

# Nanooptics and photonics

## Optically transparent nanocellulose films from wheat straw

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Cellulose is the most abundant organic polymer on Earth and is bioresource for fabricate different useful materials: paper, esters, microcrystalline and nanocellulose. Nanocellulose has high strength, flexibility, surface area-to-volume ratio, aspect ratio and transparency. These properties of nanocellulose are widely used for the production of optoelectronics, photovoltaic, as reinforcement in biocomposites, drug materials, etc. [1].

Nanocellulose is produced by various methods from different representatives of plant raw materials. Wheat straw as a waste after grain harvesting can be a source of production of cellulose and nanocellulose [2]. In order to obtain nanocellulose in first step we have been isolated cellulose from wheat straw by treatment in peracetic solution according our methodology [3]. In second step, to produce nanocellulose the obtained cellulose underwent a sulfuric acid hydrolysis with concentration 43 and 64 % at the liquid-to-solid ratio 10:1 at temperature from 20 to 60 °C during 30– 90 min and ultrasound treatment during from 30 to 60 min. The effect of hydrolysis condition on properties of the transparent nanocellulose films was studied.

It was found that with increasing temperature and duration of hydrolysis the density nanocellulose films increase from 0.8 to 1.6 g/cm<sup>3</sup>, tensile strength - from 40 to 200 MPa and transparency - from 60 to 81 %. The structure of obtained nanocellulose was investigated by SEM, TEM, AFM, XRD and TGA methods. The spectral analysis demonstrated significant increasing of the transparency of nanocellulose films with sonication of nanocellulose suspension.

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2. *Barbash V.A., Yaschenko O.V., Shniruk O.M.* Preparation and properties of nanocellulose from organosolv straw pulp // *Nanoscale Research Letters*.- 2017.- 12:241
3. *Barbash V.A., Karakutsa M.G., Trembus I.V., Yaschenko O.V.* Development of technology of microcrystalline cellulose from hemp fibres // *Eastern-European Journal of Enterprise Technologies*. – 2016. – N 3/6 (81). - P.51-56.