

A Chemical Methods Use of Reduce the Effects of Heavy Water Toxicity on Human and the Environment

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Abstract

Our current specialized scientific study includes the process of using chemical methods to remove or treat pollutants in heavy water represented by sewage water that is produced from multiple sources such as that coming out of homes, and other water such as water resulting from industrial waste, or other water resulting from different sources. The chemical oxidation method was used through the establishment of oxidation ponds of different sizes with a depth of (50-150 cm), mechanical rotation, exposure to sunlight and oxygen in the atmosphere, followed by the activation of aerobic bacteria that decompose organic matter. The most important factors and basic ingredients that were adopted in the treatment methods are solar energy and water vapor condensation, agitation and movement of the mixture mechanically, exposure to air, decomposition of organic materials, chemical reactions that take place under fixed relative conditions.

Keywords: Heavy water toxicity, chemical methods, human and the environment-

Introduction

Many issues can be solved through scientific research, new discoveries, and creative ideas. One example is dealing with pollutants in water, especially those that come from sewage water from homes. Other types of water that contain pollutants include water from factories and other sources. As a result of water pollution, different physical, chemical, biological, and other techniques and methods have been needed to clean the water. Some types of pollutants will still be in sewage water after treatment with the old technologies that are used now don't work very well against them. These pollutants will then go back into the natural environment and reach water sources (1,2). From the moment they get into the

environment, they become a threat to human health and the security of the environment. Because toxins are spread out and don't stay in large amounts, getting rid of them in different ways is hard (5). There are other ways to treat heavy water besides chemical oxidation. This is because organic pollutants in heavy water can be removed after they break down without adding chemical oxidants (6). Additionally, photocatalysis has been shown to be effective at changing metal ions, objects, and metallic materials into less harmful kinds of materials. This makes it easier to separate them from the system and get rid of them in later steps of treatment (7, 8). Because of this, sunlight will play a big part in this area because it is important for the treatment process. There is also oxygen in the air naturally and evenly in the mixture because of the mechanical stirring. These two things—sunlight and oxygen—activate aerobic bacteria that then break down the organic materials in heavy water. Many studies have shown that sewage water has negative effects on more than just people and the environment. It often has bad effects on farms, crop production and quality, and the environment as well. But if you use the right watering techniques and follow the directions, you can get rid of these issues before you use the treatment we're talking about. Sometimes, agriculture needs a certain percentage and amount of wastewater, as long as it hasn't hit a certain level of poisoning in its parts. This means that wastewater is used again without being treated first, which is what happens in many countries around the world. Estimates and data from 2014 say that wastewater is used to water about twenty million hectares of land in fifty countries around the world. Recently, the demand for wastewater has hit 11% of all the water that is withdrawn in the world. This wastewater is likely to water about 40 million hectares of the world's irrigated land. So, some basic nutrients and organic materials have been given. In addition, water for watering has been made available, and the environment has been kept clean by cutting down on water pollution. Due to the importance of the topic, it is worth mentioning that it has been said that the soil and plants have enough nutrients like nitrogen, phosphorus, and potassium thanks to the beneficial use of wastewater. This is because using wastewater to water crops lowers the cost of production (9). The World Health Organization reports that millions of fatalities occur annually in rural regions worldwide due to the most lethal waterborne diseases, including cholera, typhoid, and hepatitis. The majority of these deaths occur in children under the age of five. Consequently, the management and monitoring of effluent pollution by experts in the field is the only way to prevent its toxicity from affecting humans and the environment, as well as to implement biological, physical, and chemical treatments. The creation of a pond to collect water, manage it, and control the treatment methods in sequential phases is one of the most critical methods and means used to treat sewage and reduce its toxicity on humans and the environment.

Experimental Part:

The efficiency and success of the ponds used in treatment depend on a number of factors, the most important of which are:

1- The intensity and amount of solar radiation to which heavy water is exposed during treatment:

It is thought that about 1.95 calories of solar energy reach every square centimeter of the Earth's surface every minute. This is equal to about 1392 watts per square meter and is known as the radiation constant. To find the total amount of solar energy that reaches the Earth's surface, use the following formula: -

$$\begin{aligned} \text{The total amount of solar energy reaching the Earth's surface} &= (1392) \text{ watts} \times I.R^2 \\ &= 10^{12} \times (177502) \text{ watts.} \end{aligned}$$

It is interesting to note that this much solar energy is used by natural processes on Earth's surface, like temperature change, water vapor condensation, rain, wind, water currents, chlorophyll metabolism, the breakdown of organic matter, tidal movement, the flow of hot groundwater, the formation of fossil fuels, and gravitational energy.

The amount of solar radiation that objects on Earth are exposed to occurs in three stages: the first begins at sunrise, where the rays are weak and not strong, and the path of the radiation is oblique and not perpendicular to the Earth. At noon, the rays are perpendicular to the Earth, and their effect in this case is greater than if it were at sunrise and sunset, which is similar to the effect of the rays when they are at sunset, as shown in **table no.1**.

Figure 1: Stages of the effect of sunlight on the Earth.

Daily Sun Profile	
Low Morning Sunlight Intensity	Sunrise
Noon Time Peak Sun Intensity	Sunrise = Sunset
Low Evening Sunlight Intensity	Sunset

2- Circulating water and ensuring that it is exposed to air in a homogeneous manner:

The continuous movement of sewage water in treatment tanks is very important as it helps to homogenize the component and ensure that all its parts are constantly exposed to ventilation, and subjected to the processes to which it is exposed and the sequential steps. The intensity of solar radiation and the length of its brightness on the surface of the earth vary according to the difference in the angle of incidence of solar rays on the surface of the earth, and to the difference in the length of the day throughout the year due to the difference in the position of the earth relative to the sun during the annual cycle of the earth around the sun.

3- Taking into account the evaporation rate, and ensuring the stability of the proportions of the components of the heavy water to be treated:

It is very important to set up basins of different sizes that work with the treatment mechanism and to make them in a way that lets you control their conditions and the activities that happen on them during the treatment. This is done to make sure that the automatic evaporation process works with the treatment processes that are being used. Therefore, the purpose of creating basins is to keep the heavy water that needs to be treated from leaking and polluting the ground. This would stop the water from moving to areas close to the earth's surface, where it would be affected by gravity and leak deeper into the crust. Making sure that the right amount of stored heavy water is treated is important for keeping it under control in case basins aren't available. The groundwater's direction, movement, and speed depend on the features of the water reservoirs deep inside the earth as well as the dense rock layers that make it hard for water to get through at certain distances. Water moves underground based on how permeable the rocks are (how easy it is for water to move through them) and how many holes and pores there are in them.

4- The appropriate method for disposing of wastewater:

It includes the following conditions:

- 1- Allowing anaerobic decomposition to occur in the oxidation ponds used in treatment.
- 2- Providing a sufficient and appropriate amount of oxygen gas. O₂
- 3- Removing sediments, the amount of which should decrease as the efficiency of mechanical treatment increases before entering the ponds prepared for oxidation.

5- Chemical reactions and treatment stage:

The chemical processes step is one of the most important parts of treating wastewater because they get rid of the harmful chemicals in the water and make it safer for people and the environment. As a last step, different amounts of chlorine are added to the basins to make sure that all the bacteria are gone.

It's also important to know that the main goal of the wastewater treatment and purification process is to get rid of the main pollutants in water, whether they are organic or inorganic, suspended or dissolved. This is done by removing them in a series of steps, such as breaking them down into other materials or harmless gases, and so on. Aside from the fact that getting rid of different living things that spread diseases and outbreaks is necessary, their presence is also a risk. Depending on the technology being used, these pollutants are taken out of wastewater using physical, chemical, and biological ways. To find out what kinds of organic matter are in wastewater, a few simple tests must be used during cleanup, the most important of which are:

- 1- Testing the requirements of the biological O₂ ratio B.O.D.
- 2- Testing the requirements of the chemical O₂ ratio C.O.D.
- 3- Testing the existing suspended materials T.S.S.

Discussion

The amount of sunshine that hits Earth can kill most of the harmful microbes that are in water. This includes bacteria, viruses, protozoa, and other germs that make water dirty. **Figure 1** shows how sunlight can get into the water and kill different kinds of pathogenic microbes that are harmful to people. These microbes are very dangerous and pollute the environment and make water poisonous in general (10, 11).

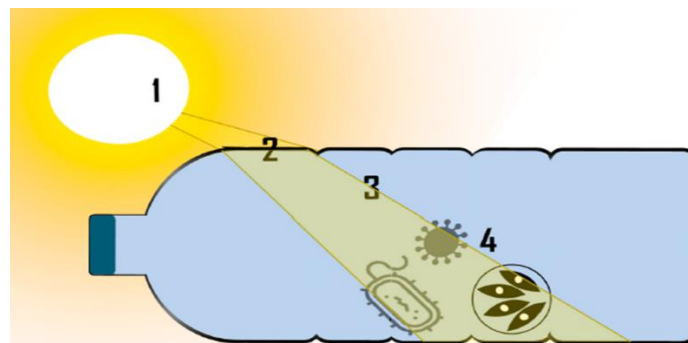
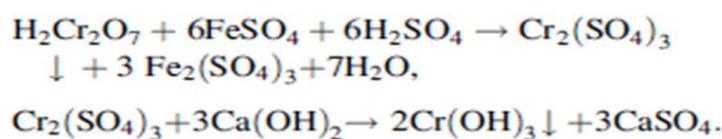


Figure 1: Shows the role of sunlight in killing pathogenic microbes in water, which is the main factor in biological poisoning of the water mass.

There are a lot of different kinds of green algae that live and reproduce in oxidation ponds. These algae benefit from the materials that are left over after organic matter breaks down completely, like carbon dioxide gas CO₂ and nitrogen, as well as phosphate. Since they are plants, they also make oxygen gas O₂ through a process called photosynthesis. Even though algae is good for you, it can be hard on aerobic decomposing bacteria if they multiply quickly and die off. This increases the amount of organic matter in the water that needs to be treated and studied, which also increases the amount of organic pollutants. Because of this, the amount of algae needs to be reduced in a number of ways, in addition to natural aeration ponds. These include oxidation and artificial aeration ponds, which are smaller, but they can be aerated by exposing them to air from inside the water or by using mechanical methods that move the water surface, which helps the water absorb oxygen O₂ from the air. Mixing the water in the pond evenly distributes oxygen O₂ and organic matter in all of its depths and parts. This process works to make creatures that are breaking down more active.

Semi-solid waste (slurry) is another thing that causes wastewater cleaning. This process is known as sewage sludge. This sludge needs to be treated more before it can be thrown away or put into the ground. That which is done to clean up wastewater is also known as wastewater treatment. The second term, on the other hand, is more general and covers more things. In most towns, the sewage system is mostly made up of industrial liquid waste that leaks into the wastewater treatment plant. To lessen the pollution, the waste is usually treated in the factories that make it. If the method for treating wastewater is a shared sewer network that relies on rainwater, which is common in cities, then a wastewater treatment system and plant needs to be set up. Either a network of lines or pumps can be used to move sewage to treatment plants.

It is important that the percentage of chlorine added doesn't go over the normal limit, though, because chlorine is a somewhat toxic chemical that makes the poisoning worse in wastewater and more complicated than it is in its natural state. Though, there is a normal process that comes before this one that gets rid of some heavy metals that might be in the trash (12), as is the treatment of chromium, which is shown in the following equation:



A significant portion of suspended materials in wastewater is eliminated through physical processes, whereas chemical processes facilitate the conversion of a substantial quantity of

dissolved substances into suspended materials via various chemical reactions, which can subsequently be precipitated and removed. The execution of biological processes results in the elimination of organic elements that are capable of decomposition when suspended or dissolved in water. Through these sequential processes, organic materials in wastewater can be effectively transformed into a collection of volatile gases that are readily precipitated. Furthermore, biological processes play a crucial role in the removal of nitrogen gas from contaminated water, as this gas is a significant toxic pollutant detrimental to both human health and the environment. It is important to note that these processes are subsequently followed by the treatment of the water. Volatile organic compounds (V.O.Cs) can be categorized primarily as solvents, with the most significant being toluene, styrene, benzene, trichloroethylene (T.C.E.), vinyl chloride, among others (13).

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