Summarizing, we can say that today the leading position in producing and using belongs to such polymers as polyamides, acrylic and polyacrylic acid, a variety of analogues based on them. The reason for this, apparently, is the high effectiveness of this reagent, combined with the desired hydrophilicity, relatively low toxicity against lower animals. Relatively easy production of basic polymers (polyacrylamide, polymethyl methacrylate), universal and simple ways to modify them are also important factors for their wide use.

However, there is no AAP production on the territory of the Republic of Belarus, which makes actual the subject of the study. The existing technology of producing monomers on the plant"Polymir" of the JSC "Naftan" allows the production of acrylonitrile, which, in its turn, can be used for the production of polyacrylamide. Therefore, the aim of further research is to find the technology for industrial producing of AAP in Belarus.

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UDC 628.33=11

MUNICIPAL UTILITY WATER TREATMENT

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For more than 20 years there has been remarkable growth in the need for quality water purification by all categories of users – municipal, industrial, institutional, medical, commercial and residential. The increasingly broad range of requirements for water quality has motivated the water treatment industry to refine existing techniques, combine methods and explore new water purification technologies.

Water treatment can be defined as any procedure or method used to alter the chemical composition or natural “behavior” of a water supply. Water supplies are classified as either surface water or groundwater. The majority of public or municipal water comes from surface water such as rivers, lakes, and reservoirs. The majority of private water supplies consist of groundwater pumped from wells.

Most municipal water found in a city or community today has been treated extensively. Specific water treatment methods and steps taken by municipalities to meet local, state, national, or international standards vary but are categorized below [1].

Screen prefiltration. A coarse screen, usually 35 to 140 microns, at the intake point of a surface water supply, removes large particulate matter to protect downstream equipment from clogging, fouling, or being damaged.

Clarification. Clarification is generally a multi-step process to reduce turbidity and suspended matter. Steps include the addition of chemical coagulants or pH-adjustment chemicals that react to form floc. The floc settles by gravity in settling tanks or is removed as the water percolates through a gravity filter. The clarification process effectively removes particles larger than 25 microns. The clarification process is not 100% efficient; therefore, water treated through clarification may still contain some suspended materials.

Lime-soda treatment. The addition of lime (Ca) and soda ash (Na_2CO_3) reduces the level of calcium and magnesium and is referred to as “lime softening”. The purpose of lime softening is to precipitate calcium and magnesium hydroxides (hardness) and then clarify the water. The process is inexpensive but only marginally effective, usually producing water of 50 to 120 ppm hardness.

Disinfection. Disinfection is one of the most important steps to municipal water treatment. Usually, chlorine gas is fed into the supply after the water has been clarified and/or softened. The chlorine kills bacteria. In order to maintain the "kill potential", an excess of chlorine is fed into the supply to maintain a residual. The chlorine level must be constantly monitored to assure that no harmful levels of chloramines or chlorinated hydrocarbons develop.

PH adjustment. Municipal waters may be pH adjusted to a pH of approximately 7.5 to 8.0 to prevent corrosion of water pipes, particularly to prevent dissolution of lead into the water supply. In the case of excessive alkalinity, the pH may be reduced by the addition of CO_2 [2].

Tank-type pressure filters. A typical filter consists of a tank to house the filter media and a valve or controller to direct the filter through its various cycles–typically service, backwash and rinse. Easily the most critical aspect of pressure filter performance is the relationship of flow rates to filter media surface area. This relationship is the primary cause of failure or trouble in filter systems. If problems develop, the most common reason is that many filters are inaccurately "sized" for the job. Some examples of pressure filters and their applications are [1, 3]:

1. **Sand filters**. Sand or other filtration media are used to remove turbidity. However, the location of the fine media on top of the coarse media causes the sand filter to clog quite quickly and the coarseness of sand allows many smaller impurities to pass through.
2. **Neutralizing filters.** Neutralizing filters usually consist of a calcium carbonate calcite medium (crushed limestone or marble) to neutralize low pH water.
3. **Oxidizing filters**. Oxidizing filters use a medium treated with oxides of manganese as a source of oxygen to oxidize and precipitate iron, manganese, hydrogen sulfide, and others.
4. **Activated carbon filters.** Activated carbon (AC) is similar to ion exchange resin in density and porosity. It absorbs low molecular weight organics and reduces chlorine or other halogens from water, but does not remove any salts. These filters must be changed periodically to avoid bacterial growth, but are not easily reactivated in the field. Accumulated solids require frequent backwashing of the filter unless installed after reverse osmosis or ultra filtration.
5. **Dual- or multi-media filters.** Dual-media filters remove suspended solids to as low as 20 microns in size, but no dissolved solids. The top layer is a coarse anthracite followed by fine sand.
6. **Pre-coat filters.** Usually with a media of diatomaceous earth, pre-coat filters remove very small particulate matter, including some bacteria (fig. 1). They are practical only for limited volume applications but are common for swimming pools, beverage plants, and small installations.

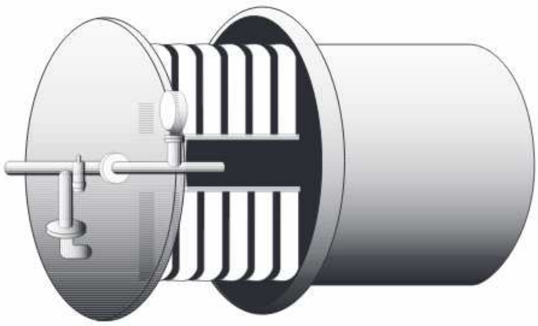

Fig. 1. Pre-coat filter

7. **Cartridge filters.** Cartridge filters can now be described two general ways: as depth filters or surface filters.
8. **Depth cartridge filters.** In a depth cartridge filter, the water flows through the thick wall of the filter where the particles are trapped throughout the complex openings in the media. The filter may be constructed of cotton, cellulose, synthetic yarns or "blown" micro fibers such as polypropylene. The best depth filters have lower density on the outside and progressively higher density toward the inside wall. The effect of this "graded density" is to trap coarser particles toward the outside of the wall and the finer particles toward the inner wall. Depth cartridge filters are usually disposable, cost-effective, and are in the particle range of 1 to 100 microns. Generally, they are not an absolute method of purification since a small amount of particles within the micron range may pass into the filtrate.
9. **Surface filtration–pleated cartridge filters.** Pleated cartridge filters typically act as absolute particle filters, using a flat sheet media, either a membrane or specially treated non-woven material, to trap particles. The media is pleated to increase usable surface area. Pleated membrane filters serve well as sub-micron particle or bacteria filters in the 0.1 to 1.0 micron range. Newer cartridges also perform in the ultra filtration range: 0.005 to 0.15 micron.

Electrodialysis (ED) and electrodialysis reversal (EDR) employ electrical current and specially-prepared membranes which are semipermeable to ions based on their charge, electrical current, and ability to reduce the ionic content of water (fig. 2). Two flat sheet membranes, one that preferentially permeates cations and the other, anions, are stacked alternately with flow channels between them. Cathode and anode electrodes are placed on each side of the alternating stack of membranes to draw the "counter" ions through the membranes, leaving lower concentrations of ions in the feedwater [1].

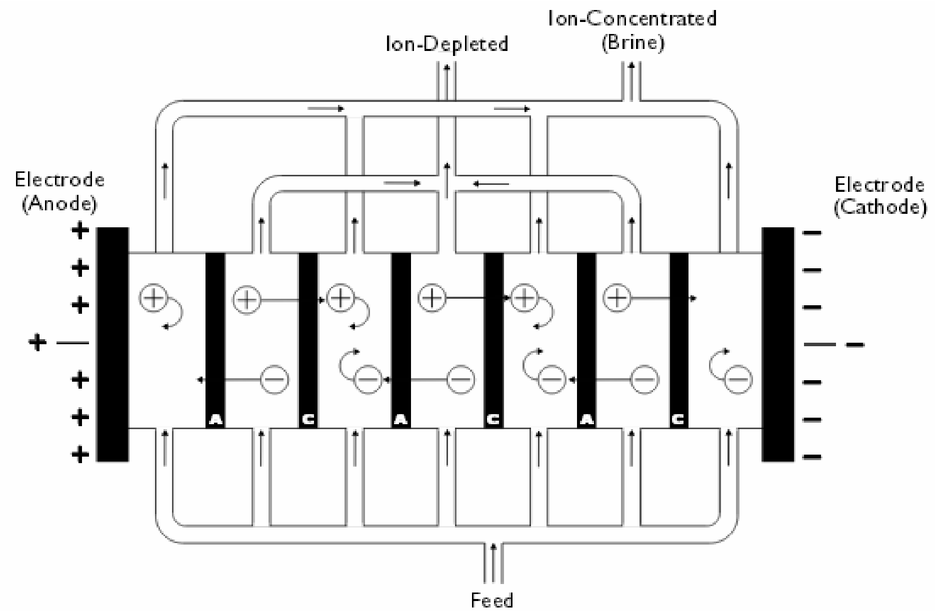

Fig. 2. Electrodialysis

The efficiency of electrodialysis depends on the ionic solids and fouling potential from organics and particles in the feedwater, the temperature, the flow rate, system size and required electrical current. Organics and weakly-charged inorganics are not removed by ED. Recent developments have improved the efficiency of ED by reversing the polarity of the electrodes periodically.

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UDC [544.725:66]=111

ABOUT THE APPLICATION OF INORGANIC MEMBRANES IN MODERN INDUSTRY

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Separation systems are a vital part of most industrial processes. These systems account for a large fraction of the equipment and operating costs of industrial processes. Inorganic membranes have the potential for providing separation systems that can reduce both equipment and operating costs. Some optimistic thoughts will be given on how several industries can be operationally and economically revolutionized with inorganic membranes systems. Some examples of developments of new technology will be given.

Separation systems are a vital part of industrial processes. These systems account for a large fraction of the equipment and operating costs of industry. Separation processes are needed for everything from feed stock materials to pure end products. Inorganic membranes have the potential for significantly reducing both the equipment and operating costs associated with these separation. In addition, there is a serious emerging systemic problem of how to