THE INFLUENCE OF SURFACTANTS ON ELASTIN MEMBRANE PREPARATION AND SEPARATION TECHNOLOGIES

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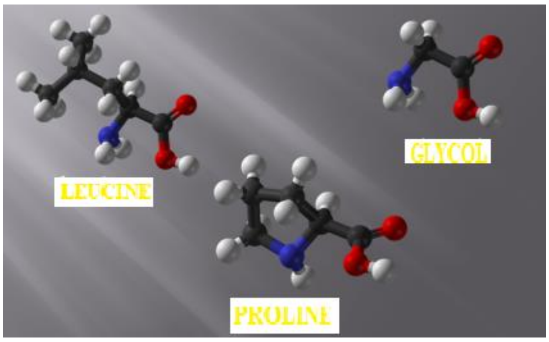
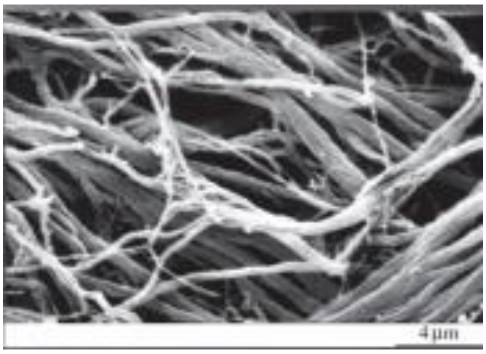
The influence of a classic surfactant: palmitoyl-glycylglycine and bola amphiphilic: bis[2-butyl(sodium bis-thioacetate) sodium dicarboxylate 1,10 decanediyl ester] upon the elastin membrane preparation and separation technologies for removing organic pollutants (dyes) was studied by: UV-VIS and FT/IR-ATR spectroscopy, dynamic light scattering, optical and scanning electron microscopy, contact angle, microbiological tests and the separation rates. Elastin is a fibrous connective tissue, and has elasticity comparable to rubber, arteries and some tendons. Like other biopolymers, elastin are composed of simple amino acids, especially: leucine, glycol and proline (fig.1).



a)



b)

Fig. 1- *a)-Elastin composed from simple amino acids: leucine, glycol and proline [2];*

b) SEM microscopy of fibrous elastin [2]

In this paper, the biomembranes were produced by a casting-solvent evaporation technique. The elastin powder was dissolved in a water- acetic acid (80:20 v/v) solution with and without plasticizer: glycerol and surfactant (classic or bola), constant continuous stirring for 4-6 hrs. at 60ºC, then degassed the solution for 2 hrs. The solution was poured and afterwards maintained in the oven at 40-50°C for 4-8 hrs.

Biomembranes were obtained with different surfactants which influenced the separation properties of membranes. Ecological biomembranes are obtained from a biodegradable biopolymer and can be used successfully in removing dyes from wastewaters.

Introduction

In this research simple elastin membranes are obtained by a uniform casting of the solution with: elastin/water- acetic acid/ glycerol/surfactant on a glass plate. Elastin membranes were prepared using or not a plasticizer-glycerol and surfactant (classic or bola) such as palmitoyl-glycylglycine and bola amphiphilic: bis[2-butyl(sodium bis-thioacetate) sodium dicarboxylate 1,10 decanediyl ester]. Although the tensile strength and hydrophobic property improved by introducing a surfactant (classic or bola). The surfactants are also involved in the membrane processes, influencing flow through polymeric porous media, cleaning of membranes during the process and after use or modifying the microstructure of the disperse system for separation [1-3]. In this work the influence of surfactants upon the microporous structure and retention of some pure water soluble dyes: Yellow III (color index 15985) and Orange III (methyl orange), were studied. The surfactant-dye mixed aqueous solutions obtained by varying the dye and surfactant concentration respectively was characterized by UV-VIS spectroscopy, dynamic light scattering and contact angle.

Materials and Methods

Surfactants used in this research: -palmitoyl-glycylglycine and bola amphiphilic: bis[2-butyl(sodium bis-thioacetate) sodium dicarboxylate 1,10 decanediyl ester].

The experimental techniques and equipments: scanning electron microscopy (Quanta 200), dynamic light scattering (Zetasizer Nano, Malvern), ultraviolet and infrared spectroscopy (Jasco 4100).

Results and discussions

A new procedure was proposed for obtaining elastin membranes by a casting-solvent evaporation technology, and is presented in figure 2:

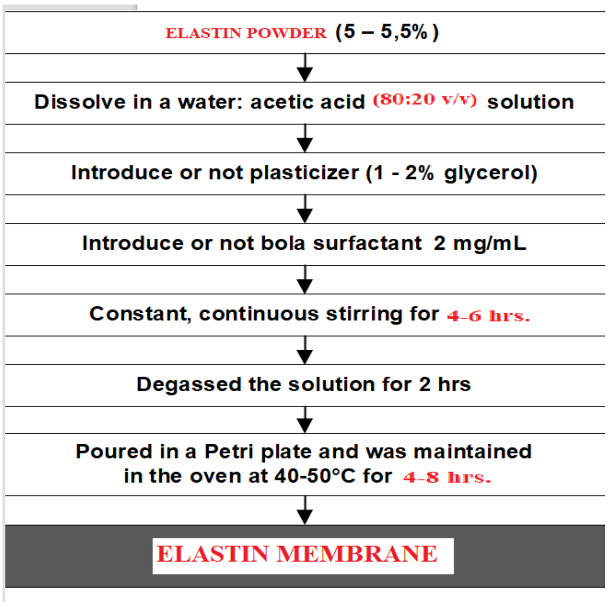
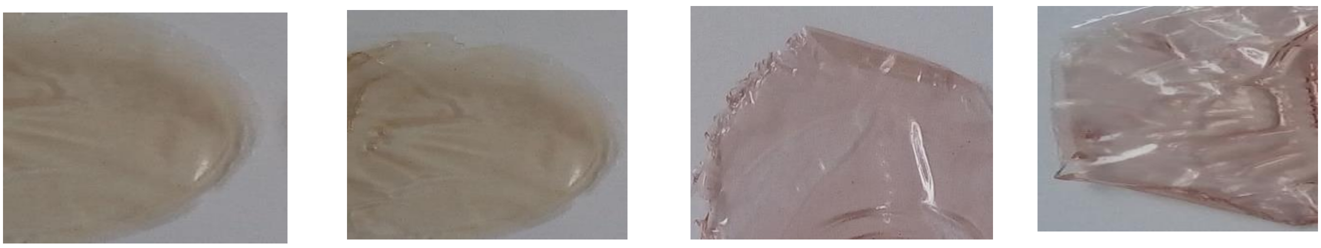


***Fig. 2**-Technological flow for obtaining elastin membrane with and without plasticizer: glycerol and surfactant classic or bola*

These conditions allow the elastin molecules from solution to be structured and to form intermolecular bonds without any cross-linking agent. The elastin membranes obtained according to technological flow presented in fig. 2 showed microporous structure (fig. 3).



a) b) c) d)

Fig.3- *a)-Elastin membrane without plasticizer and surfactant; b)-Elastin membrane with plasticizer; c)-Elastin membrane with plasticizer and bola surfactant; d)-Elastin membrane with plasticizer and classic surfactant*

SEM images of the surface elastin membranes gives information on the surface morphology of the unused membranes. The surface of the elastin membranes consists of pores of varying size. Cross-sections of the membranes were prepared to assess internal structure. Cross-sections were cut using a scalpel and fractured.

Compression of the structure is visible in fig. 4. Elastin membrane consists of a finger-like micro-substructure.

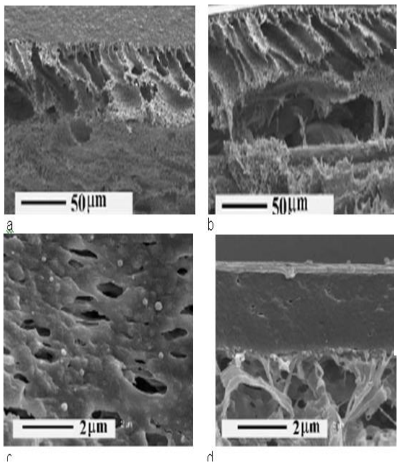


Fig. 4.- SEM images of cross-sections for elastin membranes: a)-elastin membrane without plasticizer and surfactant; b)-elastin membrane with plasticizer; c)-elastin membrane with plasticizer and bola surfactant; d)-elastin membrane with plasticizer and classic surfactant

In this research the influence of surfactants upon the microporous structure and retention of some pure water soluble dyes: Yellow III (color index 15985) and Orange III (methyl orange), were present in fig. 5-6.

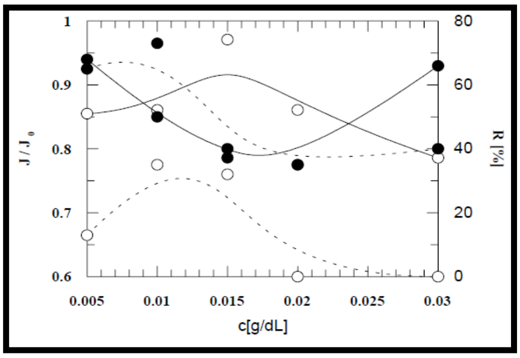


***Fig. 5** - Dependence of the normalized flux (J/J0 —) and retention (R ·····) of Orange III vs. concentration for: o- membrane-b) and ●- membrane-c)*

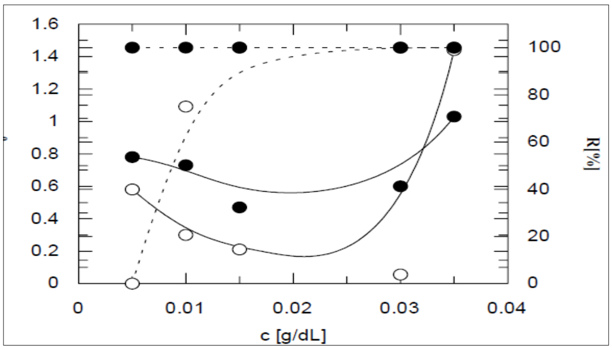


***Fig. 6** - Dependence of the normalized flux (J/J0 —) and retention (R ·····) of Yellow III vs. concentration for o- membrane-b) and ●- membrane-c)*

Conclusions

A variety of techniques for microstructural analysis were used to study the surface morphology and internal microstructure of elastin membranes. Comparison of the methods shows that either optical or SEM microscopy examination showed unused flat sheet elastin membranes. The presence of surfactants in the composition of the membranes formed was emphasized in order to maintain the hology and membrane performances. Surfactants in the casting solution alters the size, as well as the density of pores and the roughness of casein membranes surface. The surfactants analysed, yield membranes with small and dense pores and with smooth surface. Also, surfactants in the dyes aqueous solution influenced the separation rates.

Ecological membranes are obtained from a biodegradable biopolymer and can be successfully used in removing dyes from wastewaters. The actual European Community strategy related to maintenance of health of population, quality of life, and of the environment encourages the new technologies for pollution abatement.

References

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