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Catalytic Synthesis Lactobionic Acid

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Gold nanoparticles are obtained, characterized and deposited on the carrier. Conducted catalytic synthesis of lactobionic acid from lactose. Received lactobionic acid identify on the IR spectrum.

Keywords: Synthesis, Gold nanoparticles, Catalyst, lactose, Lactobionic acid, SEM, SAX, Infrared spectrum.

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1. INTRODUCTION

Lactose found in milk and serum are often used and discharged into the sewer. Meanwhile, it is a valuable product and may be used in the industry as itself or after processing. As a result of the oxidation of lactose prepared lactobionic acid [1]. Lactobionic acid is interesting for its chelating [2], anticoagulant properties, as an antioxidant in the cosmetics [3]. Catalytic oxidation is one of the methods for producing lactobionic acid from lactose. For the oxidation of lactose to lactobionic acid using a gold catalyst on a variety of media having a large specific surface. More favorable is the catalyst carriers Al_2O_3, TiO_2 [4]. In a known method of producing gold catalyst supported on a porous metal oxide precursor for the oxidation of carbohydrates is chloroauric acid $HAuCl_4$, which is unstable in aqueous solution and hydrolyzed. A number of different forms hydrolysable time-dependent and pH. These deficiencies complicate the process of obtaining gold nanoparticles . This study illustrates the synthesis of lactobionic acid on the gold catalyst obtained from scrap.

2. EXPERIMENTAL PART

As the catalyst used gold nanoparticles (NPAu), deposited on a carrier Al_2 O_3. Gold precursor was obtained from scrap flotation extraction. The role of a precursor playing salt of a cationic surfactant cetylpyridinium chloride ($AuCl_4CP$) [5]. In this study an aqueous salt solution of reduced $AuCl_4CP$ 10^{-4} M routine considering that lactobionic acid is obtained to be applied in cosmetics. The reaction mixture was kept at room temperature for two hours. As the carrier taken Puralox HP 14/150 (Sasol / Condea) with surface area of 150 m^2/g. After mixing of the carrier and reaction mixture standing for 60 minutes. NPAu adsorption on the carrier, the catalyst was filtered off, washed with distilled water and dried at room temperature.

Lactose took anhydrous from "Fluka". Infrared spectra of the samples examined by the spectrometer Nicolet iS50 Thermo Scientific. Quantitative composition of catalyst and its electronic image obtained by scanning electron microscope JEOL JSM-66.10LV (Japan) with energy dispersive attachment. NPAu size distribution in the ash NPAu examined for small-angle X-ray diffractometer SAX Sess mc² Anton Paar (Austria). Scattering angle range 0-40 degree unit with repeated distances of 0.25 nm.

3. RESULT AND DISCUSSION

NPAu content on the media was 0.41 % gold (Table 1). The catalyst comprises carbon, indicating that the surface molecules are routine that improve NPAu adsorption on a carrier.

Table 1 – Content of elements in a mixture of Al_2O_3 and NPAu

Element	Atom, %
C	11.24
O	55.49
Al	32.86
Au	0.41

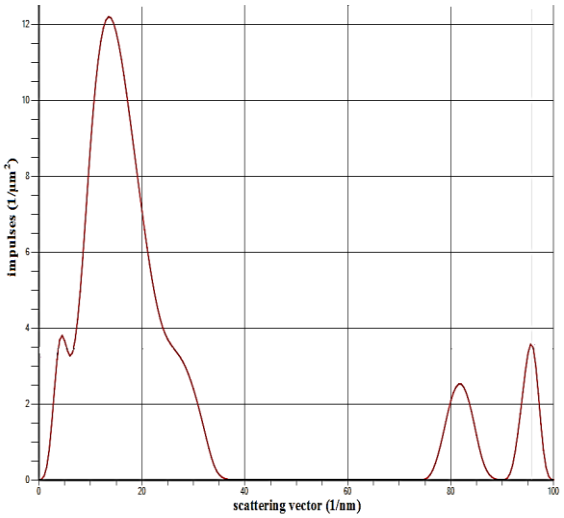

Fig. 1 – Gold nanoparticle distribution on the sizes of the small angle X-ray scattering data

A method of small-angle X-ray scattering shows a size NPAu from 5 to 40 nm, with a maximum allocation of 10 nm and a small amount, apparently agglomerated nanoparticles 80-100 nm (Fig. 1). A SEM method shows a size NPAu obtained under the same conditions ranged between 16 and 60 nm (Fig. 2).

Lactobionic acid synthesis was carried out at 80 °C, lactose oxidizing oxygen of air. For the synthesis of the

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installation going 250 ml beaker and magnetic mixer. Furthermore, the pH meter with a temperature sensor, a burette , a compressor air flow 264 l/hr. Alkaline environment created 0.1 M KOH [6].

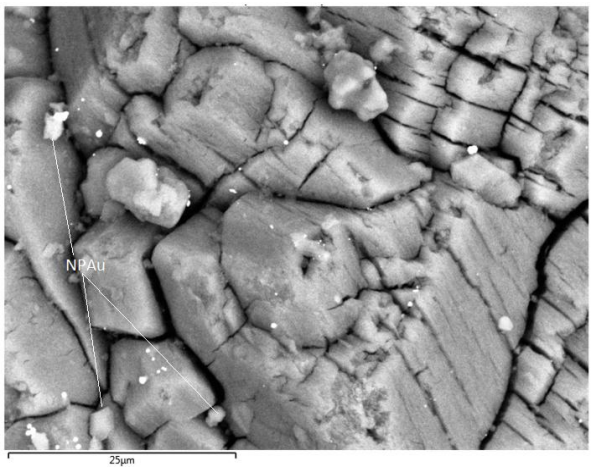

Fig. 2 – Electronic image (SEM) mixtures and Al_2O_3 NPAu

For synthesis took 100 ml of a 0.1 M solution of lactose and 2 g of gold catalyst. In the reaction zone was maintained pH 9 by adding 0.1 M alkaline. With constant stirring speed of 600 rpm and maintaining the temperature at 80 °C, after 2 hours the pH change from 9 to 4 and the further constant. Lactobionic acid, the resulting solution was filtered from the catalyst.

Lactobionic acid is precipitated from an aqueous solution of 96 % ethanol, centrifuged, rinsed with ethanol, filtered and dried at room temperature.

To determine the concentration of the acid formed taking an aliquot portion of the solution (10 ml) and it was titrated with 0.1 M KOH. The titration went 7.6 ml of alkali. The yield was 2.73 g , which is 76 %.

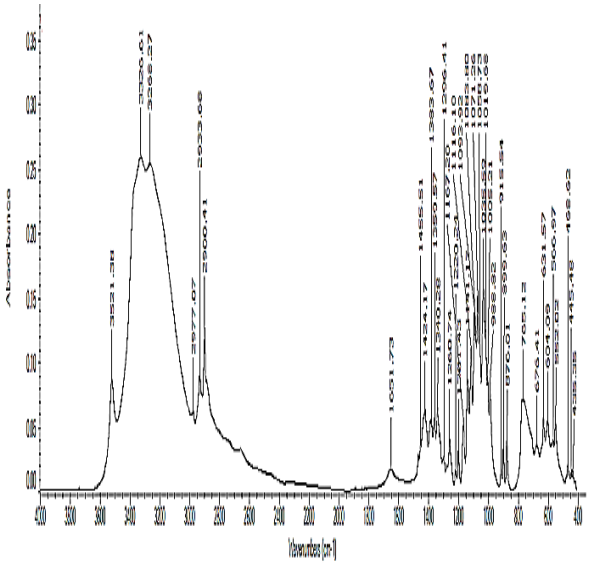

Fig. 3 – IR spectrum of lactobionic acid

The purity and identification of the resulting acid was investigated by IR (Fig. 3). Comparison of the received frequency of the IR spectra with literature data [7] has shown that we synthesized the lactobionic acid with containing a small amount of impurities. That gives a difference in the position of the absorption bands.

4. CONCLUSIONS

Invented a new method for the synthesis of lactobionic acid oxidation catalyst lactose gold from scrap electronics industry. Synthesis can be used for the oxidation of lactose derived membrane technology from the whey.

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