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Preparation and characterization of optical sensors based on biopolymers

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The purpose of the present work is the use of components extracted from waste or by-products of the fishing industry, namely biopolymers, in order to exploit its potential for the application in the synthesis of membranes for use as optical sensors of heavy metals.

The synthesis of these membranes began with some previously published procedures and its subsequent adaptation to the intended purpose at hand[1,2]. Some innovative syntheses have been developed, that successfully combine different biopolymers, namely chitosan, fucoidan and chondroitin sulfate, which possess varying degrees of metal retention ability and siloxane. The structural fragilities of the resulting membranes were studied, and by using glycerol as a plasticizer and glutaraldehyde as a crosslinking agent, it was possible to improve the malleability and swelling degree. Since the aim of this study is to obtain an optical sensor primarily for the determination of the Pb^{2+}, the incorporation of a chromophore sensitive to this cation was performed, namely dithizone (Figure 1). Due to the flexible chemical structures of these biopolymers, it was possible to use the molecular imprinting of Pb^{2+} with the intuit to improve membrane selectivity and capacity for this species, something that is still scarcely explored in the literature, having only been published to date an article about molecular imprinting of metal cations in biopolymer membranes[3].The synthesized membranes were later characterized using different techniques such as FTIR, TGA, BET and UV-Vis. For a deeper insight into the sorption properties of the membranes for lead cation, as well as their starting materials, batch biosorption studies were performed for an array of concentrations. Initially, the different constituting biopolymers were separately studied in aqueous form through dialysis membranes. The resulting solutions of these studies were analyzed by atomic absorption spectroscopy.

In the future, it is intended to determine the detection limit of the various membranes to lead in aqueous solution, as well as whether the effect of imprinting reduces membrane interaction with interfering species. If possible, the affinity of the synthetized membranes could also be tested for the cadmium cation in solution.

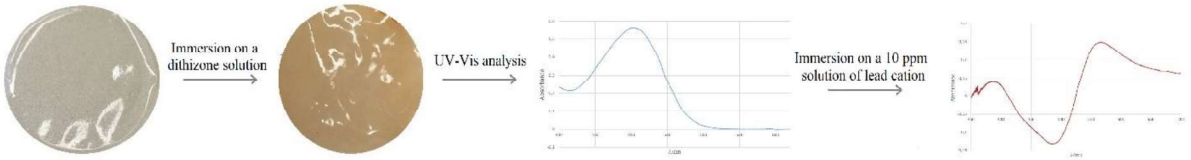

Figure 1: Study of the incorporation of dithizone and effect of Pb2 + on the membrane through UV-Vis spectrometry

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