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NEW CHITOSAN BASED FILMS

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INTRODUCTION

Recently, chitosan-based materials have become increasingly widespread due to the biocompatibility, biodegradability and low toxicity of this natural polymer [1]. The researchers are particularly attention of the chitosan-based films, in connection with which the production of chitosan derivatives is also relevant [2-4].

MATERIALS AND METHODS

The experiment was carried out as follows. The reaction mixture containing aromatic aldehyde (0.05 g) and acetone (3 equivalents) in 5 ml of 15% aqueous ethanol solution was placed in a glass reaction tube 0.5 cm in diameter, the bottom of which was a fixed film under study. Due to the properties of a semipermeable membrane (a classical property of films based on chitosan), the reaction mixture completely flowed out of the reaction tube into a round-bottomed flask-receiving flask in 2 hours. The analysis of the residue formed in the receiver flask after distillation of the solvent in a vacuum was analyzed using ^{1}H NMR spectroscopy.

RESULTS AND DISCUSSION

Within the framework of this work, films based on chitosan hexachloroiridate (IV) sodium were obtained. To obtain a film, 0.4 g of chitosan dissolved in 10 ml of 5 % acetic acid. For uniform dissolution, the resulting mixture was mixed on a magnetic mixer at 70 ° C for 30 minutes. Then, a 0.1M solution of sodium hexachloroiridate (IV) was added to the obtained solutions of chitosan in volume ratios of chitosan solution:salt solution 1:1; 1:0.5; 1:0.2; 1:0.1, as well as 0.33 g of glycerin. The resulting mixtures mixed for 30 minutes on a magnetic stirrer. The resulting solutions were poured into Petri dishes, placed in a place protected from dust and other mechanical impurities for 3-4 days. After drying, smooth elastic films were obtained.

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The data of X-ray phase analysis indicate the amorphism of the obtained film, while the data of X-ray fluorescence analysis confirm the presence of iridium in the film.

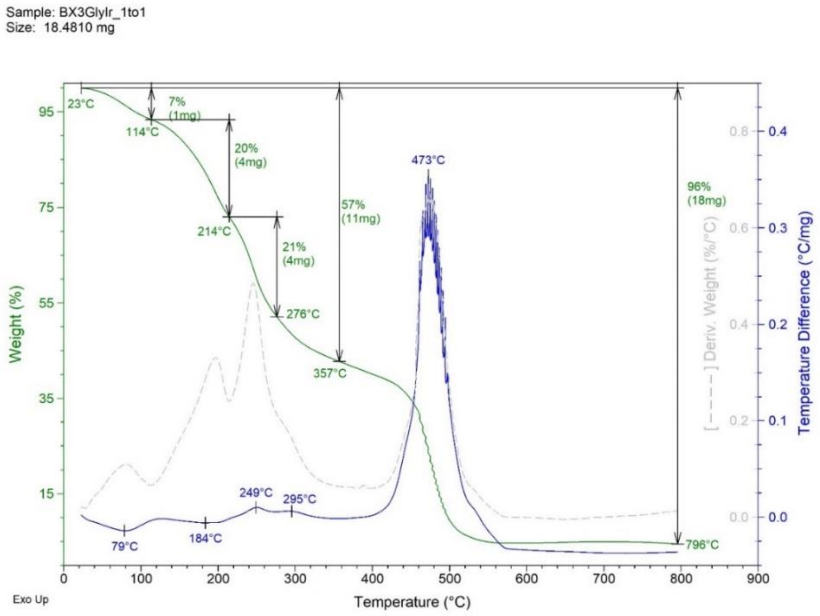


Figure 1. The results of the thermogravimetric analysis of the film containing chitosan/Ir (IV) 1:1.

The appearance of the TG and DTA curves of the chitosan/Ir(IV) 1:1 film sample (Fig. 1) differs from the corresponding curves of the chitosan film described in the literature. It should be noted the displacement of the maximum of the exo effect in the area of lower temperatures (473°C, chitosan film -557°C). The results of thermal destruction of the film containing Ir (IV) confirm the catalytic effect of metal cations. Sustainable intermediate phases during thermalization of the sample are not formed. The final product is metal iridium (iridium mob) and carbon.

SEM data were obtained on the electronic microscope JEOL JSM - 6490LV, voltage 15KV, SEM detector, electronic beam 30, in deep vacuum. Tested samples were applied to a platinum substrate with a thickness of 20 nm (40 seconds at a current of 40 m) using an automatic prefix of applying thin films JEOL JFC - 1600. The smoothest surface with a minimum number of defects is characteristic of the chitosan/Ir (IV) film (IV) 1: 1 (IV) (IV) (IV) (IV) (IV) Fig. 2).

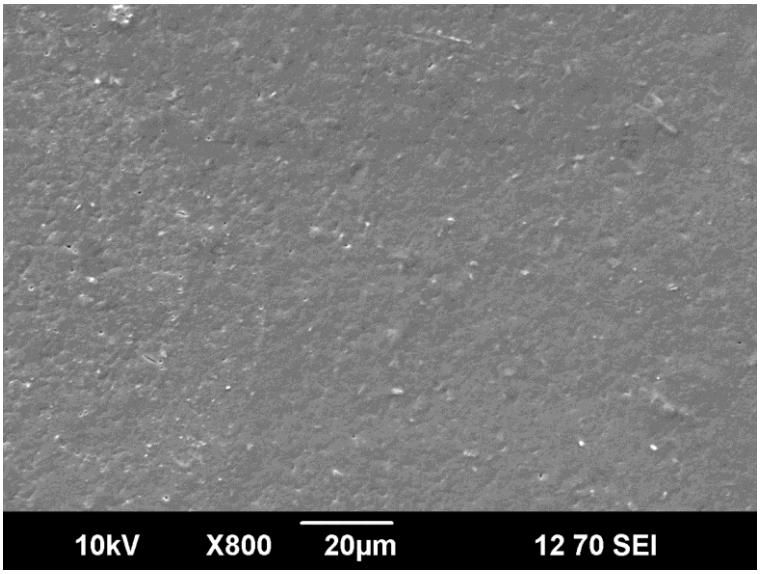


Figure 2. SEM Iridium containing a sample in volumetric ratios $Na_2[IrCl_6]$: a solution of chitosan-CH3COOH 1: 1.

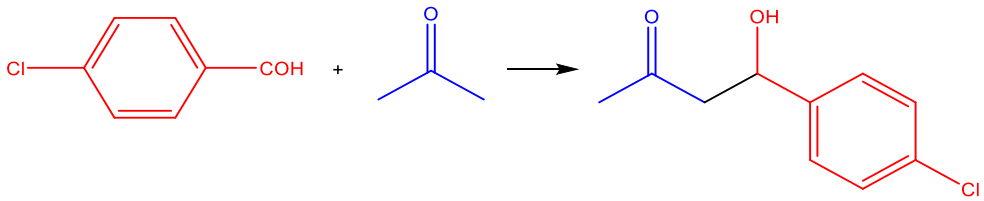
Stretch tests were carried out using an automatic tenster tester (XLW-PC Param, China), equipped with a load sensor for 500 N. Dimensions were carried out at a deformation rate of 300 mm/min at 25°C (Table 1).

Table 1. Mechanical properties of films

Cipher	σ_b (MPa)	ε_b (%)
Ir0,1:1	45.21±1.55	44.73±1.13
Ir0,2:1	42.17±1.14	39.03±1.17
Ir0,5:1	36.52±1.21	34.39±1.35
Ir1:1	28.43±1.22	28.11±1.12

The mechanical properties of the films were evaluated relative to two parameters: the limit of short -term strength (σb (MPA)) and the relative deformation of the film before the rupture (εb (%)). Both indicators are linearly fall with an increase in the concentration of the metal in the film, which may be associated with a decrease in the concentration of the polymer (chitosan) in these samples.

The catalytic activity of the resulting film (1:1) was investigated in a model aldol reaction (Scheme 1).



Scheme 1. Model aldol reaction

CONCLUSIONS

As a result, it was found that the residue obtained from the reaction mixture that passed through the film contained only the aldol (yield 93%). Thus, the 1:1 film is an efficient membrane catalyst for the aldol reaction based on the natural polymer chitosan.

ACKNOWLEDGMENTS

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