Development and Characterization of Tetracycline-loaded Chitosan-Alginate Polyelectrolyte Complex Nanocomposite Poly(vinyl alcohol) Films

De Guzman, Bienvenido Y. III[1]; Parde Ian Dansen A.[1]; Rodriguez, Cy M.[1a]; Bulatao, B.P.I. RPh, MS[2]

[1] Bachelor of Science in Industrial Pharmacy, [a] Principal Investigator-Presenter
[2] Associate Professor, Department of Industrial Pharmacy
College of Pharmacy, University of the Philippines Manila
ISPE Philippines Affiliate

ABSTRACT

Nanoparticles are being used for specific drug delivery with lower dosing of active agents targeting the specific site of action at favorable times offering numerous therapeutic advantages. As resistance to antibiotics is increasing worldwide and discovery of new effective antimicrobials are decreasing, innovation with existing drugs is therefore considered a global research priority.

In this study, nanoparticles were prepared by modified ionic gelation of chitosan and sodium alginate in solution. Tetracycline-loaded nanoparticles were prepared by dissolving tetracycline in the alginate solution yielding a polymer-tetracycline mass ratio of 1:0.5. Preparation of Tet/CS-AG PEC nanocomposite poly(vinyl alcohol) films were formed through simple casting method.

The prepared nanoparticles ranged from 112.0 nm to 4532.0 nm. Scanning Electron Microscopy showed that the nanoparticles were spherical in shape and the films showed a dense continuous sheet with no fractures. The particle size distribution of the prepared nanoparticles showed a D50% of 569.10 nm but displayed a dispersity of Đ=0.729. Zeta potential of the nanosuspension averaged 37.54 ± 2.11 mV, excellent for stability, muco- and bio-adhesion. The mean encapsulation efficiency of the prepared nanoparticles was 73.89%.

Film thickness (0.050 mm), tensile strength (52.69 MPa), elongation at break (391.67%), Young's modulus (942.46 MPa), moisture content (28.59%) and water uptake (406.88%) showed that the prepared nanocomposite film is promising as a pharmaceutical film local drug delivery system on mucosal membranes or open wounds. The in vitro release of encapsulated tetracycline showed an initial burst effect followed by sustained release over a 72-hour period from the nanocomposite film.

The prepared film in the study has potential as a nanopharmaceutical local drug delivery system, it is recommended to optimize the parameters that affect its critical quality attributes.