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Characterization of chitosan modification by hydrogen plasma

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Abstract – Chitosan membranes have been modified by plasma for biomedical applications, for exemplo drug delivery, skin regeneration, cell proliferation. We are interested in study the surface of membrane and its permeability in relation sodium sulfamerazine after treatment by hydrogen plasma. The sample characterized by atomic force microscopy, contact angle and permeability assay of sodium sulfamerazine. Hydrogen plasma surface treatment is an effective technique for modification of drug release rate of chitosan membranes. The contact angle measurements show clearly that hydrophilicity of the membrane surface increase with plasma treatment.

Chitosan membranes have been modified by plasma for biomedical applications, for exemplo drug delivery, skin regeneration, cell proliferation. Chitosan is a polysaccharide- based biopolymer, it is usually obtained from alkaline N-deacetylation of chitin [1]. We are interested in study the surface of membrane and its permeability in relation sodium sulfamerazine after treatment by hydrogen plasma. A tubular borosilicate plasma reactor was used in this study. The plasma power supplied was set at 76,5 W and at an internal pressure of 6 mbar for 60 minutes and the gas flow rate was 16 sccm of hydrogen.

The modified membranes by plasma (CHI H_2) were compared to the unmodified ones (CHI NT). The sample characterized by atomic force microscopy (AFM), contact angle and permeability assay of sodium sulfamerazine.

AFM measurements were performed Shimadzu microscopy (SPM – 9600, Japan) in dynamic mode. Aleatory area of 5 µ*m* x 5 µ*m* was scanned and analyzed by the program SPM Maneger Version 3.4 (Japan). Differences in the membrane surface morphology can be expressed in terms of mean roughness (R_a). Contact angles were measured at room temperature using a 10 µl drop of distilled water, formamide and glycerol. Contact angle were obtained using the sessile drop, and the software used to calculated the contact angle was the “surftens”. The permeability was calculated by UV/Visible Spectroscopy.

The Plasma treatment using hydrogen increase of the wettability (figure 1) and R_a of membranes (figure 2), but there are few increase in the permeation coefficient of the sodium sulfamerazine through chitosan membranes that have been plasma treated (table 1). The contact angle measurements show clearly that hydrophilicity of the membrane surface increase with plasma treatment but the concentration of drug after permeation was equal to the membrane non-treated and treated.

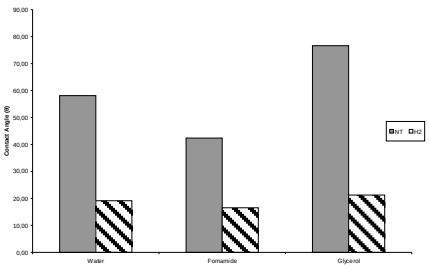

Figure 1: graphic of contact angle with water, formamide, glycerol.

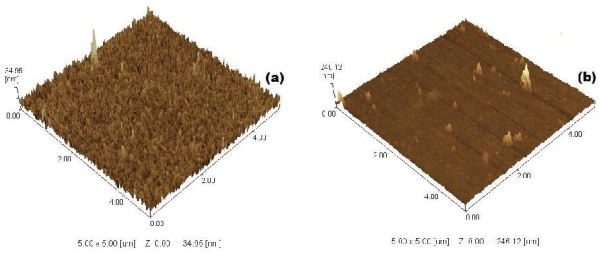

Figure 2: image of surface membranes chitosan, (a) non-treated R_a= 3.426 nm, (b) treated with plasma R_a= 5.062 nm

Table1: Permeability (P) of membranes and concentration (C) of drug after 50 minutes

Membranes	P(10^{-5} g cm^2. min^{-1})	Desvio Padrão	C(g) (10^{-5})
CHI NT	2, 218	0,014	2,6
CHI H_2	2,362	0,074	2,6

[1] P.K. Chu, J.Y. Chen, L.P. Wang, N. Huang. Plasma-surface modification of biomaterials. Mat. Sci. & Eng (2002) 143-206.