fibers content, i. e., beating is realized by separation of small segments series from the fiber.

Herewith the pulp beating degree considerably increases although its dehydration rate decreases, that confirms fiber fibrillation process. This is also confirmed by decreasing of mass zeta potential values. But even more considerable evidence of fiber development is the hardening of paper due to an increase of the hydrogen bonds between fibers. Paper quality indexes are shown in the Table 2.

As we can see from table 2, as the result of beating the paper hardness increases by 2.5–9 times. As complex index of fiber development we can use paper samples resistance to thermal-oxidative destruction processes, expressed in sample amount, that remain after heating. As regards this index, fiber development increased by 3.8 times. Data obtained allow to get conclusion, according to which, during cotton cellulose beating on disk crushers we can obtain sufficient level of fiber development, necessary to get a paper with stated properties, by using standard methods of beating management.

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SYNTHESIS OF CYCLIC ESTERS OF LACTIC AND GLYCOLIC ACIDS

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Due to their unique properties, biodegradable1 polymers have long been considered as alternative environmentally friendly polymers, and the spectacular advances achieved over the last 30 years in the synthesis, manufacture, and processing of these materials have given rise to a broad range of practical applications from packaging to more sophisticated biomedical devices [1, 2].

Of the variety of biodegradable polymers known, linear aiphatic polyesters are particularly attractive and most used, especially those derived from lactic acid, glycolic acid, and their copolymers [3].

Notably, these polymers are not only biodegradable, but also bioassimilable, since their hydrolysis in physiological media gives lactic (LA) and glycolic acids (GA), nontoxic components as water and carbon dioxide.

The combination of well-suited physical properties and biodegradable character makes polylactide and polylactide-(co)-glycolide promising substitutes for petrochemical-based plastics in a wide range of single-use packaging and commodity applications [4]. Indeed, these biodegradable polymers may well offer a practical solution to the ecological problems associated with bioresistant wastes.

It should be noted that the production of biodegradable polymers based on hydroxycarboxylic acids is complicated technology. Existing methods are not sufficiently effective, since they are multistage and energy-consuming, in the synthesis of a large amount of waste, there is a low yield and the large losses in the purification as feedstock - cyclic ethers and polymers obtained [5]

It is known that copolymers of lactic and glycolic acids can be prepared by two main methods. First – by direct melt polymerization of hydroxycarboxylic acids and second – opening through the ring of cyclic esters of these acids [6].

This paper proposes a method of obtaining cyclic esters based on lactic and glycolic acids includes the following steps:

1. concentration of the of LA and GA solution;
2. preparation of LA and GA oligomers using a catalyst;
3. preparation and purification of cyclic ethers [7].

80% aqueous solution of L-lactic acid from PURAC (Spain) and aqueous 70% glycolic acid from «AppliChem GmbH» (Germany) were used.

The oligomerization process was performed at the temperature of 130–180 єC, the rotation speed of the flask on a vacuum rotary evaporator was 75 rev/min and the pressure from atmospheric pressure to vacuum (5 kPa). In 2 hours mixture of zinc oxide used as a catalyst was added in the amount of 1.5% of concentrated hydroxycarboxylic acids weight. The process was being carried out without nitrogen blanket during 5 hours.

Depending on the molecular weight the polymers obtained might be in the resinous and solid state, from light beige to light brown in color.

Synthesis of raw cyclic ether oligomers of LA and GA was performed on a standard laboratory facility of vacuum distillation with the use of the electromagnetic stirrer IKA C-MAG HS 7 at the vacuum of 1–2 kPa. The process of the LA oligomer depolymerization in the lactide took 3,5–4,5 minutes. The experimental data showed that the presence of para-toluene sulfonic acid affected the synthesis of raw lactide.

Cyclic esters obtained according to the vapor temperature can be from to crystals of white to yellow or yellow oily liquid.

The structure of the obtained samples was investigated by infrared spectroscopy. The spectra are characterized by absorption bands of 1750 ~ 1720 cm^{-1} related to the vibrations of the carbonyl group C=O. Vibrations of ester group C–O–C appear in 1150 ~ 1087 cm^{-1}. Absorption band of 2970 ~ 2940 cm^{-1}, 1455 ~ 1450 cm^{-1} and 1383 ~ 1380 cm^{-1} belongs to methyl groups ($–CH_3$) and methylene group ($–CH_2–C–H$) in the ring ether.

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ASSESSMENT OF WATER TREATMENT EFFICIENCY FROM AMMONIUM IONS WITH A HELP OF ZEOLITES

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The effective application of softening groundwater method with a help of generator of microbubble treatment and ammonium hydroxide is shown in this paper [1]. This method can be used in order to prepare service water. To prepare drinking water by this method it is necessary to add a new stage of ammonium and ammonia ion removal. According to [2], various methods such as sorption and ion-exchange processes, oxidation, biofiltration and reverse osmosis can be used for ammonium ion removal from water to produce drinking water. Sorption process of ammonia removal from water is not directly used on a commercial scale. However, it is possible to use specific sorption of inorganic sorbent ammonium (for example, zeolites) for local water supply. The aim of this paper is to assess the efficiency of ammonium ion removal from water solution using zeolites.

The natural zeolite samples to be tested were taken from different fields (Chuguevsk, Shivyrtuisk, Kholinsk, Sokirnitsk) with various granulometric composition. The different particle size distribution zeolites (less 0.1 mm; 0.5–1 mm; 1.5–2.5 mm etc.) were taken to make experiments. Water taken from public drinking water supply in Tomsk and treated with a help of generator of microbubble process and ammonium hydroxde was used to make these experiments [1].