Największe przyrosty stężeń badanych metali ciężkich oznaczono w próbkach mchów (*Pleurozium schreberi*), porostów (*Hypogymnia physodes*) oraz glonów (Palmaria palmata) eksponowanych w pobliżu wpływu Małej Panwi do zbiornika oraz w zachodniej części zbiornika, przy wypływie, gdzie zgromadzone są największe ilości mułów sapropelowych.

Podsumowując, ocena stanu chemicznego wód zbiornika wskazuje na dwa główne źródła zanieczyszczeń: osady sapropelowe, gromadzone w misie zbiornika od ponad 80 lat oraz wody rzeki Mała Panew gromadzące odcieki z pól oraz z terenów przemysłowych.

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REDUCTION OF WASTEWATER TURBIDITY IN THE PRODUCTION OF PAPER AND CARDBOARD

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Chitosan is a natural, non-toxic and biodegradable polymer, obtained by deacetylation of chitin, which is a structural element of the exoskeleton of insects, crustaceans (such as crabs and shrimps), etc [1]. A common method for the chitosan preparation is the deacetylation of chitin with sodium hydroxide. Chitosan is a linear polysaccharide, which is composed of randomly distributed β-(1-4)-linked D-glucosamine and N-acetyl-D-glucosamine. Its molecular structure is similar to cellulose one, but in chitosan C-2 hydroxyl groups replaced by acetamido groups (Fig. 1) [2]. Chitosan is bioinertpolymer possessed bacteristatic properties, good adhesion and coagulation ability. Due to these properties, it can be used in medicine, pharmacology, cosmetics production, in the food industry, in the textile industry, for water treatment and for other purposes [3, 4].

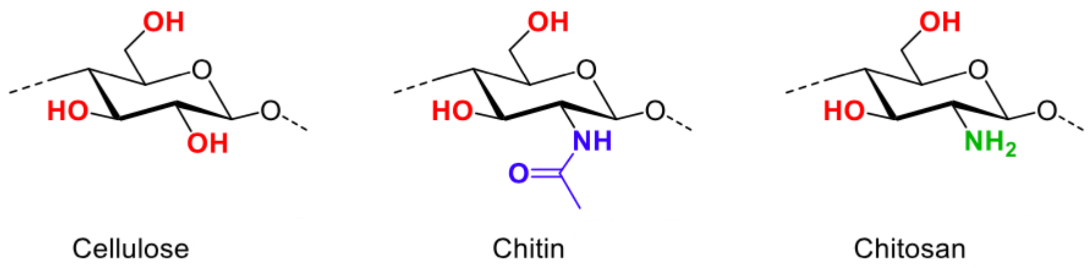

Figure 1 – Schematic representation of the repeating units of cellulose, chitin and chitosan.

Chitosan is also can used in the paper industry. The presence of three hydroxyl groups in each cellulose chain leads to strong intramolecular and intermolecular H-bonds formation in paper shirt as shown in (Fig. 2). The formation of these H-bonds takes place due to the semicrystalline structure of cellulose, with crystalline and amorphous parts. The molecular structure of chitosan is similar to cellulose structure indicating the creation of strong bonding.

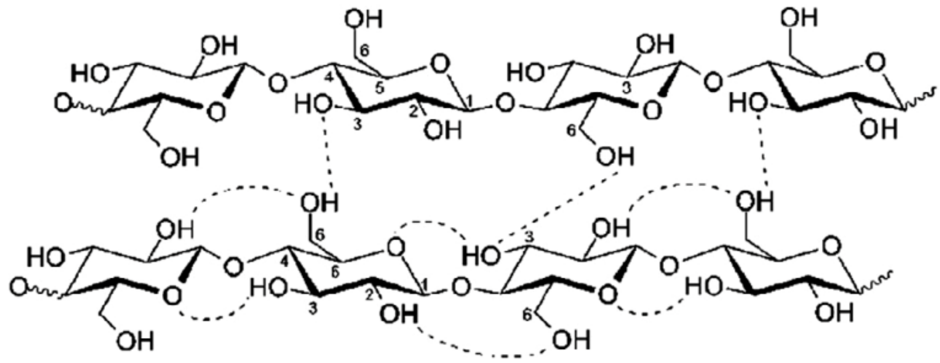

Figure 2 – Schematic representation of the intra- and intermolecular hydrogen bonding in cellulose [5].

To improve the paper properties, chitosan and its derivative coatings are used [6]. In both cases, chitosan mainly improves the strength of paper sheets. It has been shown that addition of chitosan and its derivatives leads to improvement in the strength properties of unaged and aged paper sheets.10 Values of breaking length, obtained with the addition of chitosan and its derivatives into the pulp suspension are higher than those obtained by dipping paper in chitosan and its derivatives solutions, whereas the opposite trend is observed for the tear factor. More generally, it was shown that, by using chitosan in paper production, the mechanical properties were improved. Chitosan and its derivatives also improve the electrical, printing, barrier and antibacterial properties of paper.

Nowadays, papers and boards are often used in packing of various products. Therefore, it is important to obtain papers with suitable properties, such as high strength in dry and wet states, low water absorption. In Ukraine re-cycled paper is the main source of fibers for paper and board products which affects the quality and composition of wastewater in paper industry.

The aim of this work was to investigate the effect of chitosan consumption on the turbidity of wastewater after paper and board production. For this purpose, 1% chitosan solutions (molecular chitosan) were prepared by dissolving chitosan in an aqueous solution of 5% acetic acid.

Wastepaper was used to prepare carboard laboratory sheets. Wastepaper was soaked in tap water for 30 min and disintegrated in a laboratory disintegrator for 10 min at 3000 rmp/min at a concentration of 4%. Pulp quantity was used to produce 10 paper sheets with a basis weight of 120 g/m^2. The dosage of molecular chitosan was of 0.5-2.5%. For each dosage, the required amount of macromolecular chitosan was added to fibre suspension under stirring for 1 min at 3000 rmp/min. The fibre suspension was then diluted to 0.3% (weight of fibre/weight of suspension) by tap water, allowed to rest for 15 min, to ensure chitosan adsorption onto pulp fibres. The pH was measured before paper sheet formation. Paper sheets were made on a laboratory sheet former and dried was done at 90±2 °C under vacuum. The wastewater was collected and analyzed for dry residue, ash content of dry residue and turbidity.

Effect of paper sheet composition onto wastewater turbidity is shown in Fig. 3.

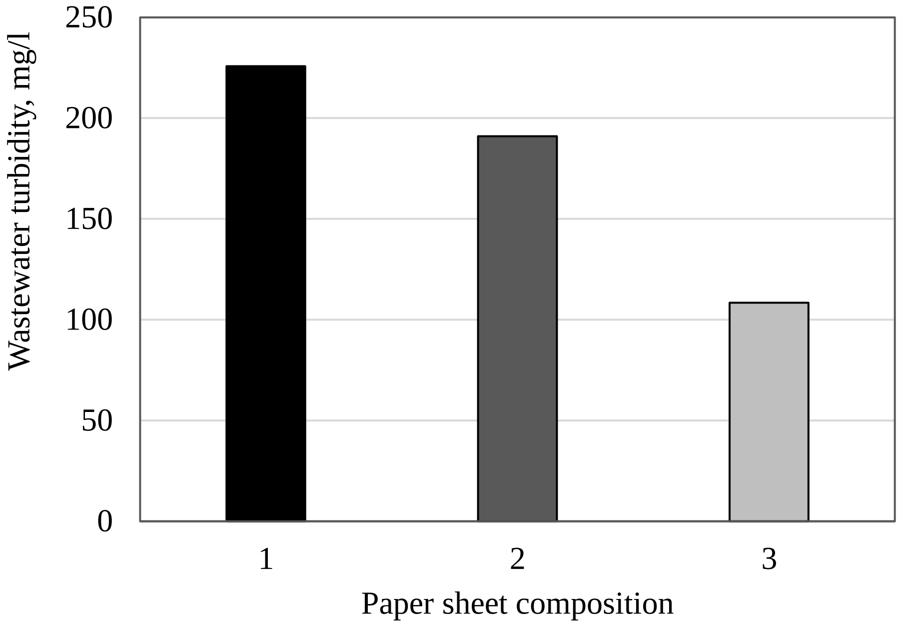

Figure 3 – Dependence of wastewater turbidity on paper composition: 1 – paper sheet from wastepaper only; 2 - paper sheet from wastepaper + starch; 3 - paper sheet from wastepaper + chitosan.

As can be seen, the adding of the starch and chitosan into fibre suspension caused decrease in wastewater turbidity due to prevention of fiber lost during paper formation.

Effect of chitosan consumption on wastewater turbidity is shown in Fig. 4.

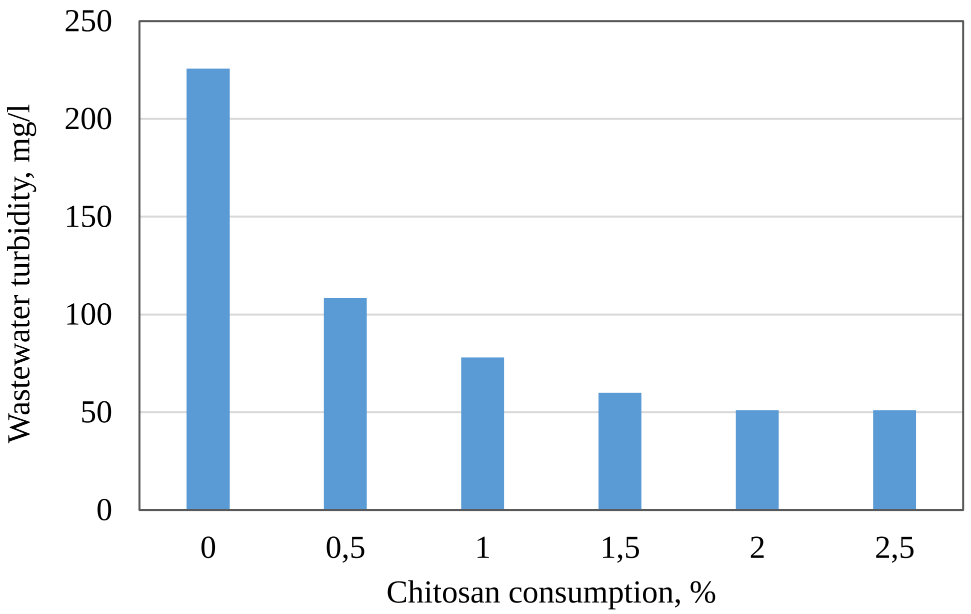

Figure 4 – Effect of chitosan consumption on wastewater turbidity.

Increase in chitosan consumption during paper production lead to decrease in wastewater turbidity. The maximum decrease in the value of this indicator corresponds to the consumption of chitosan 0.5%. A further increase in the consumption of chitosan does not lead to a significant reduction in the turbidity of the wastewater.

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BADANIE PROCESU ADSORPCJI KATIONOWYCH I ANIONOWYCH BARWNIKÓW NA BIOWĘGLACH Z ODPADÓW KOMUNALNYCH

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Barwniki są jednym z najbardziej niebezpiecznych materiałów w ściekach przemysłowych. Powszechnie stosowane barwniki obejmują barwniki kwasowe, zasadowe, reaktywne, dyspersyjne oraz bezpośrednie barwniki, które zwykle mają strukturę aromatyczną i grupy azowe. Barwniki azowe, które zawierają jedno lub dużo wiązań podwójnych azotu z azotem (–N=N–) są odporne na degradację tlenową i w warunkach beztlenowych są redukowane do rakotwórczych amin aromatycznych. Barwinki w ściekach mogą również zmniejszać przezroczystość wody, zużywać tlen, zwiększać biochemiczne zapotrzebowanie na tlen, niszcząc organizmy żywe. W ostatnich latach można zauważyć rosnące zainteresowanie problemem usuwania barwnych związków z wód powierzchniowych i ścieków przemysłowych. Opracowano kilka technik, takich jak oczyszczanie biologiczne, utlenianie chemiczne, separacja membranowa, koagulacja/flokulacja, adsorpcja, wymiana jonowa. Wśród tych wymienionych adsorpcję uważa się za prostą i wysoce wydajną. Badano szereg materiałów zdolnych do usuwania barwników, takich jak: zeolity, gliny, węgile aktywne, skorupki jajek. Jednak każdy z tych materiałów ma