

IMPROVEMENT OF GLUCOSE OXIDASE ACTIVITY IMMOBILIZED ON POLYESTER NONWOVEN MEDIATED BY HYPER-BRANCHED DENDRIMERS

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ABSTRACT

Glucose Oxidase (GOx) is a green catalyst that catalyzes the oxidation of β -D-glucose to D-glucono- δ -lactone and produces hydrogen peroxide. Immobilization of GOx on a porous substrate (e.g. polyester membrane) is a sustainable way to recycle them and ensure their reusability. However, in most cases immobilization compromises the activity of the number of enzymes by blocking their active sites. This study focuses on the use of hyperbranched dendrimers for optimizing the immobilization of GOx enzyme on fibrous PET nonwoven membrane maintaining optimum enzyme activity. The two different dendrimers were used are 1. Hyperbranched G5-PEG10k-OH dendrimer, 2. PAMAM dendrimer with the amino surface group. Dendrimer grafting was carried out by using chemical grafting method. Prior to dendrimer grafting, hydrophobic PET nonwovens were activated by eco-friendly air atmospheric plasma treatment. Wicking test, scanning electron microscopy and thermogravimetric analysis was carried out to investigate the wettability, morphological and thermal properties of the functionalized nonwovens. XPS analysis showed the integration of new functional groups (C-O and C=O as well as amines and amides) on the PET fiber surface following plasma treatment and dendrimer grafting. The activity of immobilized enzymes was measured by using the GOx assay kit. Direct sorption method was used to immobilize Glucose Oxidase enzymes on functionalized nonwovens. Results showed a maximum 63% increase in enzyme activity on PAMAM dendrimer grafted PET nonwovens compared to plasma treated nonwovens whereas 21% increase in enzyme activity was found for Hyperbranched G5-PEG10k-OH dendrimer grafted PET nonwoven. Reusability study showed that a progressive decrease in activity was observed up-to certain cycles and no decrease in enzyme activity was detected after over more than 10 cycles. This improvement in the activity of Immobilized Glucose Oxidase enzyme by using Eco-technologies (plasma) and hyperbranched dendrimers on a porous nonwoven PET membrane opens promising prospects towards commercialization of enzymatic processes in various fields including wastewater treatments.