Effects and Analysis of Chytazone in the Process of Processing Paper from Natural polymeres

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Abstract. The paper obtained during the study was mainly obtained from wheat straw cellulose and Jerusalem artichoke cellulose, which contained chitosan of various concentrations. An increase in the mechanical properties of the obtained papers was observed in samples using the substance chitosan. A 1.0% chitosan was added to the paper, mainly based on various plant celluloses. It should be noted that the obtained paper products were used without bleaching due to the fact that it was recommended to use them for wrapping paper. The youngest results were observed in samples prepared from a composition of wheat straw and artichoke pulp. From the fiber morphology, it was observed that the sized paper fibers became stronger, denser and smoother.

Keywords: chytazone, Natural polymers, fibers, cellulose

Biocomposites of chitosan (CS)/cellulose nanocrystals (CN) were prepared by using solution casting method. Influences of solution preparation method and CN content on the properties of composites were investigated. Mechanical stirring/ultrasonication or micro fluidization were used to disperse nanocrystals in the chitosan matrix. The prepared nanocomposites were characterized by FTIR, XRD, SEM, DSC, TGA, TMA and contact angle measurements.

Keywords: Polymers, artichokes, fibers, cardboard, sanitary papers

1 Introduction

The cultivation of agricultural products in the country is growing, including wheat and Jerusalem artichokes. Until now, when wheat straw was used in animal husbandry in our country, the stems of Jerusalem artichokes were burned as waste, taking into account that they are used for their use in the paper industry, as they are abundant. They are a very important raw material for writing, printing or packaging paper. Various adhesives are usually used to improve the quality of the paper. Oxidation of cellulose also results in deterioration of fiber quality. It is also important to ensure that the paper is mechanically strong. The uniformity of the fibers is also an important factor in the formation of paper. To this day, starch is used in the paper industry to impart the properties listed above.

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Chitosan is a natural polymer in which the presence of amino and hydroxyl groups determines its reactivity.[3,4]

Chitosan is obtained by diacytization from chitin, which is prone to biological degradation. This substance not only increases the durability of the paper but also has an impact on the cleanliness of the environment. Chitosan not only increases the strength of the paper, but also increases its smoothness and resistance to moisture. [1] Chitosan is also important in the production of sanitary papers, packaging papers and cardboard.

The aim of the study was to study the use of chitosan solutions of different concentrations to improve the mechanical and physical properties of paper sheets. The paper samples used here are made from a mixture of unbleached wheat straw cellulose and Jerusalem artichoke cellulose. The mechanical and physical properties of the papers were studied. The reliability of the results was confirmed by infrared spectroscopy and electron microscopy analyzes[2, 3,10].

During last decade, much attention has been focused on research and development of biocomposites and their applications due to the increased concern for environmental sustainability. Biocomposites have met demands for green technology because both matrix and reinforcement are biodegradable that provide environmental benefits e.g. ultimate disposability and raw material.

2 Methods

The paper was made from wheat straw grown in the hot climate of the Republic (Kashkadarya region) and cellulose from Jerusalem artichoke plants grown in Bustonlik district of Tashkent region. 75, 85, 95% deacetylated chitosan (high molecular weight) dissolved in 1% acetic acid was used.[7,8]

Paper injection. Celluloses obtained from plants were chemically analyzed by standard methods. Based on this, the amounts of α-cellulose, pentosans, lignin and ash were studied and analyzed. Paper injection was performed in the traditional way.

Calcification process. Before and after the addition of polymer solutions to the surface, the paper sheet was calendered using a hydraulic press (100 KN, 70°C, 3 min) and then tested as follows[4-9].

Mechanical properties, tensile index and tear resistance, transparency and brightness were measured. At least five measurements were performed for each test.

3 Results and discussion

Figures 1, 2 and 3 show that the addition of chitosan solution compared to the absence of chitosan, which improved the mechanical properties (elongation and tensile strength) of unbleached wheat straw, unbleached topinambur cellulose and chitosan-treated papers. The physical adsorption of chitosan solution on the surface and between the fibres, as well as the creation of films around the fibres, are related with changes in the strength characteristics of paper sheets in the presence of chitosan solution. These films reinforced the bonding of the fibres.

As a result, the drying and calendering of paper sheets binds the fibres not only by hydrogen bonding between the fibres, but also by forming fiber-polymer-fiber bonds; however, increasing the concentration of chitosan solution reduces these properties, which may be due to high viscosity in high percentages of polymer solution; this prevented the polymer from penetrating through the fibres.[5,6]
Fig. 1. Properties of chitosan-coated paper sheets made of unbleached artichoke pulp

Fig. 2. Properties of chitosan-treated sheets of paper made from unbleached wheat straw cellulose

Fig. 3. The composition of artichokes and wheat cellulose, as well as the properties of chitosan-influenced sheets of paper

As can be seen from Fig. 1, 2 and 3, the addition of a 1.0% chitosan solution gave high Mechanical qualities (scratch performance and breaking strength) of sheets of paper manufactured from various cellulosics. Physical characteristics improved by increasing the proportion of chitosan solution in sheets of paper created from various cellulosics; this was owing to the polymer's physical properties.

In Fig. 1, 2, and 3, the improvement of cellulose fibers formed from agricultural wastes by flocculation using chitosan was examined. This is clearly present in the sheets of paper made from unrefined wheat straw compared to unprocessed from cellulose. Attachment of chitosan to the cellulose structure and / or inside is accompanied by the formation of a semi-interpenetrated network structure, which provides the best hardness and resistance to
pilling. Characteristics of bleached paper sheets made from unbleached bag in the presence of 1.0% chitosan solution. The number of layers was selected due to the abundance of unbleached paper sheets treated with 1.0% chitosan solution as its agricultural residues and the improvement of paper sheet properties compared to untreated.

![Fig. 4. (a)Paper samples from unbleached wheat straw pulp](image1)

![Fig. 4. (b) unbleached Jerusalem artichoke pulp](image2)

![Fig. 4. (C) unbleached wheat straw and Jerusalem artichoke pulp](image3)

Compared to Fig. 5, the photos in Fig. 4 show that unbleached wheat straw cellulose, unbleached artichoke plant cellulose, and sheets of paper treated with chitosan solution showed a certain stickiness. It was observed that the fibrillation process between the fibers was more active, with a denser structure than that of the fibers and untreated paper samples.
It was also clear from Fig. 4 and 5 that the fibers of the sized paper were hard and smooth. Chitosan has been shown to penetrate paper fibers and interact with paper fibers by physical and chemical interactions, which increased the physical strength of the paper by enhancing the bond strength and bond energy between the fibers. From the morphology of the fibers on the paper surface, it can be seen that the surface of the papers with chitosan added was very smooth and transparent on micrography, while the surface of the papers without chitosan was more rough and the fibers were unevenly distributed.
Figure 6 shows samples and drawings of different layers of paper with the addition of 1.0% chitosan from unbleached wheat straw and Jerusalem artichoke pulp. As can be seen from Fig. 6 (a-d), the size of the paper becomes stiffer as the number of layers increases.
4 Conclusion

The conclusion is that the addition of a 1.0% solution of chitosan gave the best results in terms of mechanical properties (drawing performance and cracking strength) of sheets of paper made from unbleached wheat straw and unbleached topinambur cellulose compared to those not treated with chitosan.

Increasing the percentage of chitosan solution for all sheets of paper made from different cellulosics increased the physical properties through a negative effect on the mechanical properties. Although an increase in the number of layers of paper treated with 1.0% chitosan during the paper forming process leads to an increase in mechanical properties but reduces the transparency and smoothness of the paper.

When the samples were examined using an electron microscope, the irregularity of the placement of the fibers in the samples not treated with chitosan proved that it did not meet the requirements of mechanical, smoothness and gloss of the paper surface. In contrast, paper samples treated with 1.0% chitosan proved to be denser in size paper with the above-mentioned paper quality indicators as well as an increase in the number of paper layers.

References