Original Article: Treatment of Industrial Wastewater by DAF Method

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ABSTRACT

The water consumed in life is somehow returned to the sources, but most of the water that is returned to its sources after an application is not the same as the primary water, but is a liquid that, in addition to the constituents of the consumed water, transmits all kinds. It is a substance that is used in human life. The most important substances in water consumed by humans include proteins, fats, carbohydrates, soap cleansers, or detergents. If the used water that is returned to its sources is the result of industrial activities, it will contain thousands of chemical compounds that are used in industry. In general, any change in the quality of water resources in the world will occur due to the discharge of sewage or effluent. So that we cannot use these resources in normal use or with little purification, it is called pollution. Therefore, the first result of human activities appears in the form of destruction and destruction of the living environment through the pollution of water-soil-air resources and all the things that are involved in his better life. Not only surface waters are exposed to pollution from human activities, but Also, discharge of sewage and sewage to the ground causes severe pollution of groundwater, including pollution of heavy metals such as lead. Groundwater is one of the most important biological resources.

Introduction

Over the last three decades, improving and expanding lifestyles and increasing population are the reasons for a waste generation as well as the increase in sewage [1-4]. In urban communities, wastewater may be collected and treated alone or mixed with industrial effluents. The expansion of industries in communities is directly related to the reduction of water quality [5]. Pollution from various industries in recent decades has led to serious environmental problems [6]. It is the most valuable foundation for conserving community management resources [7]. Sometimes, to avoid the problems of mixing the effluent and wastewater, it is recommended to perform preliminary treatment on the waste before mixing. every four hours, the samples taken can be tested one by one and based on the discharge of wastewater at the time of sampling and the volume of it. It is required for testing.

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A single sample was prepared from the mixture of samples taken and tested. The above explanation confirms that flow measurement will be necessary during the hourly sampling of wastewater.

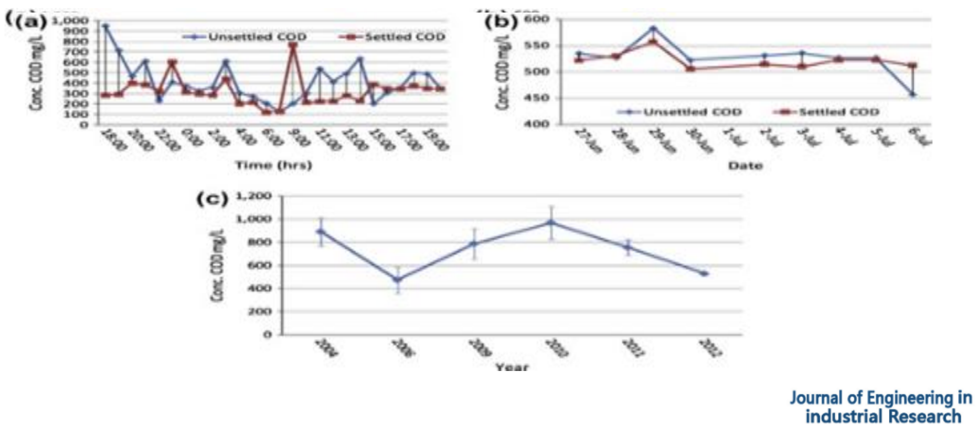

Figure1. Characterization of raw sewage and performance assessment of primary settling tank

The most important factors that are involved in determining the severity of wastewater or effluent pollution and their measurement in the laboratory will be extremely necessary. Determining the values of BOD (Biochemical Oxygen Demand), COD (Demand Oxygen Chemical), and (Permangnat Value) is because measuring BOD in laboratory treatment takes practically five days. So they show it to BOD5. Therefore, the general definition of BOD5 will be (Oxygen required for the oxidation of wastewater biologically) COD, which is defined as: (Oxygen required for the oxidation of wastewater chemicals).

A maximum of 2 hours is specified at a time. Therefore, laboratories prefer to use the curves that determine the ratio between COD and BOD to calculate BOD_5 instead of using the mentioned ratio after determining COD. BOD_5 per capita wastewater and suspended solids Per capita wastewater production depends entirely on the amount of water consumed, people's habits, social and religious conditions, and many other factors. Usually, according to climatic conditions, 80-65% of municipal water consumption is converted into sewage. In the United States, according to Anderson Farrel-Watson, for residential homes, taking into account the number of inhabitants per family of 5, depending on the social conditions, the per capita production of municipal wastewater is determined as follows. There are usually three types of sewage in communities as follows:

1. Municipal sewage which includes the following: Wastewater from personal hygiene issues Sewage from washing clothes and dishes Sewage from uncle's house washing;
2. Industrial effluents;
3. No water the odor of sewage, which is caused by the decomposition of organic matter under the activity of anaerobic bacteria with the gases in it, if it is fresh, it smells like soap scum or has a faint odor, and if it is old, it smells like rotten eggs. The alkalinity of wastewater is one of its important properties and qualities that often play an important role in its treatment. Usually, to know the quality of municipal wastewater, or industrial wastewater, it takes samples and performs the necessary tests on the samples taken. In sampling, which may be one or two hours per hour and finally one sample

Table 1. Classification of wastewater according to BOD_5, COD

Mg per liter of COD	Mg per liter of BOD5	Sewage intensity
Less than 400	Less than 200	weak
700	350	medium
1000	500	strong
More than 1500	More than 500	Very strong

Today, one of the reasons for environmental pollution is the presence of organic pollutants is stable [8-9]. The release of inorganic pollutants into the environment is a potential environmental hazard [10-11]. And harms human health [12]. Sanitary water supply is not only vital to human health but also environmental health, and the reduction and reuse of contaminants should be considered in the recovery and reuse of water, which is recognized by the United Nations as a development goal. It is placed stable [13]. Water resources are vital in providing livelihoods and meeting human needs [14]. Spontaneous treatment of water receiving pollution if sewage or effluent is discharged into water sources, the organic matter in it will enter the watercourses. Bacteria and living organisms in the environment begin to grow and multiply in the environment while using these substances in the presence of dissolved oxygen in the water. Some of the compounds that are so complex in sewage and effluent cannot be used by bacteria. In this case, their oxidized form will be consumed as food for bacteria. With this explanation, it can be seen that the disposal of wastewater in water sources, which is accompanied by a series of biochemical interactions, will cause the pollution entering the water sources to disappear over time and the polluted water will return to its original state after a while. The amazing phenomenon in which dissolved oxygen and bacterial activity are involved in a completely complex way is called spontaneous purification. Dissolved oxygen in water may not be sufficient for the oxidation of organic matter, in which case another type of oxidation will be performed using the combined oxygen of the compounds in the water or wastewater and effluent.

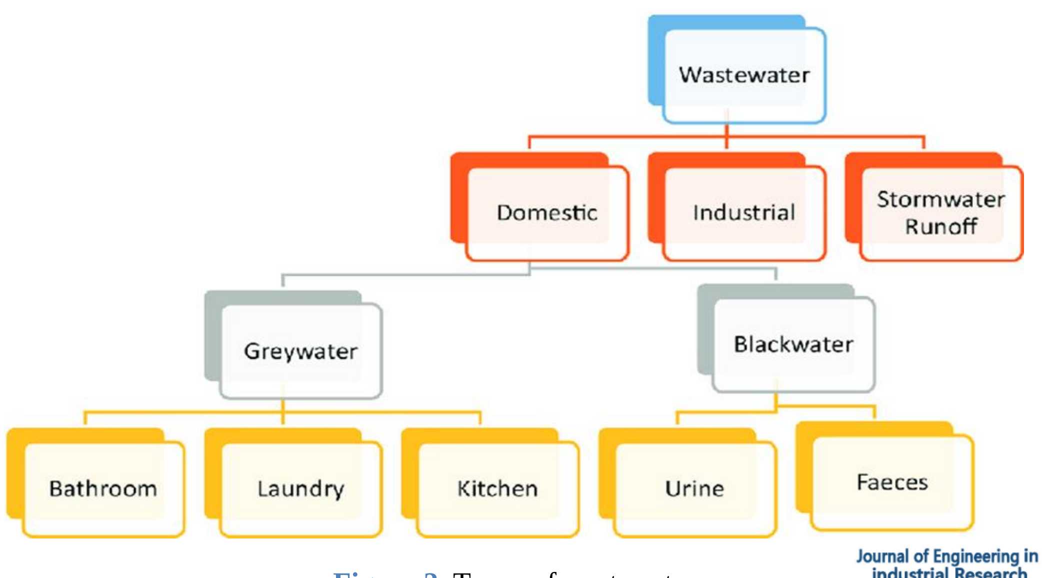

Figure 2. Types of wastewater

Oxidation of the first type is performed using dissolved oxygen. Aerobic decomposition and the second type of oxidation is called anaerobic decomposition. In summary, the figure shows that aerobic oxidation materials such as nitrates, phosphates are often odorless and in the final stage of oxidation, while the products produced in anaerobic decomposition such as hydrogen sulfide Phosphine, ammonia, and methane are all odor generators. In wastewater treatment, oxygen and air will be manually injected into the wastewater to prevent anaerobic decomposition. Some of the materials produced by anaerobic decomposition, such as hydrogen sulfide, are produced in sewage collection and transmission lines that have virtually no dissolved oxygen that can be used by bacteria, and because this body is acidic, it causes severe wall corrosion. The lack of oxygen in the solution of water streams during the day will be compensated by the activity of blue-green plants with the help of sunlight because these plants are exposed to sunlight while consuming carbon dioxide and forming chlorophyll, oxygen in They release aqueous medium, this phenomenon is called photosynthesis. Physical, chemical, and biological characteristics of wastewater In the ensuing discussion of the physical and biological components; Important pollutants in wastewater treatment, the methods of decomposition used to determine the characteristics of wastewater pollutants are briefly introduced. Biological treatment processes such as activated sludge can significantly reduce bacterial contamination [15]. Important pollutants in wastewater treatment Secondary wastewater treatment standards relate to the separation of biodegradable organic matter, suspended solids, and pathogens. Many of the more stringent standards that have been proposed recently relate to the separation of nutrients and contaminants. Wastewater recovery and reuse through physicochemical processes are often difficult and energetic [16]. Reuse of water resources must be done continuously [17]. One of the major problems of this century is water scarcity, with one-fifth of the world's population experiencing poor conditions due to water scarcity [18]. One of the factors of transfer and distribution of pollutants and pathogens is runoff from rainfall, which reduces the quality of surface water and causes the reuse of water. Another factor of water reuse is the lack of freshwater resources [19 and 13]. If the effluent is to be reused, the separation of refractory organic matter, heavy metals, and, in some cases, soluble inorganic solids will be among these standards. One of the successful applications of recycled water is in agriculture [20].

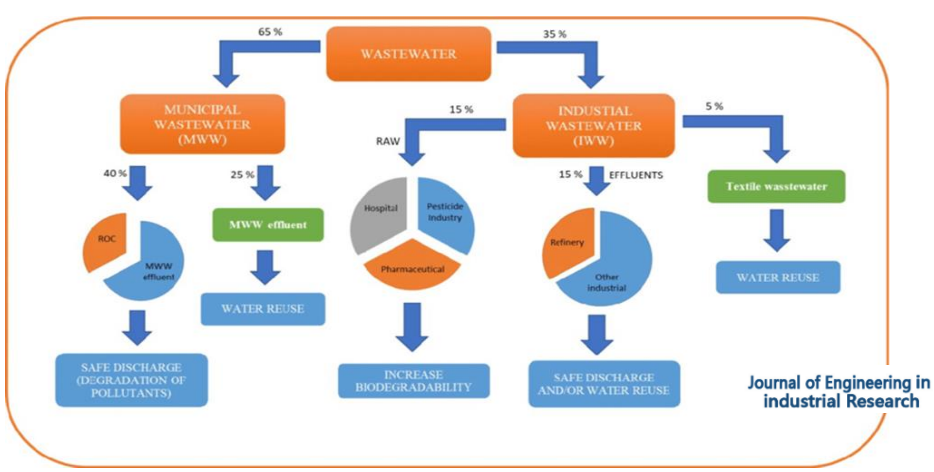

Figure 3. Schematic presentation of types of wastewater used for detoxification

Treatment Processes Chemical-biological treatment process is an evolving technology for the treatment of wastewater heavily contaminated with organic pollutants that are not done with biological treatment [21]. Decomposition methods the decomposition methods used to determine the characteristics of wastewater vary from precise quantitative chemical determination to biological and physical qualitative determination. Quantitative methods are either gravitational, or volumetric, or physical-chemical. In physicochemical methods, properties other than mass or volume are measured. Units for measuring physical and chemical parameters the results of the analysis of wastewater samples are expressed in terms of physical and chemical units of measurement. The amount of chemical parameters is usually expressed in terms of physical units in milligrams per liter (mg/l) or grams per cubic meter (3 mg/l). The concentration of trace elements is usually expressed in micrograms per liter. In dilute systems, these units can be replaced by parts per million (ppm), which is a mass-to-mass ratio. Dissolved gases, which are chemical components, are measured in mg/l or g/m^3. Wastewater treatment by-gases, such as carbon dioxide or methane (anaerobic decomposition), are measured in m^3, 3 l, or ft^3. Physical characteristics: definition and application the most important characteristics of wastewater are its total solid content, which includes floating materials, sediments, colloids, and materials. Total solids from the point of view of decomposition materials, the definition of total solids is all matter that remains in the form of wastewater evaporation at 103 to C1050. A material that has a high vapor pressure at this temperature. It is lost during evaporation and is not called solid. Soluble solids are substances that settle to the bottom of a conical container over a period of 60 minutes. Sedimentary solids, expressed in ml/l, are an approximate measure of the amount of sludge that separates during initial sedimentation. Total solids, or evaporation residues, can be broken down into filters and filters by passing a certain volume of liquid through a strainer. At this stage of separation, glass fiber filters (Watman GF/C) with holes of approximately 1 m^2/nominal size or polycarbonate membrane filters are often used.

It is noteworthy that the results obtained from glass fiber and polycarbonate filters with slabs of equal size are somewhat different from each other and this is due to the structure of the filter. The colloidal fraction consists of particles approximately 0.001 to m1 in size. Soluble solids include organic and inorganic molecules and ions that exist as real solutions in water.

The colloidal portion cannot be separated by sedimentation. To separate the particles from the suspension or flocculation is often necessary before deposition. Each group of solids can be reclassified based on their volatility in C500550. The organic part is oxidized and at this temperature, it is released as a gas and the inorganic part remains in the form of ash. Thus, the terms "volatile suspended solids" and "fixed suspended solids" refer to the organic and inorganic (or inorganic) content of suspended solids, respectively.

Figure 4. 30% of wastewater treatment equipment indigenized

Odor: The smell of municipal wastewater is usually caused by gases from organic matter or from additives to the wastewater. Fresh sewage has a distinct and somewhat unpleasant odor, and it smells less annoying than sewage that has been decomposed by non-oxygenated (oxygen-free) air. The most distinctive odor of residual or infectious wastewater is the odor of hydrogen sulfide, which is produced by anaerobic microorganisms that convert sulfate to sulfide. Sewage generally contains infectious bacteria and viruses that damage the human gastrointestinal tract [22]. Industrial wastewater may contain odorous compounds or other compounds that produce odors during the wastewater treatment process. The importance of odor in low concentrations for human beings is primarily related to the psychological stress that it causes in him and not to the harm that it causes to him. Unpleasant odors cause anorexia, low water intake, difficulty breathing, nausea and vomiting, and mental confusion. In very severe cases, these odors lead to a fall in personal and social pride, disrupt human relationships, hinder financial investment, lower the socio-economic level, and hinder growth. Becomes. These issues can lead to declining sales and rental values, tax revenues, and trade in the region. Odor detection: Stinky compounds that cause stress in humans are detected by their olfactory system, but the mechanism of this detection is not yet well understood. [23]

Table 2. Odorous compounds in untreated wastewater

Chemical formula	Fragrant composition
$CH_3NH_2,(CH_3)_3H$	Amen
NH_3	Ammonia
H_2S	Mercaptene hydrogen sulfide
$(CH_3)_2S,(C_6H_5)_2S$	Organic sulfide
C_9H_9N	Scott

Four main factors have been proposed for the complete determination of odor characteristics: Severity, Type, Pleasure. has taken. Odor can be measured by sensory methods and specific concentrations of odor can be measured by instrumental methods. Some have shown that under precisely controlled conditions, sensory measurement of odor with the human olfactory system provides meaningful and reliable information. Therefore, they often use a sensory method to measure odors emitted from wastewater treatment plants. Direct hydrogen sulfide reading device for detecting concentrations as low as 1 ppb is one of the important innovations in this field. Regarding the instrumental measurement of odors, it should be said that a diluted air odometer can be used to measure threshold odor concentrations. The equipment used for odor analysis is:

(1) Triangular dynamic bosoner;

(2) Butanol lamp, and

(3) Bostoner.

A triangular boson allows the operator to insert the sample with different concentrations into six different containers. Each container has two inlets of pure air and one inlet of diluted sample. Six dilution ratios are usually used, ranging from 4,500 to 15 times. High dilution ratios can be achieved by using a carbon diluent. All diluted samples of pure air are continuously introduced into the suction cups at a rate of about 500 ml/min. Each member of the group (usually six) smells each of the three inputs and selects the one that he or she thinks contains the sample. Butanol wheel is a device that measures the intensity of odor according to the scale of different concentrations of butanol. Dilution ratios are obtained from the ratio of odorous input to purified input. Bosnia is a very useful tool for determining odor in a large area around the treatment plant. They usually use a mobile odor laboratory for on-site testing, which is a vehicle in which several types of odor and decomposition equipment are installed.

It is usually necessary to know the specific compounds that produce the odor. Although gas painting has always been used successfully for this purpose, its application in identifying and measuring odors from wastewater collection, treatment, and disposal facilities has not been as successful. A three-stage (mass) spectrometer is a device that is made and useful for the chemical analysis of odors. This spectrometer can be used as a mass spectrum to obtain simple mass spectra or as a three-phase to obtain {molecular separation spectra by the molecular collision method.

In the first method, the masses are obtained from the molecular ions or mother ions in the samples, while in the second method, effective identification of the compounds is possible. The types of compounds that can be identified with this device are ammonia, amino acids, and volatile organic acids. [24]

Temperature: Due to the addition of hot water from industrial and domestic sources, the temperature of sewage is generally higher than the temperature of the city. Because the specific heat of water is much higher than air, the temperature of sewage is higher than the ambient temperature during most of the year, and only during the hottest days of summer, this temperature is lower than the ambient temperature.

Depending on the geographical location, the average annual sewage temperature varies from about C100 to C10 / 21 (F 500 to F700); the sample value above temperature is C60/15 (F 600). Water temperature is a very important parameter due to its effect on chemical reactions and the rate of reactions, water life, and determining the usability of water for beneficial uses. For example, rising temperatures may alter the species of fish in the wastewater receiving water. Inlet water temperature is of particular importance in industrial installations that use surface water for cooling. Besides.

Oxygen dissolves less in hot water than in cold water

An increase in the rate of biochemical reactions that occurs with increasing temperature, along with a decrease in the amount of oxygen present in surface water, usually causes a sharp drop in the concentration of dissolved oxygen during the summer months. Such effects are exacerbated when large amounts of hot water are discharged into the natural water receiving wastewater. It should also be borne in mind that a sudden temperature change may lead to an increase in the rate of mortality in aquatic life. Besides, abnormally high temperatures cause unwanted aquatic plants and wastewater algae to grow. Optimal temperatures for bacterial activity range from C250 to C350. When the temperature rises to 500 °C, aerobic decomposition, and salinization stop. If the temperature reaches about 150 °C, the methane-producing bacteria will be completely inactivated, and at about 50 °C, the self-cultivating dandruff bacteria will be virtually inactive. At C20, even the alchemical bacteria that act on carbonaceous materials are inactivated. Color In the past, the term "status" was used in conjunction with the terms compound and concentration to describe wastewater. Condition refers to the life of wastewater, the quality of which is determined by color and boost.

Fresh wastewater is usually light brownish-gray in color. However, with the increase of its movement time in the collection network and the creation of more anaerobic conditions, the color of the wastewater changes from gray to dark gray and finally to black, respectively. When the color of sewage turns black, it is called infectious, and some industrial sewage can also stain domestic sewage.

The rise of bacterial infections due to the consumption of contaminated water is a major threat to today's societies [25]. In some cases, the gray, dark gray and black color of wastewater is due to the formation of metal sulfides, which are formed by sulfides formed under anaerobic conditions with metals in wastewater.

Darkness Blurring, which is a measure of the light-transmitting properties of water, is another test used to determine the output quality of wastewater and natural water in terms of the amount of excess and key suspended matter. The measurement of opacity is based on a comparison between the intensity of light scattered by a sample with light scattered under the same conditions as a reference suspension. The key materials scatter or absorb the light and thus prevent its transmission.

In general, in untreated wastewater, there is no relationship between turbidity and the concentration of suspended solids. But in the secondary precipitated output of the activated sludge process, there is an understandable relationship between turbidity and suspended solids. Under normal conditions, activated sludge wastewater treatment is the most effective and safest method that meets wastewater monitoring standards and is the most effective biotechnology method in the world [26]. Chemical properties: definition and application the discussion of the chemical properties of wastewater is presented in four sections :

(1) Organic matter ;

(2) Measurement of organic content ;

(3) Inorganic matter and

(4) Gases.

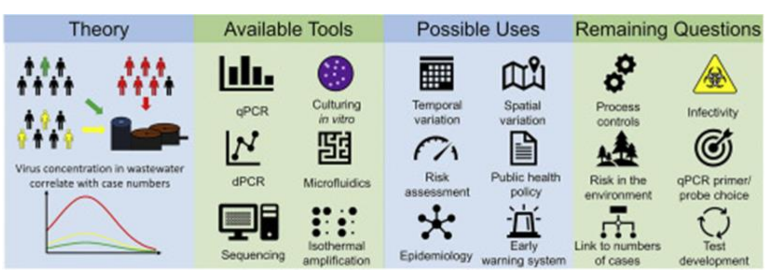

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Figure 5. Wastewater and public health: the potential of wastewater surveillance for monitoring

Organic content measurement, due to its importance in the design and operation of wastewater treatment plants and water quality control, is discussed separately. These solids come from both plant and animal domains and human activities in the synthesis of organic compounds. Organic compounds are usually a combination of carbon, hydrogen, and oxygen, and in some cases nitrogen. Other important elements such as sulfur, phosphorus, and iron may also be present. The main groups of organic matter in wastewater are protein (40 to 60%), carbohydrates (25 to 50%), and fat and oil (10%). Because urea decomposes rapidly, undecomposed urea is rarely found in non-fresh wastewater.

In addition to protein, carbohydrates, fats, oils, and urea, wastewater contains small amounts of a large number of different synthetic organic molecules with a simple to extremely complex structure. Exemplary examples discussed in this section include cleaners, first-class organic pollutants, volatile organic compounds, and agricultural toxins. Besides, the number of such compounds resulting in the formation of new organic molecules, each Year increases.

In recent years, the existence of this case has complicated the treatment of wastewater because many of these materials are either not bio-degraded or decompose very slowly. Proteins Proteins are major components of animal The amount of grease in the wastewater is determined by extracting it from the wastewater sample (in which the grease is soluble). Other extractable materials are mineral oils such as petroleum, softener oils, and bitumen. Fat and oil are compounds (esters) of alcohol or glycerol (glycerin) with fatty acids. Glycerides of fatty acids that are liquid at normal temperatures are called oils, and those that are solid are called fats. Fats and oils are chemically quite similar because they are composed of carbon, hydrogen, and oxygen in varying proportions. Fats are more stable than organic compounds and are not easily broken down by bacteria. But mineral acids attack them and result in the formation of glycerin and fatty acids. In the presence of alkalis, such as sodium hydroxide, free glycerin, and alkaline salts, fatty acids are formed. These alkaline salts are called soaps, which are as stable as fats.

Ordinary soaps are made by soaping fats with sodium hydroxide. These soaps dissolve in water, organisms and are less commonly found in plants. All raw plant and animal foods are high in protein. The amount of protein varies from low percentages in juicy fruits such as tomatoes and the fatty tissues of meat to relatively high percentages in beans or lean meats. The chemical structure of proteins is complex and unstable and decomposes in different ways.

Some of them are soluble in water and some are not. The chemistry of protein formation is the combination or binding of many amino acids. The molecular weight of proteins is very high, about twenty thousand to twenty million.

All proteins have carbon, the common element of all organic matter, hydrogen, and oxygen. Besides, proteins, as a distinguishing feature, contain a constant amount of nitrogen, about 16%. In many cases, they also contain sulfur, phosphorus, and iron. Urea and protein are the main sources of nitrogen in wastewater. If proteins are present in large quantities, their decomposition produces very unpleasant odors.

Carbohydrates are widely found in nature. They contain sugar, starch, cellulose, and wood fibers, all of which are present in wastewater. Carbohydrates contain carbon, hydrogen, and oxygen. Conventional carbohydrates have six atoms or a factor of six carbon atoms per molecule, and hydrogen and oxygen, in proportion to the amount of these elements present in water.

but in the presence of hard elements, sodium salts are converted to calcium and magnesium salts of fatty acids or so-called mineral soaps. These soaps are insoluble in water and precipitate.

Detergents: Detergents or surfactants are large organic molecules that are somewhat soluble in water and produce foam in wastewater treatment plants and surface water into which waste products enter. These materials often accumulate at the surface of air-to-water contact. During wastewater aeration, these compounds accumulate on the surface of the air bubbles, thus creating a very stable foam. Detection of detergents is performed by measuring color changes in a standard solution of methylene blue dye. Another name for this cleanser is methyl aqueous substance (MBAS).

Before 1965, the detergent in synthetic detergents, benzene crown sulfonate (ABS), was very troublesome due to its resistance to biodegradable molecular failure. As a result of legislation passed in 1985, ABS در in detergents has been replaced by biodegradable alkali sulfate (LAS), which is biodegradable. Overcoming antibiotic resistance is one of the biggest challenges in the 21st-century water purification process to protect global health [27 and 28]. Because cleaners are mainly made from synthetic detergents, the foam problem in sewage is greatly reduced. Some water resources such as rivers, seawater near the industrial center under the influence of pollution sources reduce water quality and have a detrimental effect on human health and the ecosystem [29]. Terrestrial substances such as nutrients, various pollutants, metals enter the seas as sediment [30]. The main cause of disturbance in surface waters is the overflow of non-source pollutants such as sewage, which leads to pathogens that require new monitoring of water quality using new treatment technologies [31].

First-degree pollutants**:** The Environmental Protection Agency has identified about 129 first-degree pollutants in 65 categories that must follow strict waste disposal standards. First-degree pollutants (both organic and inorganic) are based on their known or suspected effects on cancer. Maternity, mutagenicity, fetal harm, or extreme toxicity. Many first-class organic pollutants are also classified as volatile organic compounds (VOCs). In any wastewater collection and treatment system, first-degree pollutants can be separated, deformed, produced, or simply transported through the system without modification. There are five basic mechanisms here:

- Sublimation (or gas excretion);
- Decomposition;
- Adsorption to particles and sludge;
- Crossing (crossing the entire sewage system);
- Production as a result of chlorination or as a by-product of the decomposition of our compounds before it. Another important point is that mechanisms are not a barrier to aggregation, because competition and simultaneous action can also be significant.

Volatile Organic Compounds (VOCs) Organic compounds whose boiling point is equal to or less than 1000 C or whose vapor pressure is greater than 1 mmHg at 250 C are generally called volatile organic compounds, such as vinyl chloride with a boiling point of 13.90 C and a vapor pressure. It is 2548 mmHg at 200 C. An example of a highly volatile organic compound. Volatile organic compounds are very important because:

(1) If such compounds are in the vapor state, they become much more stimulating and therefore more likely to be released into the environment;

(2) The presence of some of these compounds in the atmosphere may pose a significant risk to human health;

(3) The presence of these substances contributes to the general increase in reactive hydrocarbons in the atmosphere, which may lead to the formation of oxidants.

The release of these compounds in sewage networks and treatment plants, especially in the main facilities, is of special importance for the health of workers in treatment plants and wastewater collection networks. The largest consumers of energy are wastewater treatment plants [32].

Agricultural pesticides and chemicals rare organic compounds such as pesticides, herbicides, and other agricultural chemicals are toxic to most forms of life and can therefore be important contaminants in surface water. These chemicals are not usually found in domestic wastewater but are mainly derived from surface runoff from farmland and parks. If the concentration of these chemicals is high, it will lead to the killing of fish, contamination of fish meat, which reduces their nutritional value, and damage to water sources. Many of these chemicals are also classified as primary pollutants.

One of the main challenges in evaluating the quality of water resources analysis is increasing the number of chemical contaminants in drinking water [33]. Organic content measurement over the years, various tests have been designed to determine the organic amount of wastewater. There are thousands of chemicals in consumer products whose nature has not yet been studied [34]. Every year, many pollutants with high toxicity indexes are recognized in environmental systems, so treatment processes need to evolve [35].

Designing effective programs for environmental management requires valid scientific knowledge

[36]. The use of advanced water treatment technology is commonly used for highly polluted water sources [37].

In general, these tests can be divided into two categories: one that is used to measure high concentrations of organic matter above 1 mg/l and the second that tests that are used to measure low concentrations Materials are used in the range of 10-12 mg/l to 10-3 mg/l. Common laboratory methods today for measuring large amounts of organic matter in wastewater (greater than 1 mg/ l) include:

- Biochemical oxygen demand (BOD);
- Chemical oxygen demand (COD) and
- Total organic carbon (TOC).

Complementing these laboratory tests is the Theoretical Oxygen Requirement Test, which is determined based on the chemical formula of the organic matter. Other common methods in the past include:
(1) Total nitrogen, organic and ammonia, and;
(2) Oxygen consumed. Rare organic matter in the range of 10-12 mg/l to 3-10 mg/l is determined using instrumental methods such as gas staining and mass spectrometry. Pesticide concentrations are usually measured by carbon-chloroform extraction, which involves separating contaminants from water by passing a water sample through an activated carbon column and then extracting the contaminant from carbon using chloroform.

Chloroform can then be evaporated to give the weight of the contaminants

Pesticides and herbicides with ppb concentrations (parts per billion) or less can be accurately measured using several methods, such as gas dyeing and electron absorption or cologne detectors Need for biochemical oxygen. The most widely used organic pollution parameter for both wastewater and surface water is the five-day BOD method (BOD_5). This method is the measurement of dissolved oxygen consumed by microorganisms in the biochemical oxidation of organic matter. Despite the general use of the BOD test, this method also has limitations. BOD test results are used today for the following:

- Determining the approximate amount of oxygen needed to biomass material in wastewater,
- Determining the size of a wastewater treatment plant,
- Measuring partial efficiency from treatment processes and
- Determining the level of compliance with standards and permissible limits of wastewater disposal BOD test limitations of the BOD test are as follows:
    - ✓ A large amount of active and adapted bacterial eggs is required;
    - ✓ If we dealing with toxic wastewater, we need pre-treatment and we must reduce the effects of nitrate-producing organisms;
    - ✓ Only biodegradable organic matter is measured;
    - ✓ This test has no stoichiometric validity after consuming the soluble organic matter in the solution;
    - ✓ It takes a long time and indefinitely to obtain test results.

Perhaps the most important limitation is that the five-day period sometimes matches the point at which the available soluble material is consumed and sometimes does not. Lack of stoichiometric validity in all cases reduces the usefulness of the test results. The need for chemical oxygen The COD test is used to measure the organic content of wastewater and natural waters.
The oxygen equivalence of organic matter that can be oxidized is measured using an oxidizing agent from a strong chemical oxidizing agent in an acidic medium. Potassium dichromate is excellent for this purpose. This test should be performed at a high temperature.
Catalysts (silver sulfate) are required to help oxidize certain groups of organic compounds. Because some inorganic compounds interfere with this test, care must be taken to eliminate such compounds. The COD test is used to measure organic matter in industrial wastewater as well as in domestic wastewater, which contains toxic compounds for biological life. In general, the COD of wastewater is higher than that of BOD because more compounds are oxidized chemically than biologically.
All organic carbon: Another method of measuring organic matter in water is the TOC test, which can be performed especially at low concentrations of organic matter. This test is performed by injecting a certain amount of sample into a high-temperature furnace or

chemical oxidizing medium. Organic carbon is converted to carbon dioxide in the presence of a catalyst. The carbon dioxide produced is quantified by an infrared analyzer. Acidification and aeration of the sample before decomposition eliminate errors due to the presence of inorganic carbon. If we know that volatile organic compound (VOC) is also present in the sample, then we omit the aeration step to prevent their separation by excretion.

This test can be done very quickly and this direction has become very common. However, some resistant organic compounds cannot be oxidized and the amount of TOC measured is slightly less than the actual amount in the sample.

Inorganic matter several inorganic components of wastewater and natural water are important in stabilizing and controlling water quality. The concentration of inorganic matter in water increases due to contact with geological structures and also as a result of discharge of treated and untreated wastewater into it. Natural water dissolves some of the rocks and minerals that come in contact with them. Except for some industrial wastewaters, wastewaters are rarely treated with inorganic components, which enter the water intake cycle.

The concentration of inorganic matter in water is also increased by the process of natural evaporation, which removes part of the surface water and places the inorganic matter in it. Since different inorganic components can greatly affect the beneficial uses of water, it is worthwhile to examine the nature of some of these components, especially those that enter surface water through the consumption cycle. PH of hydrogen ion concentration is an important qualitative parameter in natural waters and wastewater. The range of suitable concentrations for the survival of a major part of biological life is quite limited and critical. Biological treatment of wastewater with undesirable hydrogen ion concentrations is difficult; and if this concentration does not change before discharging into the water, the effluent may change the concentration of hydrogen ions in natural water. [38]

Chloride Qualitative parameter is another important chloride concentration

The source of chloride in natural waters is the sale of rocks and soils containing chloride with which water comes into contact, and in coastal areas, the source is the infiltration of saline water. Decreased freshwater availability is a threatening factor. A large part of the world's fresh water is used for agricultural purposes [39 and 40]. Besides, industrial and agricultural domestic wastewater discharged into surface water is a source of chloride. For example, about six grams of chloride is found in the feces of every human being daily.

In areas where water hardness is high, household hardeners also add large amounts of chloride to wastewater. Because traditional wastewater treatment methods do not remove much chloride from water, higher than usual chloride concentrations may indicate that water is being used to dispose of wastewater. Infiltration of groundwater into wastewater networks adjacent to saline water is also a potential source of increased chloride and sulfate content.

Alkaline grade: Alkalinity of wastewater is due to the presence of hydroxides, carbonates, and bicarbonates of elements such as calcium, magnesium, sodium, potassium, or ammonia. Among these, calcium bicarbonate and magnesium are the most abundant.

Borates, silicates, phosphates, and similar compounds also add to the alkalinity of wastewater. The alkalinity of the effluent helps to resist pH changes as a result of the addition of acid. Sewage is usually alkaline and derives its alkali from water sources, groundwater, and materials added to it for domestic consumption. The degree of alkalinity is determined by titration against a standard acid and its results are expressed in terms of calcium carbonate, $CaCO3$.

Nitrogen: Nitrogen and phosphorus are essential for the growth of protozoa and plants, and are therefore known as vital nutrients or stimulants. Very small amounts of other elements, such as iron, are also necessary for biological growth, but mostly nitrogen and phosphorus are important nutrients. Because nitrogen is the major building block of protein synthesis, nitrogen data are needed to assess the treatability of wastewater by biological processes. If nitrogen is insufficient, it should be added to the wastewater to treat the wastewater. Phosphorus is also needed for the growth of algae and other biological organisms. Due to the dangerous growth of algae in surface water, much attention is now being paid to controlling the number of phosphorus compounds that enter surface water through the disposal of industrial and domestic wastewater and natural runoff. Runoff contains significant amounts of pollutants as it passes [41].

For example, municipal wastewater can have between 4 and 15 mg/l of phosphorus as P. The amount of orthophosphate can be determined by the direct addition of a substance such as ammonium, which forms a color compound with phosphate. Before determining the number of polyphosphates and organic phosphates by the above method, they should be converted to orthophosphate using the acid decomposition step. Gases commonly found in untreated wastewater include nitrogen (N_2), oxygen (O_2), carbon dioxide (CO_2), hydrogen sulfide (H_2S), ammonia (NH_3), and methane (CH_4). The first three gases are general atmospheric gases and are found in all water exposed to the air. The last three gases are derived from the decomposition of organic matter in wastewater. Other gases that, although not present in untreated wastewater should be familiar with by the environmental engineer are chlorine (CI_2) and ozone (O_3) (for disinfection and odor control), and sulfur and nitrogen oxides (for processes). Invention) Soluble oxygen Dissolved oxygen is required for the respiration of aerobic microorganisms as well as for other forms of aerobic life. But oxygen dissolves only slightly in water. The actual amount of oxygen (and other gases) that can exist in solution is affected by:

(1) The solubility of the gases,

(2) The partial pressure of the gas in the atmosphere,

(3) The temperature, and

(4) The purity.

Water: As the rate of biochemical reactions that consume oxygen increases with increasing temperature, soluble oxygen levels are often more critical and important in the summer months. This is especially true in summer because water flows are usually lower and thus the total amount of oxygen available is lower. The presence of dissolved oxygen in the wastewater is necessary to prevent the formation of odors.

Hydrogen sulfide as mentioned earlier, hydrogen sulfide is formed as a result of anaerobic decomposition of sulfurous organic matter or reduction of mineral sulfites. This gas is not formed in the presence of large amounts of oxygen. It is a colorless, flammable gas with a characteristic odor of rotten eggs. The blackening of sewage and sludge is usually the result of the formation of hydrogen sulfide, which combines with existing iron to form iron sulfide. Other metal sulfides are also formed. Although hydrogen sulfide is the most important odor gas, other volatile compounds such mercaptans, which can be formed in anaerobic decomposition, also produce much more annoying odors than the odor of hydrogen sulfide.

Methane: The main by-product of the anaerobic decomposition of organic matter in wastewater is methane gas. Methane gas is colorless and odorless and flammable hydrocarbons have a high fuel value. Large amounts are generally not found in untreated wastewater because even small amounts of oxygen are often toxic to methane-producing organisms. But sometimes methane is produced as a result of anaerobic spoilage in deep wastewater sediments. Because methane is highly flammable and has a high risk of explosion, places, where gas can accumulate, should be ventilated before and during work, such as manholes and junctions, or junctions with soluble fans.

In treatment plants, methane is obtained from the anaerobic process and is used to stabilize sewage sludge. Explosion warning signs must be installed in such refineries, and their staff must be trained in safety measures in areas where gas may be present.

Comprehensive water pollution is a serious risk [42]. Impact on running water all industrial wastewater affects the natural life of running water in some way. Runoff generally occurs a few minutes before rainfall [43]. When this effect is so great that running water can no longer be used for its "best use," contamination is said to have occurred. The best application is exactly what it means to use water for drinking, watering, fishing, and the like. Running water can decompose a certain amount of wastewater before it reaches the contamination stage.

In general, larger, faster, and more distant running water, which is not used much, can tolerate significant amounts of wastewater, but in any case, the absorption of large amounts of any type of contaminant is a nuisance. Therefore, it is disturbing when absorbing large amounts of any type of contaminant. [44]

Therefore, when we can consider running water contaminated if there is a very large amount of a certain type or types of contaminants in it. Mineral salts, which are found in many industrial wastewaters and are found spontaneously in nature, cause "hardness" of water and make running water unfavorable for industrial, urban, and agricultural use. High-salt water in the pipes of the municipal water distribution network causes a mass deposit that resists the flow of water, and this action reduces the overall capacity of the pipes.

Hard water disturbs the dyeing process in the textile and fermentation industries and the brewing industries, as well as in the quality of the product in the canning industries. Magnesium sulfate, which is one of the unsuitable compounds of hard water, has laxative effects on people. Chloride ions increase the electrical conductivity of insulating paper; Iron causes colored stains on white products of textile mills and high-quality papermaking papers, and carbonates make a hard mass on canned peas. Most types of hard water disrupt heat transfer from the furnace to the boiler due to sediment in the boiler tubes.

This condition, called "boiler clogging", reduces the efficiency of the boiler and increases operating costs. Other disadvantages of saltwater are the presence of minerals, especially nitrogen and phosphorus. Under suitable conditions, the growing environment of algae plants (algae) in surface water increases. Although algae are a form of secondary contamination, their presence can be very important. Algae are important in adding dissolved oxygen to running water, but their disadvantage is the increase in organic load after death.

Industrial wastewater engineers have paid very little attention to this type of industrial wastewater mineral products. The role of phosphorus is different and complex, but it has been found that in the absence of phosphorus, the life of algae is destroyed. Acids or alkalis that are disposed of through chemical plants and other industries make running water unsuitable not only for recreational purposes such as swimming and boating. It also makes it impossible to breed fish and other aquatic organisms. High concentrations of sulfuric acid have been reported to cause itching and itching in swimmers' eyes, rapid corrosion of vessels, and premature failure of fishing nets, in the absence of free chlorine.

The toxicity of sulfuric acid to aquatic life is a function of pH

That is, the amount of sulfuric acid that can be lethal in light water may be completely harmless in hard or slightly alkaline water. The acceptable pH of running water for the survival of fish should not be less than 5 and 4.

However, the pH of running water around contaminated industrial sources may rise from a low of 2 to a high of 11. Sodium hydroxide, an example of alkali, is highly soluble in water and affects alkalinity and pH. Put. Sodium hydroxide is found in wastewater from many industries such as soap making, textiles, and dyeing, rubber recovery, and tanning. Sodium hydroxide has even been reported to be lethal to fish at 25 parts per million. Alkali in boiler water consumption due to alkaline activity can cause brittle pipes. Water treatment plants are also vulnerable to these contaminants; For example, in refineries that use white alum as a coagulant, excess loads of acid or alkali can often form clots.

Organic matter consumes oxygen sources in rivers and causes unpleasant taste, unpleasant odor, and stench. Suspended solids settle to the bottom of the bed or, after accumulating on the shores and shores, decompose, reducing oxygen and creating odors in river water. Solid and liquid floating materials include fats, oils, and other substances that float on the surface. Not only do they make the river look bad, but they also block the passage of light into the water and slow down the growth of the plants' vital food. Some specific problems with oils in running water are:

- Disruption of natural recreation;
- Toxicity to species of fish and aquatic animals;
- Create a fire hazard if the amount of oil and fat on the water surface is sufficient;
- Destruction of coastal vegetation and subsequent erosion;
- Unusable water for boilers and coolers;
- Production of defects in common water treatment processes due to giving taste and smell to water and covering sand filters with a sticky and hard coating;
- Creating bad scenic cover on the water surface;
- Reducing potential recreational uses such as boating. Hot water. Rising water temperatures, which are caused by the discharge of wastewater such as slow-

moving water into the river, have various detrimental effects. Flowing water that has different temperatures during different office hours creates problems in the processes of urban and industrial water treatment plants, and hot running water is less valuable for cooling industries. The industry may raise the temperature of the running water so much that its neighboring industrial unit downstream cannot use that water. Moreover, hot water is lighter than cold water, so the stratification of water expands, and this causes fish to take refuge in the riverbed to live, and because hot water has less dissolved oxygen than cold water.

Aquatic life is endangered; less oxygen is also available for the natural biodegradation of organic pollutants discharged into warm surface waters. The bacterial activity also increases to a higher degree, leading to rapid depletion of running water of oxygen sources.

Dye is an indicator of pollution produced by industries such as textiles, paper mills, tanning, slaughterhouses, and other industries. Compounds in wastewater absorb certain wavelengths of light and reflect residuals, a fact that is generally accepted as the cause of color in running water. The dye interferes with the passage of sunlight into the water, so less photosynthesis takes place. The dye may also interfere with the absorption of oxygen from the atmosphere, although there is no positive reason for this. Toxic chemicals, both organic and inorganic chemicals, may be toxic to freshwater fish and other smaller aquatic organisms, even in very low concentrations.

Many of these compounds are untreated in city water treatment plants and have cumulative effects on biological systems. Almost all salts, even in low concentrations, are toxic to a variety of aquatic life. For example, chlorides at concentrations of 400 parts per million are just as toxic to freshwater fish as hexavalent cream compounds at concentrations of about 5 parts per million. Copper is toxic concentrations between 0.1 and 0.5 parts per million is toxic to bacteria and other microorganisms. All three salts are often found in aquifers. Magnificent organisms sometimes have bacteria in the sewage of a small number of industries, such as tanneries and slaughterhouses. Canned vegetables and fruits also sometimes add bacterial contamination to running water. These bacteria have two distinct types:

- Bacteria that participate in the decomposition of organic matter during the movement of wastewater into the effluent. This process may act as "seeding" in running water (intentional inoculation of microscopic organisms to decompose organic matter) and accelerate the occurrence of hypoxia in the water.
- Pathogenic bacteria that are pathogenic not only to other bacteria but also to humans. An example is anthrax bacillus that originates from the tanning sites of the skin of animals with anthrax. Pathogens in sewage can cause serious problems for human health and the environment and are a public health concern [45]. Major environmental problems can be solved with the participation and cooperation of millions, and in this, the political and social aspects play an important role [46]. In some cases, water quality problems are due to climate change [47].

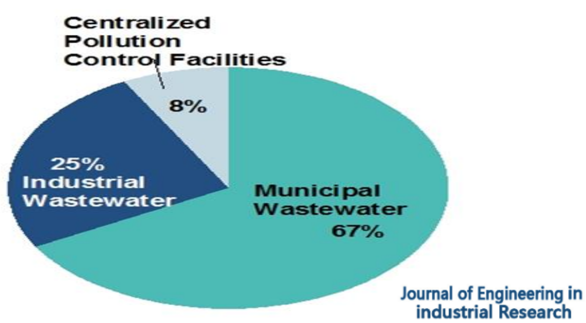

Figure 6. China's 13th Five Year Plan & the Wastewater Treatment Industry

Radioactive materials, the production of fissile nuclear material, the increase in the use of nuclear energy in peacetime, and the proposed development of nuclear power plants have created new complex problems in the field of health engineering. Because the effects of radiation can be immediate or delayed, radiation is a surprising contaminant with cumulative destructive effects on living cells. Some very active radioisotopes, such as strontium and cesium, release energy over long periods (several generations of humans). This radiation cannot be easily measured with conventional methods used to measure environmental pollution, and the biological and hydrological properties of running water may have a significant effect on the absorption of radioactive materials. At present, according to the standard of the Atomic Energy Commission, the maximum risk-free concentration of atomic fission products for a life cycle is 1 x 10 micro-curium per milliliter. Therefore, standard and controlling organizations, like the general public, are interested and concerned about preventing the contamination of surface running water by radioactive wastewater. Subsoil enters the environment from factories such as textile, pulp, and chemical pulp and gives an unfavorable view to the receiving water. Foam is one of the indicators of pollution and usually more than lack of oxygen in protesting waters. The number of industrial effluents that will reach the treatment plant in each period of the project along with municipal wastewater through networks and transmission lines, will be based on industrial developments during the project period. The number of industrial effluents, which is approximately equivalent to the per capita water consumption in each industry. Sewage technologies are high-efficiency, low-consumption technologies that require less capital [48-53]. Global water stresses have increased interest in advanced treatment systems [54-56]. New science and engineering are active in inventing new technologies that support water quality and public health [57]. Appropriate wastewater treatment approaches can potentially benefit from the design and optimization of treatment processes [55-58].

Table 3. Properties and solubility of air

Temperature		Volume solubility		Weight solubility		Density	
^0c	^0f	Ml/l	ft^3 / Thousand gal	Mg/l	Lb/thousand gal	G/l	Lb/ft^3
0	32	28.8	3.86	37.2	0.311	1.293	0.0808
10	50	23.5	3.15	29.3	0.245	1.249	0.0779
20	68	20.1	2.70	24.3	0.203	1.206	0.0752
30	86	17.9	2.40	20.9	0.175	1.166	0.0727
40	104	16.4	2.20	18.5	0.155	1.130	0.0704
50	122	15.6	2.09	17.0	0.142	1.093	0.0682
60	140	15.0	2.01	15.9	0.133	1.061	0.0662
70	158	14.9	2.00	15.3	0.128	1.030	0.0643
80	176	15.0	2.01	15.0	0.125	1.000	0.0625
100	212	15.9	2.13	15.0	0.125	0.974	0.0607

Conclusion

Groundwater penetrates through the connections of collection networks and sewage transmission lines to the treatment plant. Lack of resources has raised concerns among countries and industries and it is a vital problem in arid regions and limits agriculture and sustainable development. According to the results, the time of water shortage forecast for water shortage prevention programs have been increased to more than a few months. It is said that water deficiencies are usually calculated in two ways:

- The amount of water supply may be calculated according to the length of the network and sewage collection lines; in which case the length of the domestic sewerage network will not be used in these calculations.
- Failure of water may be calculated according to the rate of infiltration per hectare of the surface whose wastewater is collected by the network. It should be noted that the wider the wastewater collection and transfer network, the more water will not be available due to the presence of more connection points. Soil quality, groundwater level, land topography, population density are some of the factors that are involved in the amount of water leakage. In the UK, 30 to 40 liters of water per person per day is considered. In the United States, the amount of water is 0.94 cubic meters per day for every millimeter of pipe diameter per kilometer. In some parts of the world, water is calculated as 10 to 12 percent of the average daily volume of wastewater or a mixture of wastewater and effluent. In the old and old networks, the figures of 35 to 135 cubic meters per kilometer per day can also be the basis of unaccounted for water. It is related to land or water currents. The use and efficiency of water is a difficult process to increase environmental benefits in arid and semi-arid regions. Instead of discharging treated sewage and industrial effluents into land and rivers, it may be used in the irrigation of plants and agriculture in general. River streams are a source of water for drought. Irrigation systems need to be distributed for urban, industrial, and agricultural uses. Reuse of wastewater is a form of optimal use of water. Recent research is aimed at human awareness of energy saving, especially renewable energy.

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