DEHYDROCHLORINATION AND GRAFTING STUDIES ON POLY (VINYL CHLORIDE)

By

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CERTIFICATE

This is to certify that the thesis entitled "Dehydrochlorination and Grafting Studies on Poly(vinyl chloride)" being submitted by Miss Achla Kumari Gupta to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Textile Technology, is a record of bonafide research work carried out by her. Miss Achla has worked under my guidance and supervision and has fulfilled the requirements for the submission of this thesis, which to my knowledge, has reached the requisite standard.

The results given in this thesis have not been submitted in part or in full, to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Dehydrochlorination of poly(vinyl chloride) (PVC) was carried out in a basic solvent (pyridine) under an atmosphere of nitrogen. Infrared (IR) spectroscopy was used to indicate the presence of conjugated double bonds (polyene sequences) in the dehydrochlorinated PVC(DHPVC). The effect of dehydrochlorination conditions such as time, temperature and dilution of the reaction solution on the structure and consequently on the properties of PVC was studied. The relative changes in the molecular weight were investigated by viscosity measurements and gel-permeation chromatography (GPC) analyses. Variations in the polyene sequence lengths and their distribution were evaluated by ultraviolet (UV) spectroscopy. Thermal properties were studied by thermogravimetric analysis (TGA), differential thermal analysis (DTA), and colour development studies. The effect of dehydrochlorination on various tensile parameters such as yield stress, initial modulus, breaking stress and elongation-at-break was evaluated using an Instron tensile tester.

The dehydrochlorination may take place through the intra-molecular as well as inter-molecular

elimination of HCl. Intra-molecular dehydrochlorination results in the development of conjugated double bonds in the polymer chains, whereas inter-molecular elimination leads to inter-molecular cross-linking. Secondary reactions of the polyenes may also take place leading to either inter-molecular or intra-molecular cross-linking. There is no indication of chain scission taking place during the dehydrochlorination.

DHPVC was graft copolymerized with styrene monomer using benzoyl peroxide (Bz_2O_2) as free radical initiator, in vacuum. The effect of synthesis conditions such as time, initiator concentration, the ratio of monomer to polymer and temperature on polystyrene (PSt) content of the graft copolymer was studied. The graft PSt contents determined by gravimetry, chlorine analysis and UV spectroscopy have been compared. On the whole, a maximum of 47% grafting was obtained. A "grafting-from" mechanism has been proposed for the graft copolymerization.

The presence of grafts was revealed by the appearance of new absorption peaks in the IR spectra of dehydrochlorinated poly (vinyl chloride)-g-polystyrene (DHPVC-g-PSt). GPA analyses showed increase

in molecular weight of the graft copolymer on increasing the PSt content. Besides, GPC analyses showed the uniform PSt distribution of the graft copolymer. A marked improvement in the thermal properties of DHPVC-g-PSt over those of DHPVC and DHPVC/PSt blend was observed. Graft copolymers with high percentage of grafting were thermally more stable than even the original PVC. However, there was a loss in the mechanical properties of DHPVC-g-PSt as compared to DHPVC.

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REFERENCES

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LIST OF PUBLICATIONS AND PRESENTATIONS