CHARACTERIZATION OF THIN CHITOSAN COMPOSITE FILMS

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Introduction

Chitosan is a derivative of chitin obtained most often from crustacean shells although it is also produced by other organisms, e.g. Mushrooms. Chitin is a substance that is hard to dissolve. In contrast, chitosan can be dissolved in dilute acids, such as lactic acid or acetic acid, which do not harm humans and the environment. Chitosan is used in the cosmetics, pharmaceutical and medicine industries. To discover its potential, various substances are added to chitosan, such as ionic liquids, inorganic additives, other polymers. The aim of the study was to determine the effect of addition of nanoclay on the properties of the composite in the form of thin films. Thin films have been formed by casting methods from lactic acid solution. Morphology and swelling behavior of chitosan composites before and after neutralization process were studied.

Materials and Methods

Chitosan was supplied by Institute of Sea Fisher (Poland). Nanoclay was supplied by Aldrich Chemical Company. Lactic acid, sodium hydroxide and the substances needed to prepare phosphate buffered saline (PBS) were provided by POCh (Avantor) or Chempur Poland. All chemicals were of analytical grade and used as received without further purification.

To create thin films, 2.0 wt.% aqueous solution was prepared by dissolving chitosan sample in a lactic acid (0.1M). The additive of nanoclay (3% and 5% on solid chitosan) was dispersed in the solvent. Then, polymer solution was added slowly to the nano-additive dispersion. Polymer and composite films were achieved by a solution casting methods. Thin films were also neutralized by immersing into a sodium hydroxide solution (1%) for 15 min. After the alkaline treatment, the films were rinsed and left in distilled water, overnight.

Morphology of composite films were observed with SEM (Quanta 3D FEG, D9399, FEI Company, Eindhoven, the Netherlands).

Each type of film (10 mm x 10 mm) was immersed in phosphate buffered saline (PBS, pH = 7.4) solution. After 1, 4, 24 and 48 h, samples were removed from the PBS solution, were gently dried by putting them between two sheets of paper and weighted.

Results and Discussion

Unmodified chitosan film shows a relatively smooth flat surface morphology. For chitosan composites, the surfaces of films exhibited a few asperities, corresponding to the presence of nanoclay particles, which were homogeneously distributed.

The swelling test of the resulting composites without neutralization showed that the samples without neutralization dissolve in PBS. For neutralized samples, swelling results were different depending on the average molecular weight of chitosan and the concentration of nanoclay.

Conclusions

The morphology and swelling behavior of chitosan/nanoclay composite as thin films are affected by nanoclay concentration, average molecular weight of chitosan, and the neutralization process.

References

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