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Lipase Immobilization on Facile Synthesized Polyaniline-Coated Silver-Functionalized Graphene Oxide Nanocomposites as Novel Biocatalysts

Mohd Shamoon Asmat* and **Qayyum Husain**
Department of Biochemistry, Aligarh Muslim University, India

Enzymes perform an essential role in catalysing extensive reactions. Yet, their instability upon repetitive use, as well as their activity inhibition by different solvent remains a cumbersome task of concern. We present here a simple method to immobilize *Aspergillus niger* lipase (ANL) onto polyaniline-coated silver-functionalized graphene oxide nanocomposites (PANI/Ag/GO), involving the facile synthesis of PANI/Ag/GO and the formation of ANL@PANI/Ag/GO nanocomposites. Covalent bonding was achieved via glutaraldehyde as a cross linking agent onto these nanocomposites. The resulting ANL@PANI/Ag/GO with a nanoscale dimension has a remarkably high enzymatic activity recovery yield of 88.5% and immobilization yield upto 94%. The apparent optimum temperature and pH for ANL@PANI/Ag/GO were higher than those of free ANL. ANL@PANI/Ag/GO exhibited comparatively higher catalytic efficiency and enzyme-substrate affinity. The binding of ANL on PANI/Ag/GO-NCs was confirmed by Fourier transform infrared spectroscopy, transmission electron microscopy, scanning electron microscopy, dynamic light scattering and atomic force microscopy. The metal content was examined by energy-dispersive X-ray spectroscopy. ANL@PANI/Ag/GO biocatalyst retained over 86% of its initial enzyme activity after 11 repeated uses. ANL@PANI/Ag/GO displayed significantly enhanced solvent tolerance and high thermal stability compared to the free enzyme, it might be due to the increase in enzyme structure rigidity. Remarkably, the as-prepared nanobiocatalyst ANL@PANI/Ag/GO will have a deep impact on practical industrial scale uses of enzymes for the transformation of lipids into fuels.