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DEVELOPMENT OF SPECIFIC CHEMICAL SENSORS BASED ON MOLECULARY IMPRINTED POLYMERS FOR DETECTION OF 2-METHYLISOBORNEOL AND GEOSMINE

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1. Introduction

The development of chemical sensors is something very much in demand these days, whether to identify unwanted compounds or to confirm the presence of specific substances. For this case, moleculary imprinted polymers (MIP) makes it possible to manufacture specific sensors, in such a way that only molecules with a certain geometry can be detected by the device.

In this sense, the present work consists of studying the feasibility and further development of a chemical sensor that can detect 2-methylisoborneol and geosmine in water samples from the Basic Sanitation Company of the State of São Paulo (SABESP) [1]. These substances are produced by seaweed at certain times of the year and, when present in large amounts, cause changes in odor, taste and even color in the water that will be distributed to the population of the region. Thus, the development of a sensor that can detect such substances is something that would directly affect the quality of life of millions of people.

2. Methods

The MIP solution was prepared based on the literature [2]. Isoborneol (ISO) was used as a template which, in addition of presenting similar geometry in comparision with the original compounds, is much cheaper and, therefore, ideal for initial analyzes.

Initially, 20 mg of ISO together with 76 µL of methacrylic acid (MAA) and 200 µL of hexane were sonicated for 10 minutes. After this process, the mixture was incubated for 4 hours under slow shaking (300 rpm) to form the ISO-MAA complex. Then 200 µL of ethylene glycol dimethacrylate (EGDMA) and 1000 µL of 2,2-azobis (isobutyronitrile) (AIBN) were added, followed by sonication for another 10 minutes. Finally, the solution went through a pre-polymerization step at 60 ° C for 40 minutes in order to increase its viscosity and improve its adhesion to the substrate [3].

40 µL of the pre-polymerized solution was deposited with the aid of spin coater (30 seconds) on glass slides of 0.5 x 0.5 in. (substrate). Different speeds were used (700, 1000, 1500 and 2000 rpm).

The films were polymerized using two UV lamps, each one with 8W, confined in a closed box. Different polymerization times were analyzed, namely: 30 min., 1 hour, 2 hours and 5 hours. After polymerization, the films were immersed in a solution of ethanol and water (v / v 1:10) to remove Isoborneol.

3. Results

The deposited films were evaluated by UV-vis absorbance (Figs. 1 and 2) and thickness (shown in the detail in Fig 1). When macroscopically analyzing the homogeneity of the films formed after the polymerization step with UV, it was noticed that those deposited at 700 and 1000 rpm showed isolated white spots. This fact suggests an accumulation of solution in certain regions of the film, which, when polymerized, increased its thickness locally and made a more precise analysis of the obtained UV spectrum impossible. As expected, the thickness of the films decreases as the rotation speed increases.

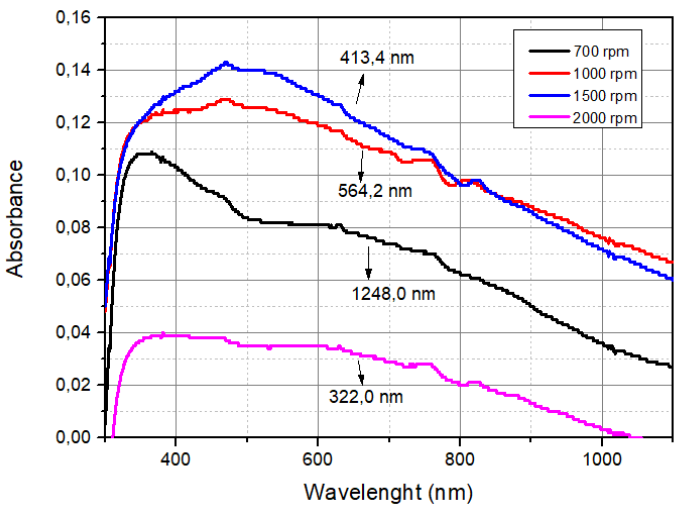
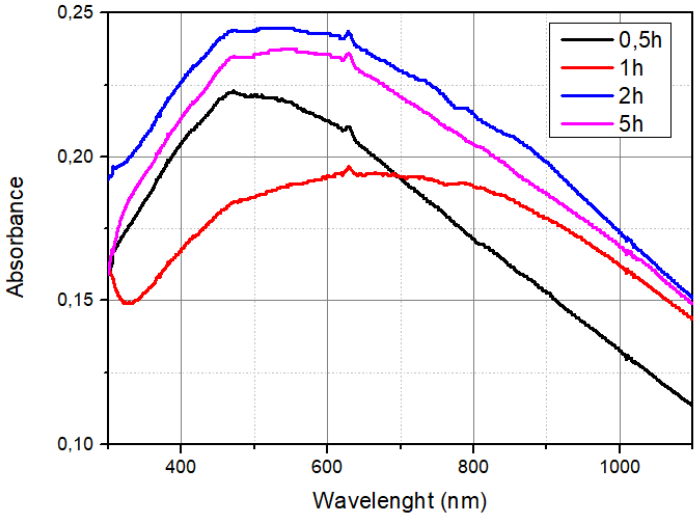


Fig.1. *UV spectrum for films with different speeds and polymerization time of 2 hours.*



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Of all the films, those deposited at 1500 rpm were the ones that presented the most homogeneous surface and were used in the second study that evaluated the polymerization time (Fig. 2). 2 hours was the time defined as the most appropriate for this situation because, in addition to being in accordance with the data in Figure 1, it optimizes the polymerization process.

4. Conclusions

Through the analysis of Figures 1 and 2 it was possible to notice that there was an optimization of the polymeric film formation for a rotation of 1500 rpm during a polymerization time of 2 hours. In addition, the thickness of the films formed is consistent with the obtained UV spectrum, which showed low absorbance values for the analyzed samples.

Among the issues to be addressed in future works, the study of the treatment of the glass surface using 3-mercapto-1-propanesulfonic acid (3-MPS) and its effect on the formation of films can be mentioned. After this work, the first studies on the deposition of polymeric films on gold electrodes will be carried out to measure important electrical parameters to verify the functionality of the devices when exposed to solutions containing the original templates.

Acknowledgments

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