Dielectric barrier discharge plasma surface modification of polymers

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With increase of industrialization, demand for all polymeric materials for various applications in fastest growing field. At a time increase in environmental concern needs to develop environmental friendly processing of these polymers. Non-thermal plasma is an emerging eco-technology for surface modification which can advantageously improve dyeing of various natural and synthetic materials. Dielectric barrier discharge (DBD) plasma treatment of polymers has attracted great interest due to low cost, high processing speed, reduced environmental impacts and simple system of operation. The advantage of DBD over other discharges lies in having the option to work with non-thermal plasma at atmospheric pressure and a comparatively straightforward scale-up to large dimensions. In the present study, two different types of polymers: Polyester and leather polymers were exposed to dielectric barrier discharge at atmospheric pressure in oxygen and air plasma. DBD plasma treatment changes surface morphology and chemical composition of polyester and leather polymers. Surface analysis was carried out using with various characterization techniques such as ATR-FTIR spectroscopy, X-ray photoelectron spectroscopy (XPS), Scanning electron microscopy (SEM) for both the polymers. We observed significant improvement in hydrophilic properties after oxygen and air plasma treatment. Apparent decrease in contact angle in plasma treated polymers is attributed to functional group formation and roughness which is created by DBD plasma treatment. Aging effect on plasma treated polymer surfaces was also studied. Dyeing of untreated and plasma treated polyester textile has been carried out using six natural dyes by alcohol assisted dyeing method at room temperature. Spectroscopic measurement and fastness analysis have shown significant increase in colour intensity and dye uptake properties on plasma treated samples. This study divulges that DBD plasma treatment is dry and eco-friendly technique to modify the polymer surface to improve dye uptake properties with natural dyes at room temperature.

Biography

Lalita Ledwani is a professor in the department of chemistry at Manipal University Jaipur; served as head of chemistry department from year 2011-2014, and she is the controller of examinations in the same University. She has been extensively working in plasma surface modification of polymers and natural products research areas. She has received external research grant from different funding agencies namely KWEF, Japan, DST, Govt of India, DST, Govt of Rajasthan and UGC, Govt of India. On her credit, she has more than twenty research papers published in peer reviewed international and national journals, she also delivered several invited/expert lectures besides more than forty research papers in international and national conferences. She has supervised three PhD theses and three PG dissertations and four UG dissertations. At present, six research scholars and one post doc fellow are working under her supervision. She has also organized various national and international academic events as a convener/coordinator.

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