

YU. M. FEDENKO

Candidate of Technical Sciences,
Senior Lecturer at the Department of Technology of Inorganic Substances,
Water Treatment and General Chemical Technology
National Technical University of Ukraine
“Igor Sikorsky Kyiv Polytechnic Institute”
ORCID: 0000-0002-8599-1717

D. V. DIDENKO

Bachelor Student at the Department of Technology of Inorganic Substances,
Water Treatment and General Chemical Technology
National Technical University of Ukraine
“Igor Sikorsky Kyiv Polytechnic Institute”
ORCID: 0009-0004-5257-3422

REVIEW OF METHODS OF WASTEWATER TREATMENT FROM COMPOUNDS OF DIFFERENT NATURE AND GENESIS. ENVIRONMENTAL ASPECTS

Environmental pollution has a negative impact on natural resources, including water bodies. Wastewater can easily infiltrate into the soil and even into the liquid supplied to residential and public buildings. Wastewater treatment is required to improve the environmental conditions. There are various ways to remove pollution from wastewater.

Type of pollution affects the choice of method of wastewater treatment. Often combined methods are used to achieve the best result. The main methods of wastewater treatment: mechanical – used to remove insoluble impurities; biological – liquid purification is carried out without the use of chemicals; biochemical – along with chemical reagents, microorganisms that feed on pollutants are used; chemical – used to remove various acids and alkalis from the effluent; physical-chemical – includes several methods of removing contaminants. Before using a particular method of sewage treatment, it is necessary to analyze the wastewater.

Mechanical methods of wastewater treatment consist in removing insoluble and partially colloidal insoluble and partially colloidal impurities from the water. Waste contained in wastewater (paper, rags, bones, various industrial wastes, etc.).

Chemical methods of wastewater treatment include the following neutralization, oxidation, and reduction. Chemical treatment can be used as a preliminary stage of biological treatment or as a subsequent treatment method. Both chemical and physicochemical treatment are used only in industrial conditions and require preliminary mechanical cleaning. Chemical purification reduces the amount of insoluble pollutants by up to 95 % and soluble pollutants up to 25 %.

Biological methods are considered the main way to treat wastewater from the oxidation of organic impurities. They are based on biological oxidation, which allows to filter wastewater from various organic substances. These substances cannot be removed from wastewater mechanically. Biological oxidation is carried out with the help of a community of microorganisms (biocenosis), which includes many bacteria, protozoa and some highly organized organisms such as algae, fungi, etc. Rarely used for wastewater from machine-building enterprises.

Key words: wastewater, environment, mechanical methods, chemical methods, biological methods.

Ю. М. ФЕДЕНКО

кандидат технічних наук,
старший викладач кафедри технології неорганічних речовин,
водоочищення та загальної хімічної технології
Національний технічний університет України
«Київський політехнічний інститут імені Ігоря Сікорського»
ORCID: 0000-0002-8599-1717

Д. В. ДІДЕНКО

бакалавр кафедри технології неорганічних речовин,
водоочищення та загальної хімічної технології
Національний технічний університет України
«Київський політехнічний інститут імені Ігоря Сікорського»
ORCID: 0009-0004-5257-3422

ОГЛЯД МЕТОДІВ ОЧИЩЕННЯ СТІЧНИХ ВОД ВІД СПОЛУК РІЗНОЇ ПРИРОДИ ТА ГЕНЕЗИСУ. ЕКОЛОГІЧНІ АСПЕКТИ

Забруднення навколишнього середовища негативно впливає на природні ресурси, в тому числі на водні об'єкти. Стічні води можуть легко проникати в ґрунт і навіть у рідину, що подається в житлові та громадські будівлі. Очищення стічних вод необхідне для поліпшення екологічних умов. Існують різні способи видалення забруднень зі стічних вод.

Тип забруднення впливає на вибір методу очищення стічних вод. Часто для досягнення найкращого результату використовують комбіновані методи. Основні методи очищення стічних вод: механічний – використовується для видалення нерозчинних домішок; біологічний – очищення рідини здійснюється без застосування хімічних реагентів; біохімічний – поряд з хімічними реагентами використовуються мікроорганізми, які харчуються забруднювачами; хімічний – використовується для видалення зі стоків різних кислот і лугів; фізико-хімічний – включає в себе кілька методів видалення забруднень. Перед застосуванням того чи іншого методу очищення стічних вод необхідно провести їх аналіз.

Механічні методи очищення стічних вод полягають у видаленні з води нерозчинних і частково колоїдних домішок. Відходи, що містяться у стічних водах (папір, ганчірки, кістки, різні промислові відходи тощо).

Хімічні методи очищення стічних вод включають нейтралізацію, окислення та відновлення. Хімічне очищення може використовуватися як попередній етап біологічного очищення або як наступний метод очищення. Як хімічне, так і фізико-хімічне очищення застосовуються тільки в промислових умовах і вимагають попереднього механічного очищення. Хімічне очищення зменшує кількість нерозчинних забруднювачів до 95 %, а розчинних – до 25 %.

Біологічні методи вважаються основним способом очищення стічних вод від окислення органічних домішок. Вони засновані на біологічному окисленні, яке дозволяє фільтрувати стічні води від різних органічних речовин. Ці речовини неможливо видалити зі стічних вод механічним шляхом. Біологічне окислення здійснюється за допомогою спільноти мікроорганізмів (біоценозу), яка включає багато бактерій, найпростіших і деяких високоорганізованих організмів, таких як водорості, гриби тощо. Рідко використовується для стічних вод машинобудівних підприємств.

Ключові слова: *стічні води, навколишнє середовище, механічні методи, хімічні методи, біологічні методи.*

Statement of the problem

Environmental pollution has a negative impact on natural resources, including water bodies. Wastewater can easily infiltrate into the soil and even into the liquid supplied to residential and public buildings. Wastewater treatment is required to improve the environmental conditions. There are various ways to remove pollution from wastewater. The activities of many industries lead to wastewater pollution [1]:

- petrochemical and oil refining industries;
- metallurgy and mining industry;
- chemical and pulp and paper industries;
- food processing plants and a number of other industries.

Huge harm to wastewater is caused by improper use of fertilizers and pesticides in agriculture. Some compounds are very difficult to remove from wastewater, including surfactants contained in synthetic detergents.

Radioactive contaminants pose a great danger. These impurities appear during the processing of nuclear fuel, violation of uranium ore purification technology and in several other situations.

Analysis of recent research and publications

Wastewater pollutants can be categorized into three large groups [2-4].

1. Physical – sand, clay, silt, sludge, sludge, suspended solids, radioactive elements. Organoleptic pollutants affect the color and odor of the liquid.
2. Biological – yeast and mold fungi, lignin and algae, various pathogens.
3. Chemical – acids and alkalis, oil and petroleum products, salts and phenols, dioxides and pesticides, heavy metals, ammonium and nitrite nitrogen, SPABs.

Thermal pollution of wastewater is less common. When high temperatures of process water mix with cooler masses, the chemical and gas composition of wastewater changes. This carries the danger of multiplication of anaerobic bacteria, the release of poisonous gases – methane and hydrogen sulfide, the growth of hydrobionts. Type of pollution affects the choice of method of wastewater treatment. Often combined methods are used to achieve the best result. The main methods of wastewater treatment [5, 6]:

- mechanical – used to remove insoluble impurities;
- biological – liquid purification is carried out without the use of chemicals;
- biochemical – along with chemical reagents, microorganisms that feed on pollutants are used;
- chemical – used to remove various acids and alkalis from the effluent;

- physical-chemical – includes several methods of removing contaminants.
- Before using a particular method of sewage treatment, it is necessary to analyze the wastewater.

Purpose of the study

The purpose of the study is to analyze the literature on wastewater treatment methods of different nature and genesis, as well as to establish the environmental aspects of water treatment methods.

Presentation of the main research material

Methods of wastewater treatment are divided into mechanical, chemical, physicochemical and biological, and when these methods are used together, they are called combined. The choice of approach depends on the type of pollution and its harmfulness. Methods for treating contaminated industrial water can be divided into several groups: mechanical, physical, physical-mechanical, chemical, physical-chemical, biological and integrated methods [7-9].

Mechanical methods of wastewater treatment consist in removing insoluble and partially colloidal insoluble and partially colloidal impurities from the water. Waste contained in wastewater (paper, rags, bones, various industrial wastes, etc.) are collected in the grates in advance. Mechanical cleaning allows removing up to 60–75 % of insoluble contaminants from domestic wastewater and up to 95 % from industrial wastewater. Many of them are valuable pollutants used in production [10].

Grids and nets are used for filtration, and there is also a process of filtration of coarse dirt (bags, rags, plastic, large things and objects). The cleaning device works by installing a special mesh that traps large particles of dirt. Then the purified water enters the fine mesh, and small particles of dirt are trapped in it. Finally, microfilter removes particles and insoluble substances [11-14].

Chemical methods of wastewater treatment include the following neutralization, oxidation, and reduction. Chemical treatment can be used as a preliminary stage of biological treatment or as a subsequent treatment method. Both chemical and physicochemical treatment are used only in industrial conditions and require preliminary mechanical cleaning. Chemical purification reduces the amount of insoluble pollutants by up to 95 % and soluble pollutants up to 25 % [15].

Neutralization is a method of purifying contaminated water that can be to return to normal pH (6.5–8.5). This process neutralizes acids and alkalis and turns them into safe substances. When treating wastewater from industrial enterprises must deal with such contaminants. Even if acidic wastewater is mixed with alkaline wastewater, it can be neutralized by simply by mixing them. To neutralize acidic water, alkaline waste, caustic sodium, soda, chalk, and limestone. To achieve this method, companies install filters and various devices to achieve this method [16-18].

The main methods of neutralization include:

- mixing acid and alkaline liquids;
- introduction of reagents;
- filtering of acidic wastewater with the use of neutralizing substances;
- alkaline dissolution of gases;
- introduction of ammonia solution into acidic wastewater.

After oxidation, pathogenic microorganisms die. This method is used when the removal of pollutants by mechanical means or changing the composition of wastewater is not enough. Advocacy does not give the desired results. The active reagents are ozone, chlorine, potassium dichromate, pyrolusite, calcium chlorate and oxygen. The use of chlorine additionally dechlorinates the water. Although ozonation is an advanced technology, it is very expensive. In addition, ozone is an explosive substance if it is present in large quantities [19].

The reduction process can neutralize compounds such as chromium, mercury, arsenic, and some other easily recoverable elements. The reagents used are sulfur dioxide, sodium hydrosulfite, hydrogen, and ferrous sulfate. Among the methods of wastewater treatment, biological methods play an important role, based on the application of the laws of biochemical and physiological self-purification of rivers and other water bodies. There are several types of biological equipment for wastewater treatment: biofilters, biological tanks and aerotanks [20].

In a biological pond, all living organisms of the lake participate in wastewater treatment. Aerotanks are large reinforced concrete tanks. The active sludge of bacteria and microscopic animals is the treatment element here. All these living beings evolve intensively in aeration tanks, influenced by the organic content of wastewater and the excessive proportion of oxygen that enters the structure by the incoming air stream. Bacteria stick together in flakes and begin to release flakes and begin to secrete enzymes that mineralize organic waste. The sludge with flakes becomes sediment at a high rate, by separation from the water that has been purified. The following list is provided: infusoria, amoebae, flagellates, rotifers and possible similar small organisms, eat bacteria that do not have the ability to stick together in flakes, make the actual bacterial consistency of the sludge younger [21].

Before biological treatment, wastewater is subjected to mechanical treatment, and afterwards to remove pathogenic bacteria and chemical treatment, chlorination with non-solid chlorine or it is also possible to use bleach lime can also be used. Other physical and chemical methods are also used for disinfection (ultrasound, electrolysis, ozonation, and others) [21]. The biological method demonstrates significant results in the treatment of municipal wastewater. It is also used to treat waste from oil refineries, pulp and paper industry and artificial fiber production [22].

Wastewater filtration in various institutions and enterprises has the following list of implementation:

- filtration of wastewater using special treatment facilities of the plant/enterprise;
- filtration of wastewater, following contamination at the plant, and then at municipal wastewater treatment plants and then discharged into water bodies;
- non-continuous treatment of water and institutional or industrial solutions at local treatment facilities according to the time specified by time, after which they are sent for regeneration, after regeneration are returned to circulation and only after the possibility of the possibility of non-regeneration is determined, they are averaged and transferred for processing for planting and utilization.

Biological methods are considered the main way to treat wastewater from the oxidation of organic impurities. They are based on biological oxidation, which allows to filter wastewater from various organic substances. These substances cannot be removed from wastewater mechanically. Biological oxidation is carried out with the help of a community of microorganisms (biocenosis), which includes many bacteria, protozoa and some highly organized organisms such as algae, fungi, etc. Rarely used for wastewater from machine-building enterprises [23].

Conclusions

Type of pollution affects the choice of method of wastewater treatment. Often combined methods are used to achieve the best result. The main methods of wastewater treatment: mechanical; biological; biochemical; chemical; physical-chemical.

Mechanical methods of wastewater treatment consist in removing insoluble and partially colloidal insoluble and partially colloidal impurities from the water. Waste contained in wastewater (paper, rags, bones, various industrial wastes, etc.).

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