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Title of thesis: Preparation of Thermosensitive Membranes for Transdermal Drug Delivery by Radiation Grafting of Acrylic Acid/*N*-Isopropyl Acrylamide Mixture on Polypropylene Fabric

SUMMARY

The thesis on the development of thermosensitive membranes for transdermal drug delivery comprises of the grafting of NIPAAm and AA onto PP nonwoven fabric by gamma pre-irradiation method, which offers an attractive route to develop functional materials. It was observed that the grafting parameters play a key role in the graft management within the fabric matrix. The optimization of the grafting conditions such as reaction time, preirradiation dose and monomer concentration was carried out with AA so that a roadmap for the graft variation under specific conditions may be formulated. The most interesting aspect of the grafting process is that the thermoresponsive character of the grafted chains plays an important role during the grafting process itself. The grafting was found to be very high at ~30°C above which it decreases drastically. Such behaviour is due to the hydration of the grafted chains at ~30°C which allows monomer to diffuse in and help in the propagation process. At a higher temperature, the grafted matrix deswells and monomer diffusivity is restricted significantly. As a result the grafted chains are deactivated and lead to lower graft levels.

The characterization of virgin and NIPAAm/AA grafted PP nonwoven fabrics were carried out using various techniques. The influence of the graft composition on the physical structure of the material was studied. The characteristic peaks for AA and NIPAAm were obtained in FTIR and confirmed their grafting on the PP fabric. The TGA results showed that the thermal stability of PP fabric increased after grafting of NIPAAm/AA. The IDT of PP-*g*-NIPAAm/AA were increased with increasing PAA component due to the formation of stable anhydride structures by the cyclization of PAA chains at elevated temperatures. For the variation in degree of grafting, the thermal stability is found to improve significantly with the increasing degree of grafting. The crystallinity values from DSC and XRD decreased with increase in degree of grafting because of the addition of grafted chains within the noncrystalline region. PNIPAAm/PAA exists as the hydrophilic component as observed from

decrease in contact angles of the grafted fabric. AFM images show that surface roughness increases after grafting, may be due to the formation of domains and morphologies by the grafted PNIPAAm/PAA chains. Therefore, the surface morphology is significantly affected by grafting process.

The immobilization and release behaviour of 4-acetamidophenol onto the modified PP nonwoven fabric were studied. The effect of degree of grafting and temperature on the drug release behaviour was investigated. At temperature below the LCST (32°C), a small amount of loaded drug was released, and a relatively large amount of drug still remained in the polymer matrix. However, when the release temperature was 40°C (above the LCST), the drug release was greatly accelerated due to temperature induced structure changes of the grafted copolymer chains. It was also observed that the drug release was higher for samples with higher degree of grafting. Thus, the resulting grafted membranes exhibited temperature-triggered drug release behavior, and have great potential for use as drug carriers.