Chitosan (CS), a naturally occurring polysaccharide, is widely being used for medical and pharmaceutical applications owing to its biocompatibility and biodegradability. However, its brittle nature and weak mechanical properties often limit its application in the biomedical field. Therefore, the aim of the present study is to reduce the brittle nature of the CS films by addition of polyethylene glycol (PEG) and to further improve their mechanical properties by reinforcing with the polyether ketone (PEEK). Briefly, CS (2% w/v) was dissolved in 2% acetic acid solution and stirred overnight at 37°C. PEG in the concentration of 1% w/v was added to the CS solution and stirred again for 6 h. In the CS-PEG composite, PEEK was added at concentrations of 0.1% and 0.5% w/w (w.r.t. CS) to develop CS-PEG-PEEK composites. The composites were characterized by performing scanning electron microscopy (SEM), X-ray diffraction and Fourier transform infrared study. The contact angle measurement, swelling studies, degradation studies, hemocompatibility and protein adsorption studies were also performed. The mechanical properties of the composites were evaluated by performing tensile studies. The SEM micrographs showed well dispersion of PEG and PEEK in the CS matrix. The CP showed lowest contact angle values, whereas, the addition of PEEK increased the contact angle values. The PEEK containing samples (CP 0.1 and CP 0.5) showed least swelling percentage and degradation rate than the control (CP). All the samples exhibited ≤5% hemolysis values confirming their hemocompatible nature. The adsorption of protein on all the composites indicated their suitability for biomedical applications. Further, the reinforcement of PEEK in CS-PEG matrix improved the mechanical properties of the composites many folds. This study confirms the potential of CS-PEG-PEEK composites for biomedical implant applications.

Keywords: chitosan, polyethylene glycol, polyether ether ketone, composite, degradation, biomedical applications

INTRODUCTION

Chitosan (CS), a naturally occurring polysaccharide, is widely being used for medical and pharmaceutical applications owing to its biocompatibility and biodegradability. However, its brittle nature and weak mechanical properties often limit its application in the biomedical field. Therefore, the aim of the present study is to reduce the brittle nature of the CS films by addition of polyethylene glycol (PEG) and to further improve their mechanical properties by reinforcing with the polyether ketone (PEEK).

MATERIALS AND METHODS

PREPARATION OF FILMS

CHARACTERIZATION

SCANNING ELECTRON MICROSCOPY AND FTIR

CONTACT ANGLE MEASUREMENTS

DEGRADATION STUDIES

HEMOLYSIS STUDY

SWELLING STUDIES

TENSILE PROPERTIES

PROTEIN ADSORPTION

CONCLUSION

Chitosan-PEG-PEEK composites so developed showed porous structures and all the individual components were found to be evenly distributed in the Chitosan matrix without any agglomerate formation.

The addition of PEEK made the samples more hydrophobic leading to reduction in swelling and degradation properties.

All the samples showed hemocompatible nature and overall good mechanical properties.

An increase in protein adsorption and contact angle measurements manifesting PEEK containing samples more suitable for tissue engineering applications

BIBLIOGRAPHY