



Assessment of Sewage Water Quality in Selected Areas of Kotri for the Use of Irrigation Purpose

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Citation | Abro, A. F., M, Laghari., Mangio, H. R., Talpur, M. A., Siyal, A.A., Depar, N. "Assessment of Sewage Water Quality in Selected Areas of Kotri for the Use of Irrigation Purpose", IJASD, Vol. 07, Issue. 04 pp 531-549, October 2025

Received | September 16, 2025 **Revised** | September 22, 2025 **Accepted** | September 28, 2025 **Published** | October 03, 2025.

The effectiveness of irrigation is significantly affected by the quality of sewage water. The objective of this current learning was to evaluate the state of sewage water in the Taluka Kotri, chosen for irrigation. Sewage water tests were collected from the orientation point, the people of Gorkhani, taking the appropriate precautions. This exhibition was carried out in the Laboratory of the Department of Energy and Environment of the University of Agriculture of Sindh, Tandojam, Sindh, Pakistan, to investigate the characteristics of sewage water so that it can be confirmed for use in irrigation. The selection parameters considered were TDS (Total Dissolved Solids), SAR (Sodium Adsorption Ratio), RSC Sodium Residual Carbonate, pH (Hydrogen power), Cl-(Chloride), As (Arsenic), B (Boron), and Zn (Zinc). Physicochemical parameters are measured to determine the problem of sewage water quality. It is seen that sewage water was highly contaminated when used for irrigation for agriculture.

The study results were compared to the standard of IWQCS (Irrigation Water Quality Criteria Standards). In this area of amendment, sewage water facilities were considered dangerous and inappropriate for irrigation. When the sample was collected from the Gorakhani village, Kotri, the situation was very poor, in which high TDS, RSC, SAR, and Cl- were found. According to health data and IWQCS (Irrigation Water Quality Criteria Standards), irrigation can cause serious health diseases such as diarrhea, abdominal pain, typhoid, and other diseases. This sewer water requires adequate treatment for irrigation use for agricultural purposes. The study result was compared to the standard of IWQCS (Irrigation Water Quality Criteria Standards). The sewage water function in this review region was considered dangerous and inadequate for irrigation. When the sample of the Gorkhani people, Kotri, was collected, the situation was very poor, in which high TDS, RSC, SAR, Cl- were found. According to health and IWQCS (Irrigation Water Quality Criteria Standards) data, irrigation can cause serious health diseases such as diarrhea, abdominal pain, stomach problems, typhoid, and other diseases. This sewage water needs adequate treatment to be used in irrigation for agricultural purposes.

Keywords. Sewage irrigation, water quality assessment, heavy metals, microbial safety, sustainable reuse.

Introduction.

Water, a vital natural resource that maintains life on earth, is both a blessing and one of the fundamental components of the environment. Fresh water represents only 2.5% of the total water resources of the Earth. Of this small fraction, almost 77% is enclosed in glaciers, approximately 22% is under the ground as underground water, 0.33% is contained in lakes,

around 0.18% exists as soil moisture, and only 0.03% is in the atmosphere. Water is considered to represent up to 70% of the average human body weight and approximately 50-97% of plants and animals. Unfortunately, water is among the most poorly managed resources on the planet. In numerous parts of the world, groundwater levels decrease rapidly, creating uncertainty about their ability to meet the growing demands of agriculture and industry in the coming years. According to estimates, agriculture consumes most groundwater, while agriculture uses 80% of real water resources for irrigation. In urban and peri-urban areas, many farmers are forced to use sewage water for crop irrigation due to the absence of better alternatives [1]. Around sewage water treatment facilities, sewage water is used as a potential irrigation source to grow vegetables and feed crops. Unpredictable sewage water contains a high concentration of organic and inorganic nutrients that can be used for irrigation. Sewage culture, a common practice in many urban areas where industrial sewage water is used for irrigation, often contains high concentrations of dangerous metals. As a result, depending on the type of industrial sewage issued, the composition of national sewage water can vary. In the peri-urban neighborhoods of the main cities, numerous small and medium-sized companies discharge hazardous waste directly into the sewerage system. As water and nutrients are the two most critical supplies in agriculture, optimization of sewage water and its nutritional potential is vital to improve food production, fodder, and fuel. Even conservative calculations based on the assumption that it is the accessibility of 70% of sewage water in large cities show that these effluents can water (7.5 cm) around 21,000 hectares of land every day, or 7.8 million ha per year. Studies have shown that direct discharge of effluents to the bodies of the earth and water has the potential to contaminate the air, surface and underground water, as well as the soils and crops cultivated in these soils, which will have an effect on human health [2].

Sewage water introduces TDS (Total Dissolved Solids), EC (Electrical Conductivity), SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate), pH, Cl^- Chloride, As (Arsenic), B (Boron) and Zn (Zinc), which suggests its potential use as a low cost fertilizer of low cost of low cost of low cost of low cost. By partially replacing chemical fertilizers, it can also contribute to a significant cost reduction.

[3] Compared to established safety thresholds, it was found that heavy metal concentrations such as Cu, Pb, and CO₂ in plant tissues were low, well below hazardous levels. Continuous irrigation with sewage water has a significant impact on the increase in exchangeable cations. The soil acts as a biofilm, capable of eliminating a significant portion of national sewage water pollutants. However, this process also increases the levels of Mg, SAR, EC, Na, and Ca of the ground. Sewerage water also includes high levels of hazardous elements, which accumulate on the ground and are transported to vegetables that grow in these soils. Heavy metals and other environmental tensions stimulate the activity of antioxidant enzymes in plants. These metals are considered accumulated pollutants that enter the food chain through plants and, ultimately, affect humans. Excessive accumulation of heavy metals in the human body is well known to cause serious health problems.

The concentration of heavy metals in receiving soils has increased due to irrigation with sewage water. Heavy metal levels in receiving soils have increased due to sewage water irrigation. After accumulating on the ground, some of these metals are transferred to the food chain, which represents serious health risks for both humans and animals. In addition to causing nutritional insufficiency, certain metals, for example, iron, copper, and manganese, decrease the absorption of zinc by plants, perhaps as a result of competition by the same carrier site in the soil water system. Despite being vital nutrients, metals such as iron, manganese, cobalt, copper, and nickel are only allowed in very small quantities in living beings. The absorption of heavy metals by plants is influenced by a variety of soil variables, particularly the pH, organic content, the availability of metals in the soil, and the capacity to exchange cations. The yields of crops on the ground watered with contaminated water with sewage water have decreased for many farmers.

The implications of heavy metal pollution are particularly significant in agricultural production systems [4].

In Pakistan, as in many other parts of the world, the municipal discharge of sewage water remains a great concern, and the treatment of sewage water is perhaps one of the most pressing environmental challenges. Several activities and research are being carried out intensely to complete the treatment and discharge or reuse waste and industrial waste safely. Sewerage water generally contains solid and liquid waste generated from several human activities, along with trace metals and metal complexes. At present, the contamination of superficial and underground water resources arises from multiple sources, including industrial effluents, agricultural runoff, and municipal sewage water. These discharges often have substantial amounts of toxic organic and inorganic compounds, as well as pathogenic microorganisms. The rapid growth of the population, industrial expansion, and urbanization has not only consumed a significant proportion of the cultivable lands of the world, but has also generated large volumes of sewage water daily. According to estimates, the world produces 30 million tons of sewage water every year, 70 percent of which is used as agricultural fertilizers and irrigation. With that, the use of sewage water for agricultural production has gained popularity worldwide as a profitable alternative to fertilizer and water requirements for irrigation. Waste discharge not treated or treated inappropriately in open fields contaminates the upper soil, surface water, and groundwater. The quality of the final sewer water released to the open field has a significant impact on the surrounding treatment facilities and the high locations [5].

A significant source of water pollution, sewage water discharge increases oxygen requirements and nutrient loads in water bodies, encourages harmful algae flowers and creates an extremely unstable aquatic ecology. The problem arises in locations with basic and inappropriate sewage water treatment facilities. It is crucial to evaluate how the different sources and activities affect the water from sewage water to safeguard both the health of people and the environment. The mud and effluents produced by sewage water treatment facilities must be removed safely and economically. It is widely recognized that the sewage water mud could be a rich source of organic matter and nutrients for agriculture, improve sandy and degraded soils, control erosion, and stabilize the earth. Although the sewage water mud improves soil properties and offers a convenient option to rehabilitate degraded natural and anthropogenic soils, its use remains controversial due to possible health and environmental risks [6].

The reuse of sewage water treated for irrigation offers a practical solution to the environmental and health risks associated with the removal of sewage water. Nutrient-rich, this water can also support plant growth. Soils irrigated with sewage water serve as an important energy tank and nutrients for bacteria, which contain 4.1% of organic matter in weight, but represent up to 47.8% of the total soil carbon and 41.7% nitrogen. Despite the apparent advantages of irrigation, human and environmental health has raised several concerns about this approach. Numerous reports have linked fresh vegetables associated with foodborne outbreaks transmitted by food, which highlights concerns about contamination due to fecal pathogenic bacteria in agricultural environments. The soil, excrement, and green or insufficiently decomposed manure are potential sources of pollution before harvest. The contaminated irrigation water applied to the soil can be a cause of contamination. However, it is known that *E. coli* bacteria from many sources can survive on the ground for many years. The survival of the pathogen in the agricultural areas is determined by a variety of environmental conditions and varies according to the source of pollution. On the other hand, guaranteeing the safe use of sewage water and minimizing biological risks for human populations is essential [7].

An effective method to eliminate sewage water is to reuse it as irrigation water. In the regions affected by chronic drought and erratic rain, this additional water supply can provide substantial benefits for agriculture and economics. The state of chemistry and soil fertility improved when sewage water was used for irrigation. Both nutrients required for the growth of

heavy plants and metals that can be dangerous for animals if their concentration exceeds the permitted limit are present in sewage water. Irrigation with sewage water can improve the amount of water available for alternative uses. The use of water sewerage also benefits the environment by avoiding direct discharge into bodies of water that could otherwise be contaminated. In addition to the direct economic benefits of conserving natural resources, this water has many nutrients that can be used as an alternative to the expensive chemical fertilizers. It has been estimated that national sewage water could only supply all the essential nutrients necessary for crop growth. Soil suitability to accept residual fluids without degradation varies largely depending on soil characteristics, such as infiltration capacity, permeability, capacities for the exchange of cations and anions, water retention capacity, and texture [8].

For fertility global water resources are under increasing stress, and the situation in Asia is particularly severe. The rapid growth of the population, urbanization, intensive agriculture, industrialization, poor sanitation, ineffective management of solid waste, and unsustainable water use practices have collectively degraded both the quality and the amount of water resources available. Worldwide, big cities experience practically identical difficulties, as in Pakistan, where the population of Kotri, Hyderabad, is expanding rapidly due to the migration of rural regions that demand modern cultural advantages. Urbanization exercises additional tension on the finite natural resources of a region, as well as its social and physical infrastructure, resulting in a variety of social, economic, and environmental difficulties. As a result, landfills and open sheet sites are seen as the cheapest and most convenient options to handle solid waste in numerous regions of the world. Kotri is dealing with health and environmental problems as a result of poor sewage water. In Kotri, less than half of the sewage water produced is collected because it is incorrectly eliminated in the garbage dumps, along the edges, or burned without taking into account air and water pollution. Unfortunately, sewage water is used in irrigation without proper treatment. Urban sewage water is increasingly used for irrigation due to the shortage of fresh water resources available for agriculture, especially in the world's arid and semi-arid regions. Sewerage water is commonly used for irrigation in regions with limited access to alternative water sources. In comparison with the ground watered with pure groundwater, the use of sewage water for agricultural purposes has been related to a series of potentially positive changes in soil composition [9].

In the 21st century, the degradation of potable water resources has become a great concern. Water is essential for the daily functioning of all living organisms, which makes access to clean and safe water crucial. The increase in rapid population growth significantly affects fresh water quality and is expected to reduce per capita fresh water availability every year. Some of the most popular sources of fresh water include lakes, rivers, ponds, and groundwater. Compared to flow and groundwater, water in lakes and ponds is more susceptible to environmental deterioration due to its stable state. Agricultural ecology can be harmed by the use of several pesticides and improper application techniques. National and industrial sewage water can severely contaminate water, damage fish populations, aquatic vegetation, desalination facilities, treatment systems, and aquatic ecosystems in general. Throughout the world, it is estimated that 70-80% of the water is contaminated by family and industrial sewage water [10]

Objectives.

- To determine physico-chemical characteristics of sewage water applied in Kotri for irrigation tenacities.
- To compare the quality of sewage water with the IWQCS (Irrigation Water Quality Criteria Standards) for its suitability for irrigation purposes.

A Review of the Works.

In suburban areas, the health of soils and crops is increasingly threatened by the contamination of chemical industries, sewage water irrigation, the application of fertilizers, and

transport activities, which raises serious potential health risks [11]. According to the ministries of land and resources and protection of the environment, China's cultivated land had an excess of heavy metals at a rate of 19.4% in 2014. Heavy metals are characterized by high toxicity, resistance to decomposition, long-term persistence, and a tendency to bio accumulate [11]. Several studies have shown that high metal flows and health risks associated with suburban agroecosystems indicate a strong human influence, with various sources of pollution that contribute to the enrichment of heavy metals in soils.

By 2050, it was projected that the world's population would reside in nations with "stressed" water shortage, which makes the lack of water one of the biggest problems of the century, according to [12]. The shortage worsened due to climate change. More than 50% of people on the planet still consume contaminated water for a variety of activities. As an illustration, sewage water was frequently used for irrigation, especially in underdeveloped nations, which is a lower response to water scarcity.

He [13] emphasized that water is a vital and inseparable component of life, providing support and well-being for millions of living organisms. While it is common knowledge that water is composed of H_2O , the concept of water quality is more complex. As water moves through different environments, it accumulates a variety of natural components, and those that humans do. To feed the expected increase of 70% in world food consumption by 2050 and the predicted growth of the global population to 9.3 billion people, there is a growing demand for fresh water worldwide. Every day, millions of tons of non-treated sewage water from agricultural and industrial waste are thrown into bodies of water. As a result, lakes, rivers, and deltas are contaminated daily.

According to [14], pollution of individual sources such as sewage water and industrial effluents is often easier to monitor compared to diffuse water pollution, which arises from multiple sources. Freshwater diffuse contamination is an important problem. Therefore, understanding how several types of diffuse pollution affect water quality is essential. One of the best taxpayers to reduce pollution is through agriculture. Natural processes such as agriculture, forestry, mining, construction, and urban life contribute to diffuse pollution. Local climate and geology are two additional natural factors that can have an impact on the severity and scope of the problem. Diffuse pollutants in agriculture contain a variety of soil corrosion, fertilizer function, and food management infractions and chemical application regulations.

According to [15], life on Earth cannot exist without water, which constitutes more than 70% of the body weight of most species. While water is widely available, clean water is scarce and is getting more and more contaminated every year. Groundwater serves as the main source of water in some areas, such as deserts. Irrigation represents almost 80% of the use of available water. Water is indispensable for life on earth, which represents more than 70% of the body weight of most species. Although there are numerous places where you can get water, clean water is rare and is increasingly contaminated every year. Groundwater serves as the main source of water in some regions, such as deserts. Irrigation uses about 80% of the available water. To calculate and include the details of the components of water quality in such a dimensionless number, an average level was used that extends from the lowest degree to the most notable water condition.

Described agriculture as a method that takes advantage of nature for human subsistence, similar to the modern practices of organic agriculture [16]. Indian farmers, for example, use crop residues, animal fertilizers, legumes, green fertilizers, organic waste in the farm, and natural pest management techniques to maintain soil fertility, improve crop production, and control pests, weeds, and insects. After gaining independence, the population of India grew rapidly, exerting pressure on the countries limited resources. To meet the country's high demand for food grains, fertilizers, and the use of pesticides have increased. Farmers in developing countries have adopted the green revolution", a scientific intervention in agriculture, which has improved

production.

Pointed out that guava is a highly nutritious fruit widely cultivated in the tropical and subtropical regions of the world. In many parts of the world, Guayanes plantations are slowly slowed down by contaminated water. The fruits of Guayaba, belonging to the varieties of Gola and Surahi, were obtained from orchards in Finos, Pakistan, which were rigid using several water sources, including Tubewell and Sewage water. The copper, nickel, and zinc were more abundant in the irrigation of the soil with sewage water, while the same elements were less abundant in the irrigation of the soil with tubular water [17].

Emphasized that the rapid expansion of urbanization and industry leads to a greater generation of sewage water and greater challenges in its treatment and recycling. In addition, groundwater quality is in danger due to unrelated sewage water discharge. Sewage water recycling is necessary to avoid contaminating groundwater. In addition, it helps in water conservation. Sewage water can be treated with acceptable standards for use in several non-potable, commercial, and agricultural applications[18].

[19] He explained that the purpose of water quality indices is to assign a unique value to a water source that combines multiple criteria, thus simplifying data interpretation and facilitating the easiest monitoring. The value of groundwater for ingestion purposes was determined by the development of a weighted index for water quality (Wawqi). Most of the country's drinking water sources come from surface water. When comparing particular metrics (physical, chemical, and biological factors) with the recommended levels, experts describe the state of water.

[20] Emphasized that water, which constitutes an important part of the body weight of all living organisms, is a beautiful gift from divine mercy to humans and all other creatures on earth. Water is essential for all biological processes and interactions. However, overexploitation and negligence of water resources in many countries have compromised their quality.

[21] Defined sewage water as contaminated water generated when fresh water is supplied to a community and is used for its planned purposes. National sewage water, in particular, includes a large amount of organic material that, when they are not controlled and deposited in surface rivers, can be dangerous for people and the environment. It is defined by the volume or speed of the current, the condition of being, the synthetic and dangerous ingredients, and the bacterial state.

He stressed that water is essential for human survival. The key factors that contribute to the degradation of urban groundwater resources include solid waste and sewage water elimination, urban runoff, agricultural activities, and surface water pollution. When sewage water is placed on the ground, it can filter hazardous compounds and absorb heavy metals from the sewage water. However, soil's potential to operate as a natural filtration can decrease over time, mainly due to changes in pH or ton in the continuous and considerable application of pollutants. Underground water pollution is mainly caused by the discharge of unregulated industrial waste and the use of chemical compositions in agriculture [22].

[23] Research on the Indo River has shown that it is among the most important sources of income for millions of people and other living beings. Water pollution has constantly increased accordingly to industry, urbanization, and climate change. Sewage water treatment and proper elimination of sewage water are basically non-existent in all the main cities of Pakistan. In the province of Sindh, Hyderabad, the second largest metropolis in Pakistan, is also dealing with this problem. Without any preparation, the city's sewage water and Hyderabad suburbs are discharged into the Phuleli channel. The Phuleli channel also obtains all Hyderabad sewage water, as well as hazardous liquid waste from slaughterhouses and poultry farms, as well as contaminated effluents from other companies. Numerous communities along the Phuleli channel are affected by the unregulated discharge of solid waste and sewage water not treated in sections of old and new channels, which increases the risks to human health, the ecosystem, and the quality of the groundwater.

Despite the constant interaction between these means, the elimination of the sewage water mud remains restricted. After primary and secondary purification, mud or biosolids are solid waste or fractions that separate in sewage water trade from water or water resources suppliers, depending on the amount of stability or digestion. SARS-COV-2, the virus responsible for COVID-19, has been detected in sewage water. In New Haven, Connecticut, during the first weeks of the pandemic, the cases of COVID-19 and hospital admissions correlated with the levels of SARS-COV-2 RNA in the main mud of sewage water [24].

Instead of using an inferential or statistical investigation to estimate the direct time that their data can provide through epidemiological indicators, researchers show a high-resolution data set created from sewage water mud, which moves away from conventional sewage water study methods. Their findings support the idea that monitoring sewage water could be a useful strategy to locate and control COVID-19.

[25] He reported that irrigation with sewage water increased Zn (Zinc) concentrations in *Solanum lycopersicum* while reducing the Zinc (Zn) content in *Capsicum baccatum*. All samples of vegetables examined showed higher daily admission levels (Ni) and Zn (Zinc) when irrigated with sewage water compared to the water from the channel. It was found that vegetables accumulate Ni (Nickel) and Zn (Zinc) at levels below Pakistan's allowed limits, indicating that they are safe for human consumption. Since fresh water supplies are limited, farmers must use sewage water to increase agricultural production. The abundance and importance of macro and micronutrients in sewage water for the development of the plant cannot be exaggerated.

[26] They have conducted some research on the subject, since fresh water, in all its forms, only represents 3% of the world's total water supply, 70% is caught in the ice layers of Antarctica and Greenland, and most sewage water is too deep to reach or catch the soil moisture. Fresh water constitutes only about 3% of the world's total water supply, and much is too deep to access or capture soil moisture. Almost 70% of this fresh water is stored in the ice layers of Greenland and Antarctica.

Materials and Methods.

This section on materials and methods outlines the resources employed and the procedures implemented to accomplish the study's objectives.

Selection of Sampling Site.

The investigation was carried out in several places in the coastal area of the Jamshoro district, Taluka Kotri, specifically in the town of Gorkhani, located 23 km from the center of Hyderabad, Shahi Bazar. The harvest was performed with sewage water. The city of Kotri was divided into experimental sectors, and a single sample of sewage water from a site in Kotri was collected to evaluate its quality. A densely populated area vulnerable to the contamination of industrial effluents generated by small-scale companies.

Methods of Sampling.

The sample was obtained using a 1.5-liter plastic bottle. The bottles were washed with acid with 5% acid and then rinsed with deionized water. The water temperature was recorded at the time of sampling.

Sewage water discharge was collected and taken manually with hands and face covered in the selected sector. The sample was properly labeled and analyzed for its physicochemical characteristics. The samples were stored and studied in the laboratory of the Faculty of Agricultural Engineering and Technology, Department of Energy and Environment, University of Agriculture of Sindh, Tandojam, Sindh, Pakistan.

Parameter Selection.



Figure 1. Geographical characteristics of the study region and locations of the chosen collecting sites

The species that were investigated were TDS (Total Dissolved Solids), RSC (Residual Sodium Carbonate), SAR (Sodium Adsorption Ratio), B (Boron), Zn (Zinc), and Arsenic (As), as well as pH (Hydrogen power) and Cl⁻ (Chloride).

Explanation of physicochemical parameters and their procedures.

Physical Parameters.



Figure 2. Sewage water taken from the Sewage Drain Mechanically

This location, where sewage water is used in the field to obtain cutting yields, was used for the collection of gutter samples in a sterilized sampling bottle, allowing fresh sewage water to enter while avoiding contact with the walls of the camera, avoiding floating debris, to guarantee a representative sample of sewage water. These are the materials and methods used to collect samples for the analysis of all the different parameters.

In semi-arid and arid regions, irrigation is mainly based on two water sources. water and water that pump water by aquifers. These sources often contain significant amounts of dissolved unwanted substances, which can reduce soil fertility and negatively affect crop growth and performance. These unwanted substances come from natural or artificial sources (domestic and industrial effluent sources and their severity depends on the type of substance and its quantity.

Calculating the TDS (Total Dissolved Solids) of Sewage Water.

The organic and inorganic components of a liquid, whether ionized, micro-granular (colloidal Sol), molecular, or suspended, are measured by the TDS (Total Dissolved Solids). Water salts contain TDS (Total Dissolved Solids) that originate from industrial discharges, sewage water, and natural sources. TDS (Total Dissolved Solids) consists mainly of ions such as carbonates, bicarbonates, chlorides, sulfates, nitrates, sodium, calcium, and magnesium. TDS (Total Dissolved Solids) are usually measured in parts per million (ppm). A standard solution of 1000 ppm (mg/l) was used in distilled water.

After turning on the total TDS (Total Dissolved Solids) and allowing it to heat up for five minutes, press the selected button.

The probe or electrode was rinsed with distilled water before calibrating it using a standard solution of 1000 mg/l and the same amount of water. To determine the reading of TDS (Total Dissolved Solids) of the instrument in mg/l at 25 ° C, 50 ml of the sample to a beaker, and the probe or the electrode was submerged inside, and the solution was stirred.

Determination the SAR (Sodium Adsorption Ratio) of Sewage Water.

The SAR (Sodium Adsorption Ratio) is a key parameter to determine the suitability of irrigation water. It is also used to evaluate salinity and soil texture. SAR (Sodium Adsorption Ratio) is determined by the absorption of solids dissolved in the water. Water with a high sodium adsorption ratio is less suitable for irrigation. Since 8 is the standard SAR (Sodium Adsorption Ratio) value, the following calculation shows that the sewage water sample used in this experiment exceeded the recommended reference point.

$$SAR = \frac{[Na^+]}{\left\{ \frac{([Ca^{2+}] + [Mg^{2+}])}{2} \right\}^{1/2}}$$

Where. Magnesium (Mg), Sodium (Na), and Calcium (Ca).

Determination the RSC (Residual Sodium Carbonate) of Sewage Water.

The residual value of RSC (Residual Sodium Carbonate) of irrigation water or soil solution indicates the potential alkalinity risk for the soil. In clay soils with high cation exchange capabilities, the RSC (Residual Sodium Carbonate) index is used to evaluate water suitability for irrigation. Clay soils tend to swell or disperse when the ratio of salts dissolved to calcium and magnesium in the water is high, which greatly reduces the ability to infiltrate the soil. The RSC (Residual Sodium Carbonate), when the ions were measured in meq/l, was proportional to the total bicarbonate, as well as the concentration of carbonate less the amount of concentrations of calcium and magnesium ions.

$$RSC = [HCO_3^- + CO_3^{2-}] - [Ca^{2+} + Mg^{2+}]$$

For irrigation purposes, the RSC (Residual Sodium Carbonate) value must not exceed 1.25 mg/l and preferably be below 0.5 mg/l.

Determination the pH (power of Hydrogen) of Sewage Water.

The accurate pH (Power of Hydrogen) is important for physicochemical processes. The pH is defined as the negative logarithm of the concentration of hydrogen ions in a solution. The pH (Power of Hydrogen) is a numerical scale used to measure the acidity or alkalinity of a solution, which reflects the activity of hydrogen ions (H⁺). Glass electrodes are commonly used for pH measurement. The pH (Power of Hydrogen) of sewage water is more than 7 (the average range is 7.5-9.5), and sewage water is alkaline.

pH = - log (H⁺). Where (H⁺) represents the concentration of H⁺ ions in moles/l/l.

Turn on the instrument and let it heat for 5 minutes, then press the desired measurement mode. He cleaned the probe with deionized water, then used a known pH (Power of Hydrogen) buffer to test the calibration (9.00, 7.0, 0, or 4.00). Take 50 ml of deionized water, immerse the probe, and stir until the instrument shows a constant pH (Power of Hydrogen) at 25° C. Then,

determine the pH (Power of Hydrogen) of the sample.

Determination the Chloride (Cl-) of Sewage Water.

Potassium chromate (K_2CrO_4) acts as an indicator to determine the end of chloride titration with silver nitrate in natural or slightly alkaline solutions. Before the endpoint, the formation of silver chloride ($AgCl$) is favored quantitatively. A standard solution of 0.1 N silver nitrate is used for the degree.

I took 10 ml of the sample and mixed it with 2 to 3 drops of the potassium chromate indicator (K_2CrO_4) so that the yellow color became dark yellow. Then titrate against silver nitrate (0.01 N) until the pink-yellow color appears. That is the endpoint, and verify the initial and final readings of the buret.

Determination the Heavy Metals B (Boron) and Zn (Zinc) of Sewage Water.

Elementary analysis of sewage water specifically identified heavy metals such as B (Boron) and Zn (Zinc) as the main taxpayers to irrigation pollution, with higher concentrations observed near the sewage water drain. Key metal concentrations in sewage water vary according to the type of industry generated by effluents. It is believed that sewage water is a rich base of natural matter and plant nutrients, but contains enough amounts of soluble salts, such as B (Boron) and Zn (Zinc). The long-term use of sewage water for irrigation can lead to the accumulation of sewage water components in the soil, damaging irrigation systems and negatively affecting soil health. B (Boron) and Zn (Zinc) are analyzed using ICP-OES (Inductively Coupled Plasma Optical Emission Spectrometry).

Determination the As (Arsenic) by Filler Kit of Sewage Water.

A Merck kit was used to investigate As (Arsenic) in a sample of sewage water taken from Kotri. Arsenic test kit content.

- Tube with 100 analytical test strips
- 1 bottle of 11ml reagent As-1, 1 bottle of 160 gm of reagent As-2 -2 and 1 bottle of 135gm of reagent As-3
- 1 reaction bottle with screw cap
- 1 red measuring spoon
- 1 green measuring spoon
- 1 color card with handy hints

The field method was used to investigate arsenic in the sewage water sample, and the procedure was as follows.

60 ml of the sewage water sample was added to the reaction bottle, since the reaction bottle was already marked at the 60 ml level. Two drops of As (Arsenic)-1 reagent (purple color) were added to the sample, and then they were shaken thoroughly so that the color of the reagent could be mixed correctly with the sewage water. After the complete mixture of reagents, As (Arsenic)-1, a red spoon of As (Arsenic)-2 reagent was added to the mixture in the reaction bottle. After adding the AS-2 reagent, the bottle cover closed so that the reaction could be done correctly. Finally, the bottle was properly shaken for all solid chemicals to mix. Then, a green spoon was added that measures the AS-3 reagent to the reaction bottle. After adding the As (Arsenic)-3 reagent, the color of the sample became gray. Quickly, the reaction bottle was firmly cut through its reaction. Finally, the strip was inserted into the reaction bottle through its lid in such a way that the reaction zone was halfway in the bottle. I left the reaction bottle for 20 minutes, gently turning it three times during the reaction period.

Results.

This study used sewage water from the Gorkhani village to evaluate its suitability for irrigation in the Taluka Kotri, located in the Jamshoro district. The researchers carried protective costumes, long boots, and gloves. Sewage water collected from the designated location and placed in plastic bottles and polyethylene bags. Consequently, we evaluate the composition of sewerage water against the quality standards of global irrigation water to determine its suitability

for irrigation.

The characteristics that were analyzed were TDS (Total Dissolved Solids), SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate), pH (Hydrogen power), Cl⁻ (Chloride), B (Boron), Zn (Zinc), and As (Arsenic). Next, the results were compared to the IWQCS (Irrigation Water Quality Criteria Standard) limit.

IWQCS (Irrigation Water Quality Criteria Standards). In the semi-arid and dry regions, the most used irrigation water sources are the water from the channel and the water from the tube well extracted from the aquifers. The water from the aforementioned sources has a high concentration of unwanted compounds or superfluous dissolved substances, which can be harmful to crop production, soil fertility, and plant development. The number and type of these strange elements, which resulted in a decrease in water quality, determined the seriousness of the problem. These unnecessary substances come from natural or artificial sources (national and industrial effluents).

Table 1. The above are the IWQCS (Irrigation Water Quality Criteria Standards)

Parameters	Units	Permissible Limits	Parameters	Units	Permissible Limits
TDS	mg/l	1800	As	ug/l	100
Na	mg/l	230	Pb	ug/l	5000
Ca	mg/l	230	Fe	ug/l	5000
Mg	mg/l	100	Mn	ug/l	200
SO ₄	mg/l	500	Ni	ug/l	200
B	mg/l	0.5-2.0	Zn	ug/l	5000
Cl ⁻	mg/l	400	pH	Unitless	7.5-9.5
As	mg/l	50	RSC	meq/l	1.25
B	mg/l	20	SAR	Unitless	Upto 10

Source. WHO (1989)

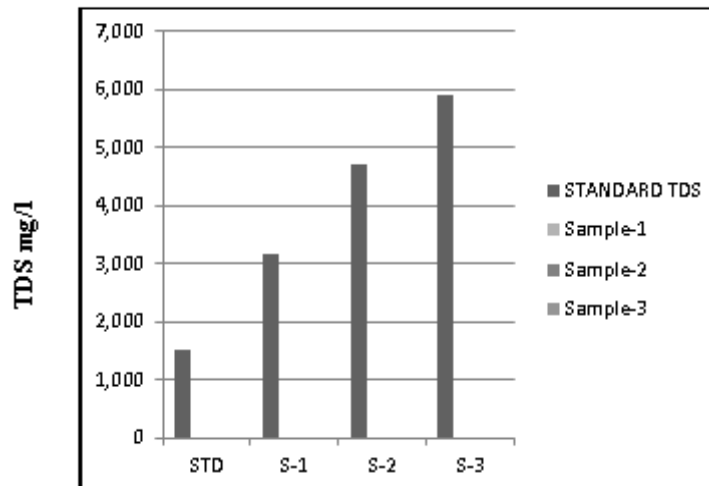


Figure 3. TDS (Total Dissolved Solids) value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=1500mg/l

TDS (Total Dissolved Solids).

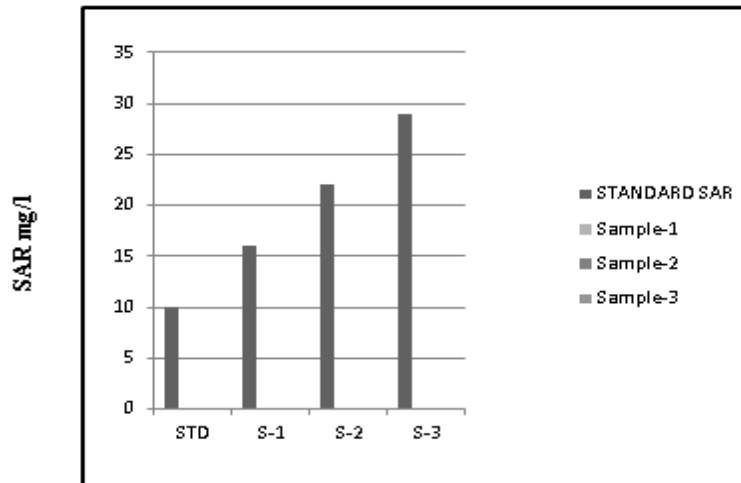
Figure 3 shows the total results of TDS (Total Dissolved Solids) in the sampling location, Taluka Kotri. Samples 1, 2, and 3 exceeded the acceptable limits established by the standards of the quality of irrigation water IWQCS (Irrigation Water Quality Criteria Standards). Sample 3 had the total value of TDS (Total Dissolved Solids) exceeding (5,900 mg/l), indicating that sewage water is not suitable for irrigation due to its high concentration of substances that can

increase health risks.

SAR (Sodium Adsorption Ratio).

Figure 4 illustrates the SAR (Sodium Adsorption Ratio) in the sampling location, Kotri. Samples 1, 2 and 3 exceeded the acceptable limits established by the standards of the quality of irrigation water IWQCS (Irrigation Water Quality Criteria Standards). Sample 3 had the highest of (29 mg/l), while RSC (Residual Sodium Carbonate) values varied from (16 to 29meq/l).

Figure 4. SAR (Sodium Adsorption Ratio) value of sampling location IWQCS (Irrigation



Water Quality Criteria Standards) Limit=10mg/l

RSC (Residual Sodium Carbonate).

Figure 5 shows the results of the RSC (Residual Sodium Carbonate) in the sampling location, Kotri. Samples 1, 2, and 3 exceeded the acceptable limits established by the standards of the quality of irrigation water IWQCS (Irrigation Water Quality Criteria Standards). Sample 3 had a high sodium carbonate value RSC (Residual Sodium Carbonate) greater than (28 mg/l), indicating that the sewage water is not suitable for irrigation.

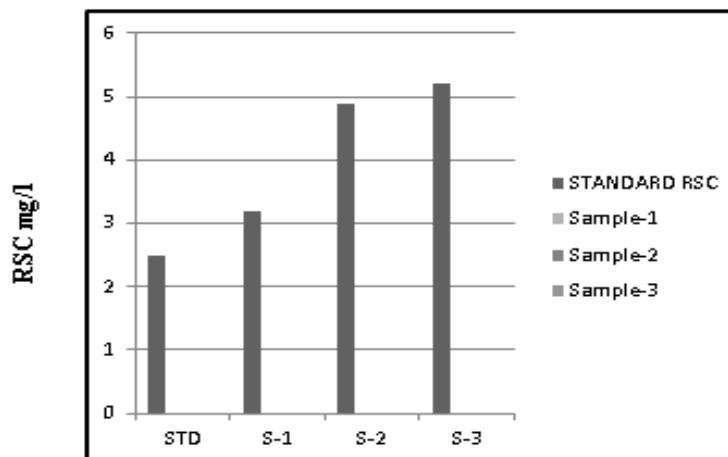


Figure 5. Residual Sodium Carbonate value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=2.5mg/l

pH (power of Hydrogen).

Figure 6 shows the pH (power of Hydrogen) results, indicating that the levels on the sampling site for samples 1, 2, and 3 are suitable for irrigation purposes. All pH (power of Hydrogen) values complied with irrigation water quality standards IWQCS (Irrigation Water Quality Criteria Standards), ranging from 7.8 to 8.2, 9.3 being the lowest value.

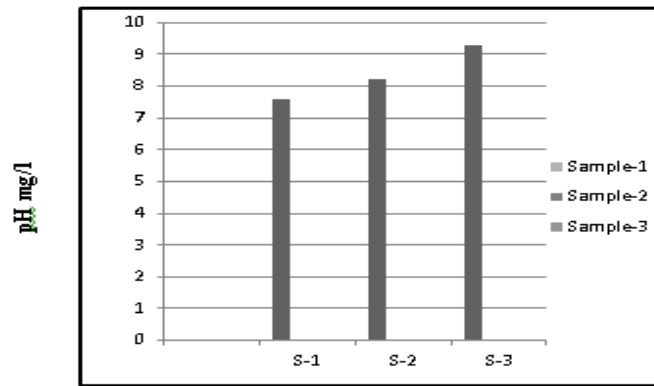


Figure 6. pH (power of Hydrogen) value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=7.5-9.5mg/lCl⁻ (Chloride).

Figure 7 shows the Cl⁻ (Chloride) results, indicating that the IWQCS (Irrigation Water Quality Criteria Standards) were exceeded, making the water unsuitable for irrigation. Chloride levels exceeded the IWQCS (Irrigation Water Quality Criteria Standards). Sample 3 had the lowest chloride concentration (400 mg/l), while sample 1 had the highest.

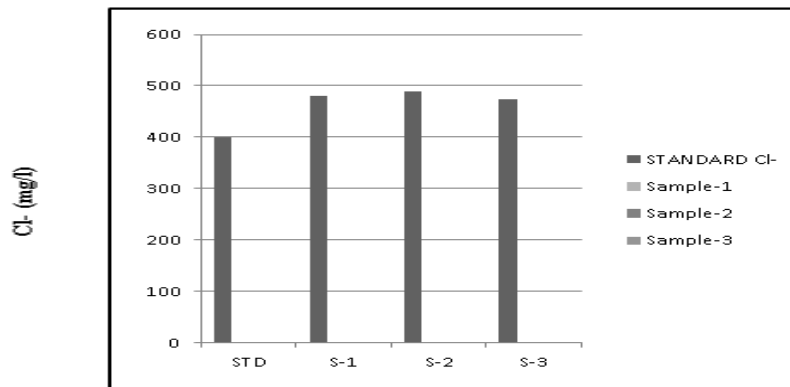


Figure 7. Cl⁻ (Chloride) value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=400mg/l

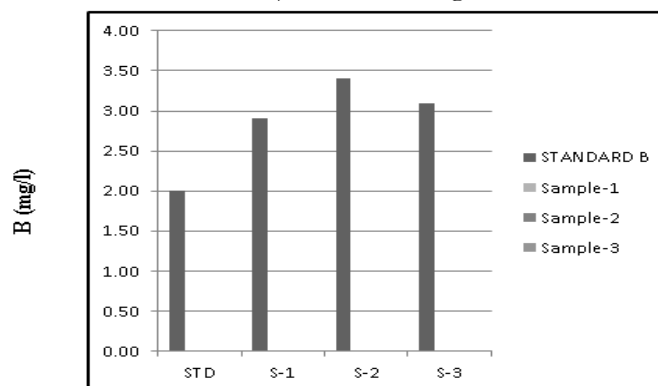


Figure 8. B (Boron) value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=2.0mg/l

B (Boron).

The B (Boron) outcome is shown in Figure 8. It shows that the value of the B (Boron) in sampling 1, 2, and 3 location categories crossed the acceptable limits of the IWQCS (Irrigation Water Quality Criteria Standards) and were not adequate for irrigation.

Zinc (Zn).

The pH of the soil was low to moderately acidic levels, and the current study found significantly higher concentrations of Zn (Zinc), Cr, and Cu in the bioavailable pool. These findings can be associated with an increase in organic carbon from the continuous use of sewage water effluents, as well as a decrease in the pH of the soil.

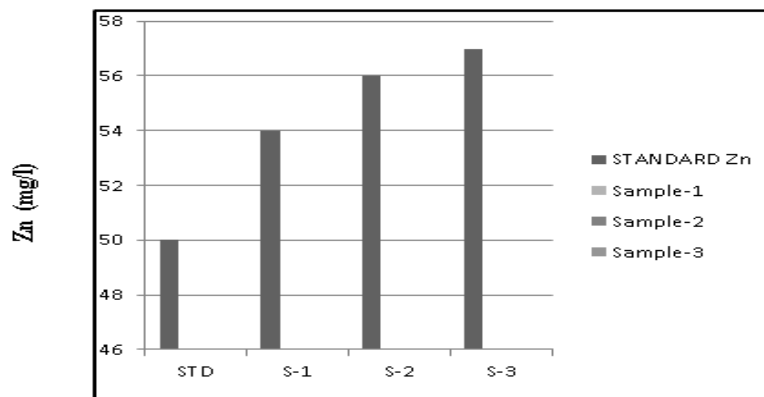


Figure 9. Zn (Zinc) value of test location IWQCS (Irrigation Water Quality Criteria Standards) Limit=50ug/l

Arsenic (As).

Figure 10 presents the results of the arsenic (As), which shows that the standards of the quality of the irrigation IWQCS (Irrigation Water Quality Criteria Standards) were exceeded, making the water not suitable for irrigation. The value of the arsenic was high compared to the IWQCS (Irrigation Water Quality Criteria Standards). The highest arsenic concentration (14 mg/l) was discovered in sample 3, while the lowest value of arsenic As (Arsenic) was (12 mg/l) observed in sample 2.

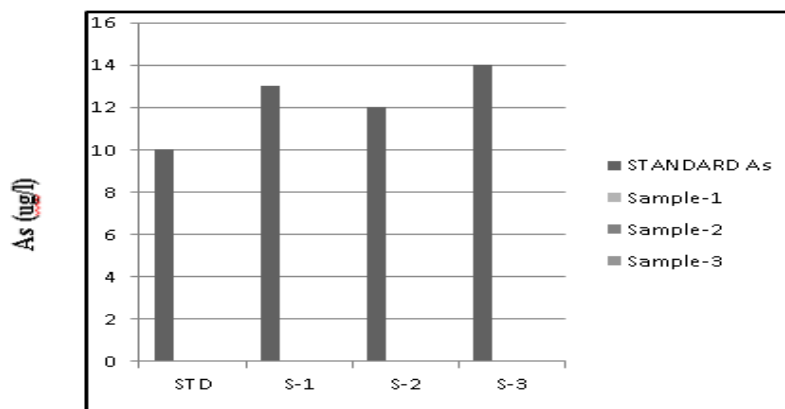


Figure 10. Arsenic (As) value of sampling location IWQCS (Irrigation Water Quality Criteria Standards) Limit=100ug/l

Discussion.

Water is a gift of nature, and despite the fact that there is a lot of fresh water on Earth, it is said that many regions face a shortage of water due to pollution caused by human activity. The amount of fresh water available for agricultural use has decreased as a result of the use of sewage water [27]. Previously thrown into fresh water bodies, treated sewage water is now used to water the farms. Especially in peri-urban locations and stressed by water, sewage water is higher than traditional water sources, since it contains a variety of nutrients and requires less fertigation. This approach was useful in some places, since it was promising in terms of raising fertility and soil productivity. Because certain impurities of sewage water, such as heavy metals, are poisonous, sewage water is bad for agriculture and the environment.

As a result, the recent learning was made to estimate the state of sewage water in the

village chosen in Taluka Kotri. Sewage water samples were examined in the location chosen for this purpose. The result of the present study showed that metals TDS (Total Dissolved Solids), SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate), Cl⁻ (Chloride), heavy metals B (Boron), Zn (Zinc), Arsenic were high while other parameter pH (power of Hydrogen) was low within the permitted limits for according to the IQWCS (Irrigation Water Quality Criteria Standards) in many samples.

[28] In the same way, it was concluded that the use of sewage water for irrigation is a viable strategy to improve food and water safety. Although sewage water consists of 99.9% water, the remaining 0.1% contains several chemical components, which increases concerns about the safety of its reuse. The use of sewage waters for irrigation for a prolonged period of time, especially unreasonable the water, can have negative effects on Earth. Even at low concentrations, toxic compounds in sewage water have the potential to bioaccumulate in fruits and vegetables grown in the soil over time. The interference of vegetables and crops that have bioaccumulated toxic chemicals can lead to various health problems.

According to [29], correct processes of sewage water treatment must be established to reduce the number of hazardous compounds contained in sewage water. Prolonged irrigation with sewage water can help handle the risks associated with the soil, crops, and, ultimately, human health. Risk management would ensure both the continuous use of sewage water that has been properly discussed and the continuous production of cultivated crops in land that receives sewage water irrigation. The intake rate of undesirable elements through sewage water should not exceed the takeoff rate of undesirable elements by crops to provide effective management and avoid accumulation.

[30] They declare that, as evidence of absorption of organic compounds, the problem of persistent chemical compounds in unwanted effluents has been discovered in previous studies. Dangerous substances in sewage water can be introduced to domestic animals during irrigation, although this is unlikely. Examples of such measures include regular monitoring of sewage water treatment and proper use of sewage water, particularly in agriculture.

Quality Survey of Sewage Water.

The study also analyzed the survey on the quality of sewage water using several interview methods. It was discovered that about 65% of the population of the research area was affected by diarrhea, food poisoning, and other food-related diseases. Due to the high incidence of diseases and pollution, the water quality of sewage water is low. With the correct treatment, the sewage water used for irrigation can be of higher quality.

Conclusions and Recommendations.

Conclusions.

Calculated and compared to the IWQCS (Irrigation Water Quality Criteria Standards) allowed for TDS (Total Dissolved Solids), SAR (Sodium Adsorption Ratio), RSC (Residual Sodium Carbonate), pH (power of Hydrogen), Cl⁻ (Chloride), B (Boron), Zn (Zinc), and As (Arsenic).

The conclusions below illustrate the results.

The Value of TDS (Total Dissolved Solids) was high 5,900 (mg/l) according IWQCS (Irrigation Water Quality Criteria Standards), the value of SAR (Sodium Adsorption Ratio) was high 9 (mg/l) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of RSC (Residual Sodium Carbonate) was high 28 (meq/l) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of pH (power of Hydrogen) were low (9.3) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of Cl⁻ (Chloride) were high 489 (mg/l) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of B (Boron) were high (34) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of Zn (Zinc) were high (57) as per the IWQCS (Irrigation Water Quality Criteria Standards), the value of As (Arsenic) were high (14) as per the IWQCS (Irrigation Water Quality Criteria Standards).

These high concentrations highlight that sewage water tests were not adequate for irrigation purposes without prior treatment, since their use increases the risk to soil health, crop productivity, and environmental stability.

Recommendations.

It may be possible to do more studies weekly from day one after registration until adulthood to demonstrate a distinctive pattern of changes at the thick morphological and histomorphological level. A variety of spots, such as newspaper-schiff (PAS) and Alcian blue for mucinas, bromophenol blue to stain the acid-based areas of the avian stomach, or a combination of other immunohistochemical techniques, should be used during histochemical staining, according to some experts.

Acknowledgment.

The corresponding author is very grateful to the Department of Energy and Environment of the Faculty of Agricultural Engineering and Technology, and the Laboratory of the "Center for Advanced Studies in Water (USPCAS-W) at the University of Engineering and Technology of Mehran (MUTI), Jamshor, Sindh, Pakistan, for the support of the laboratory and instruments.

Author's Contribution.

All the authors contributed equally.

Conflict of interest.

The author declares there is no conflict of interest in publishing this research in the International Journal of Agriculture and Sustainable Development (IJASD).

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