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Surface modification of chitosan membranes by CH_4 plasma

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Abstract – cold plasma can be used to modify the properties of polymers such as hidrophilicity, adhesion, permeability and biocompatibility. We are interested in controlling the rate of water-soluble drugs permeation of a chitosan membrane by adjusting its surface hydrophilicity/hidrophobicity using plasma treatment. The sample characterized by degree of swelling in water, contact angle and permeability assay of sodium sulfamerazine. Methane plasma surface treatment is an effective technique for control of permeation and drug release rate of chitosan membranes. Degree swelling and contact angle measurements show clearly that hydrophilicity of the membrane surface decrease with plasma treatment.

Cold plasma can be used to modify the properties of polymers such as hidrophilicity, adhesion, permeabitlity and biocompatibility [1]. Recently, the modification of the surface properties of membranes by plasma treatment has attracted the attention of research groups [2]. Plasma treatments using polymer – forming plasma gases lead to the increasing of membrane surface hydrophobic. It is known that chitosan membranes are hydrophilic with high permeation rates for water-soluble drugs and small molecule solutes. We are interested in controlling the rate of water-soluble drugs permeation of a chitosan membrane by adjusting its surface hydrophilicity/hydrophobicity using plasma treatment. 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 methane.

The modified membranes by plasma (CHI CH_4) were compared to the unmodified ones (CHI NT). The sample characterized by degree of swelling in distilled water, contact angle (distilled water, formamide and glycerol) and permeability assay of sodium sulfamerazine.

The degree of swelling was measured using an immersion assay as described by Möller et al. and Liu et al. The chitosan membranes of dried were weighed and immersed in distilled water for 24 hours at room temperature. The sample were removed from the water and weighed. Contact angles were measured at room temperature using a 10 µl drop of distilled water, formamide and glycerol. Contact angles were obtained using the sessile drop, and the software used to calculated the contact angle was the “surftens”. The plasma treatment using methane decrease of the wetability and degree swelling of membranes (figure 1). Also, there are significant decrease in the permeation coefficient of the sodium sulfamerazine through chitosan membranes that have been plasma treated (table 1).Methane plasma surface treatment is an effective technique for control of permeation and drug release rate of chitosan membranes. Degree swelling and contact angle measurements show clearly that hydrophilicity of the membrane surface decreases with plasma treatment.

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 CH_4	1, 649	0,011	1,9

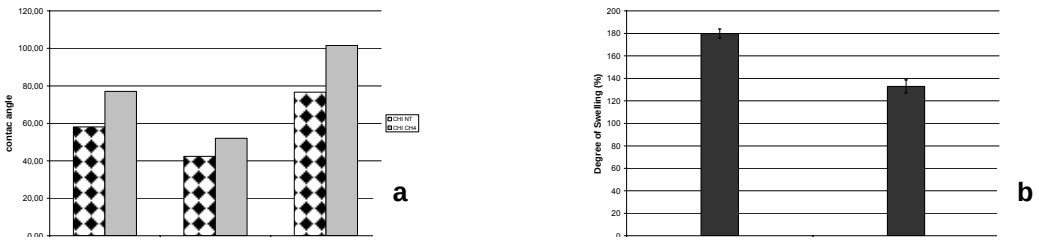

Figure 1: graphic of contact angle and degree swelling of chitosan membranes, **a)** graphic of contact angle with water, formamide, glycerol and **b)** graphic of degree swelling in water after 24 hours.

References

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