C, was 90 mg/g ; 25 mg/g ; and 20 mg/g. From the equilibrium data in various temperatures, thermodynamic properties such as Gibbs free energy, enthalpy, and entropy could be obtained. Pristine MWCNT sample (RAW) was followed chemisorption mechanism, while the others followed physisorption mechanism. In addition, oxidized MWCNT (O-MWCNT) and chitosan grafted MWCNT (CH-MWCNT) produced high adsorption capacity (23,9808 mg/g and 12,2399 mg/g) and gave the best dispersibility.

Keywords: Adsorption, carbon nanotubes (CNTs), chitosan, curcumin, dispersion, gelatin.

Carbon nanotube (CNT) merupakan material yang berpotensi digunakan sebagai pengemban obat. Pada penelitian ini, *multi-walled carbon nanotube* (MWCNT) dimodifikasi dengan campuran asam nitrat dan asam sulfat, kemudian dilakukan grafting menggunakan kitosan dan gelatin untuk memperoleh nanokomposit yang dapat mengemban obat serta memiliki sifat dispersi yang baik. Nanokomposit tersebut dikarakterisasi dengan Titrasi Boehm, *Fourier transform infrared spectrophotometer* (FTIR), *thermogravimetric analysis* (TGA), analisis *surface area* dengan metode BET, dan uji dispersi. Studi kinetika dan keseimbangan adsorpsi kurkumin pada nanokomposit dilakukan dengan sistem batch pada suhu ruang, 40°C, dan 50°C.

Dari hasil penelitian, proses kinetika adsorpsi mengikuti model pseudo orde dua. Selain itu, dari keseimbangan adsorpsi dapat disimpulkan bahwa proses adsorpsi mengikuti model Langmuir dan model Freundlich, tergantung dari suhu operasinya. Kapasitas adsorpsi kurkumin maksimum (q_m) yang diperoleh sebesar 90 mg/g untuk suhu ruang, 25 mg/g untuk suhu 40°C, dan 20 mg/g untuk suhu 50°C. Dari kajian termodinamika adsorpsi, energi bebas Gibbs, entalpi, dan entropi sistem dapat dihitung. Dengan parameter tersebut, dapat diketahui bahwa sampel RAW mengikuti mekanisme *chemisorption*, sedangkan sampel yang lain mengikuti mekanisme *physisorption*. MWCNT yang telah dimodifikasi dengan asam (O-MWCNT) dan MWCNT yang digrafting dengan kitosan (CH-MWCNT) memberikan kapasitas maksimum adsorpsi yang cukup besar (23,9808 mg/g dan 12,2399 mg/g) dan dispersi yang baik.

Kata Kunci: Adsorpsi, carbon nanotubes (CNT), kurkumin, dispersi, gelatin, kitosan.