Graphene oxide membrane immobilized aptamer as a highly selective hormone removal

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Abstract

Three-dimensional (3D) reduced graphene oxide (RGO) modified by polyethyleneimine (PEI) was prepared and functionalized by fluorophore-labeled dexamethasone-aptamer (Flu-DEX-apt) *via* π-π stacking interaction. The RGO/PEI/Flu-DEX-apt was used as a selective membrane for dexamethasone hormone removal from water. The prepared RGO/PEI/Flu-DEX-apt membranes were stable, insoluble, and easily removable from liquid media. The membrane was characterized by Raman spectroscopy, scanning electron spectroscopy, and FT-IR spectroscopy. The RGO/PEI/Flu-DEX-apt membrane showed high sensitivity and specificity toward the dexamethasone hormone in the presence of other steroid hormone analogs, such as progesterone, estrone, estradiol, and 19-norethindrone. The fluorescence and UV-visible spectroscopy were used to confirm membranes performance and the quantification of hormones removal. The resulting data clearly shows that the graphene oxide concentration influence the aptamers and analytes interaction (π-π stacking interaction). It was found that by varying the graphene oxide concentration yields to different porosities of RGO/PEI/Flu-DEX-apt membranes, which affects the adsorption recovery rate, the specificity and selectivity toward the dexamethasone hormone.

Keywords: Graphene oxide, polyethyleneimine, aptamer, graphene membrane, dexamethasone