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Macroscopic Characterization of Biopolymers with Natural Pigments and Monomer

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ABSTRACT :*In this work we had the goal to obtain film made out of chitosan and starch combined with natural antioxidants and, using as a variation the addition of monomer to the synthesis, with the sole purpose of finding a material with the special qualities in order to be used in food packaging due to the demand of plastics made with natural ingredients that, besides being biodegradable they will be antimicrobial. These films also have the function to protect the product and reduce the need of using plastics that contaminate the environment.acquisition units both for monitoring system operation and control of its operation.*
KEYWORDS *films, biopolymers, monomer*

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I. INTRODUCTION

The natural antioxidants used in this work are found in the group of anthocyanins, these are compounds that belong to the group of bioflavonoids and include the water-soluble red, violet and blue pigments of the plants, which are natural colorants that are found in leaves, flowers, fruits and seeds.

The anthocyanins are the pigments or dyes of red shades found in grapes, vegetables, plums and cranberries, which are powerful antioxidants. These pigments besides giving coloration, they function as a protection against the ultraviolet light that comes from the sun rays; these dyes also produce antimicrobial and antiviral properties. The fruits that ripe attached to the tree are normally richer in anthocyanins than the ones that ripe separately. Among the foods that contain a great amount of anthocyanins are the blue and black raspberry, pomegranate, brambleberry, cherry, blueberry, strawberry, blue and black grape, apple, plum, eggplant, beetroot, onion and purple cabbage among others [1].

The chitosan obtained by partial deacetylation of chitin has particular properties that are very important because it is the unique cationic polyelectrolyte. It is soluble in diluted organic acids, gelling and coagulating in a weakly acidic or neutral environment.

It presents the capacity of preserving aliments for a longer time mainly due to its ability to form semi-permeable thin layers to O_2 and to CO_2 and to its biological properties; in contrast with other materials used to cover fruits, it has proven to work as a fungicide. In addition of the great advantage to be innocuous, it is a renewable and biodegradable resource [2].

Pyrrole is the monomer used in the production of polypyrrole [3], which is a polymer that conducts electricity, characterized by being one of the few materials which combine the semi-conductor metallic properties with the polymeric properties that are flexible, elastic and resistant. The most practical advantage of the polymers is its processability and the fact that its properties can be controlled by methods of organic synthesis [4, 5].

II. METHODOLOGY

In order to obtain the natural antioxidants, a water-based extract was made and it was added to the film, because it is synthesized in water. The chitosan solutions (2% w/v) were made according to the methodology of Delgado et al. (2017) [6]. Once the chitosan was disolved, the starch watery solutions (1, 2 and 3% w/v) were heated to a temperature that was higher to the gelling point for about 20 minutes under constant stirring. The pyrrole solution was made in distilled water 1% w/v.The films that would only have chitosan were made at 2%

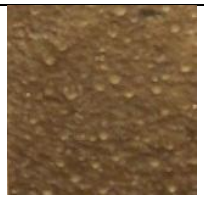
with the starch solution (1, 2 or 3%) under constant stirring for 10 minutes. The films which were obtained by the combination of pyrrole and chitosan were made by mixing in a 1:1 ratio and adding the starch solution and the extract of the different concentrations. Later the mix was poured in a polystyrene container and was left to dry in the sun exposing the membranes two to three hours to the sun light up to the day they were totally dry.

The macroscopy was realized by taking a series of photographs to each of the different membranes that were obtained, the camera Kodak Easyshare C713 Zoom was used for this purpose.

III. RESULTS

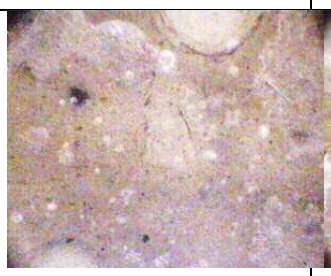
Table 1 shows that the chitosan membranes show lighter brown tones than the rest of the membranes, with the exception of the pyrrole and chitosan membrane with 2% starch, which had a light tone similar to that of chitosan with 2% starch and on the other hand, the pyrrole membrane with chitosan and 3% starch obtained a hue similar to that of the chitosan membrane with 1% starch, which indicates the different degrees of polymerization. It can be seen that the degree of polymerization corresponded to the percentage of starch in the sample, that is, within all the membranes that had 2% starch, the one that only had pyrrole oxidized more than the one with pyrrole and chitosan, which at In turn, it obtained a darker shade than that of chitosan alone. It can also be seen that the concentration of starch at 2% was the best when mixed with pomegranate due to the fact that this combination managed to form three films, one with pyrrole alone, one of pyrrole with chitosan and one with chitosan alone. Another important aspect in this table is that as the starch concentration increased, the roughness also increased.

Table 1. Films with 5 ml of pomegranate in macroscopic view

	Pyrrole		Pyrrole-Chitosan		Chitosan	
Starch 1%				**A little flat**		**A little flat**
Starch 2%		**Flat**		**A little flat**		**A little flat**
Starch 3%				**A Little rough**		**A Little rough**

In table 2 it can be seen that there is a similarity between the 1 and 3% chitosan membranes and the 3% pyrrole-chitosan membrane, while the 1 and 2% pyrrole-chitosan membranes have a resemblance to that of 2% chitosan, in addition, there is a similarity between all the membranes that have a percentage of 2% starch. It can also be seen that only with 2% starch was it possible to form the membrane composed solely of pyrrole.

Table 2. Films with 5 ml of pomegranate in macroscopic view

	Pyrrole	Pyrrole-Chitosan	Chitosan
Starch 1%			
Starch 2%			
Starch 3%			

IV. CONCLUSION

The films with the chitosan base show a slight yellowish tonality, while the combination with pyrrole with chitosan resulted in light brown films, which indicates the formation of polypyrrole, when the color is darker the monomer gets more polymerized, this depended on the intensity of the sun light. Besides that, when the amount of starch increased, the film resulted rougher.

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