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Structural Characteristics, Miscibility and Properties of Silk Fibroin/Polyurethane Blend Films

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Silk fibroin, one of the typical natural protein polymer, have been studied as a source of textile fiber and biomaterials. However, silk fibroin films in the dry state, being very brittle, are not suitable for use by themselves. Polyurethane have been used in biomedical application due to their excellent mechanical properties and relatively good blood compatibility. However, the problem of blood surface of material interactions remains a major obstacle in application of polyurethane polymer to blood contacting biomaterials. In this backgrounds, silk fibroin/polyurethane blend films were prepared to improve blood compatibility of polyurethane and mechanical property of silk fibroin. Structural characteristics, miscibility and property of the blends were also examined. XRD and FTIR results indicated that there was no specific interaction between two polymers and no conformational change was occurred by blending. SEM observation suggested degree of phase separation in blends decreased with increase of polyurethane composition. DMTA measurement demonstrated immiscibility of silk fibroin/polyurethane blend films showing two T_g peak. Thermogravimetric analysis indicated degradation products of silk fibroin accelerated thermal decomposition of hard segment of polyurethane. It was turned out that blood compatibility of polyurethane can be improved by addition of silk fibroin by blood compatibility test. However, mechanical properties of silk fibroin were not improved by blending due to deterioration of polyurethane by formic acid.