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Preparation and Characterization of Chitosan-pHEMA with semi-IPN structure

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1. Introduction

Chitosan (CS) is a deacetylated products of chitin, which is a naturally occurring nontoxic, biocompatible and biodegradable and is one of the most promising various medical application. Nowadays, natural polymer is developed to prepare polymeric material structure in thin-film, fibers and sponge. Poly (2-hydroxyethyl methacrylate) (PHEMA) is well known for the excellent hydrophilicity, biocompatibility and outstanding tissue compatibility, which is one of the most used monomers in the medical application. One of method to obtained polymeric materials is semi-interpenetrating networks (semi-IPNs) which consists of two different polymers to improve widely application from their properties of those polymer. Therefore, the purpose of this work is to develop the study of semi-IPNs CS/PHEMA structure by using simultaneous polymerization technique. Thus, chitosan and poly (2-hydroxyethyl methacrylate) (Chitosan/PHEMA) was prepared using potassium persulfate (KPS) as an initiator and triethylene glycol dimethacrylate (TEGDM) as a crosslink agent of HEMA.

2. Experiment

2.1 Materials

Chitosan FL-grade with 89.9%dec. was purchased by Kyowa Technos Co., Japan. HEMA, TEGDM, KPS and sulfuric acid were purchased from Wako Chemical Co. (Japan).

2.2 Preparation

2%Chitosan dissolved in 1% acetic acid was mixed with HEMA for 1 h. then TEGDM and KPS with various condition was mixed and polymerization at 50°C for 24 h. After that samples were dried and Soxhlet extraction to remove un-reacted and free homopolymer.

2.3 Characterization

The confirmation of semi-IPN with various condition were checked by FTIR spectra were recorded using spectrophotometer with a resolution of 4 cm^{-1}. The cross-sectional and surface morphology of the CS/PHEMA structure was investigated by SEM. porosity, swelling test and mechanical property were also checked.

3. Results and Discussion

Semi-IPNs structure of CS/PHEMA was evident from the Soxhlet extraction (fig.1(c)). It can be seen that CS/PHEMA structure is brittle in dry state and flexible in wet state. FT-IR experimental results confirmed that chitosan and PHEMA entangled as interpenetrated structure (Fig.1(d)). SEM observations revealed porous structure of CS/PHEMA (fig.1(a, b)) where the porosity showed individual with varying mole ratio of CS/HEMA, crosslink agent and initiator, it was observed in the rage of 64%-83% porosity. It implied that the porous were produced by interpenetrating between PHEMA networks and chitosan with optimized proportion of conditions. Swelling ratio showed no significant tends, it might indicate that not only the porosity was observed but also side of hydrophilic group from HEMA and chitosan affected similar trends of swelling ratios. The tensile strength and elongation at beak were obtained from semi-IPNs of cCS/PHEMA conditions. These results may be expected widely biomedical applications and promoted on natural polymer to improve many properties of materials.

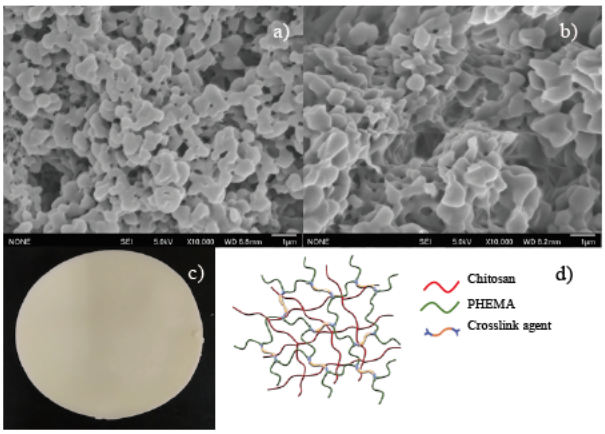

Fig 1 (a) Sureface (b) Cross-sectional fracture of the Chitosantin/PHEMA sturcture with mole ratio of chitosan/HEMA is fixed at 1:12 37, together with TEGDM and KPS are of 2 5 and 5 mole%, respectively, respective to amount of HEMA (c) Apprerance of the prepared Chitosan/PHEMA sturcutre, (d) Semi-IPN structure simulation

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