

**PHYSICOCHEMICAL AND MECHANICAL
CHARACTERISTICS OF CHITOSAN-ALGINATE,
CHITOSAN-ALGINATE-ZINC OXIDE FILMS**

PhD (DISSERTATION)

NWE NI AYE

**DEPARTMENT OF CHEMISTRY
UNIVERSITY OF YANGON
MYANMAR**

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ABSTRACT

In the preparation of chitosan based composites films and beads, 90.13 % degree of deacetylation, 13.21 % moisture content, 0.6 % ash content and molecular weight of 3.9×10^5 Da were found to be the most reliable for casting films and forming beads. In order to produce one of the potential wound dressing materials, chitosan with a yield of 75.00 % was converted from chitin by using Fujita's method. The precursor chitin with a yield of about 17.09 % was extracted from Black Tiger Shrimp shells by the conventional Hackmann's method. Fourier transform infrared spectroscopy was used to confirm the degree of deacetylation of chitosan. Flexible and thin films such as chitosan salt (CTSS), chitosan salt-sodium alginate (CTSS-SA) and chitosan salt-sodium alginate-zinc oxide (CTSS-SA-ZnO) were prepared by using solution casting method.

The equilibrium water content (EWC) of the films were in the range (91-132)% with regard to sodium alginate (SA) and (143-205)% with regard to zinc oxide. The water retention capacity (WRC) of the films were 51% with regard to (SA) and 63% with regard to (ZnO). The weight loss (WL) of the films were 41% with regard to SA and 74% with regard to ZnO.

The morphological structure of the films was observed to be composed of a dense skin of fibrous layer by scanning electron microscopy (SEM). The antibacterial activity was examined by agar plate diffusion method. From the behavior of antimicrobial releases the antimicrobial agents could protect the wound surfaces from bacterial invasion and effect suppress bacterial proliferation.

An effective antibacterial efficacy films of optimal amounts, 1.5% (w/v) chitosan salt (CTSS), 0.3% (w/v) sodium alginate (SA) and 0.3% (w/v) zinc oxide can be utilized as an impaired wound dressing for infected sores and ulcerated skin. The antibacterial action of the wound dressing film was observed favourable responses in its action towards relative microorganisms such as *bacillus subtilis*, *pseudomonas aeruginosa*, *staphylococcus aureus*, *bacillus pumilus*, *candida*

albican, mycobacterium species which are more or less relative to some of the diseases that cause in infected wounds and ulcerated skin. The prepared chitosan salt-sodium alginate-zinc oxide (CTSS-SA-ZnO) film do possess pronounced synergistic effects on the tested microorganisms and it can be utilized as a wound dressing as well as a medicinal therapeutic ointment. The chitosan salt-sodium alginate (CTSS-SA) composite bead form was found to remove 99 % (w/w) mercury and may be used as an effective sorbent in mercury contaminated water body.

Keywords: *chitosan salt-sodium alginate and chitosan salt-sodium alginate-zinc oxide composite, wound dressing, removal of mercury*