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New approach to the synthesis of a functional macroporous poly(vinyl alcohol) network and design of boronate affinity sorbent for protein separation

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Abstract

A new method for preparation of a functional macroporous crosslinked polyvinylalcohol (MP-PVA) matrix in aqueous media without usage of an outer porogen has been elaborated. The method includes PVA oxidation by sodium periodate followed by a) self-crosslinking of the oxidized PVA and b) glutaraldehyde crosslinking. MP-PVA represents a highly crosslinked matix that is non-swellable in water and common organic solvents and has a high pore volume and pore surface and contains reactive aldehyde groups. Surface topography of MP-PVA has revealed its heterogeneous globule-like structure with open macropores of about 100–300 nm in diameter and large pores of about several microns. Dynamic light scattering study has elucidated the phase separation during the self-crosslinking step as the main factor responsible for macroporous structure generation. Boronate affinity sorbent has been designed by means of immobilization of aminophenylboronic acid via aldehyde groups of MP-PVA matrix, and its applicability for quantification of glycated and non-glycated haemoglobin in human blood of diabetics patients has been demonstrated. The proposed approach to the preparation of the functional macroporous MP-PVA matrix may be promising for designing new macroporous sorbents and monoliths for affinity ligands immobilization and separation of hydrophilic macromolecules.

Keywords: poly(vinyl alcohol), oxidation, crosslinking, gel formation, phase separation, macroporous network**.**