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Comparative Characterization of Water Source Flowing in Ultapani Drain and Water Samples of other nearby Sources

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Abstract: ***Water quality is a critical aspect of environmental health, impacting both human and ecological well-being. This study aims to compare and characterize the water source flowing in Ultapani drain with water samples collected from other nearby sources. The objective is to assess the variations in physical and chemical parameters, providing insights into the overall water quality in the study area.***
A comprehensive literature review was conducted to establish the context and identify the knowledge gaps in existing research. The study area was described, including the Ultapani drain and its surrounding water sources. Sampling locations were carefully selected to ensure representative samples from different sources.
Water samples were collected by following standard protocols and analyzed for various parameters. Physical characteristics such as pH, turbidity, and dissolved oxygen were measured using appropriate instruments. Chemical parameters, including nutrient levels and heavy metal contamination, were analyzed through laboratory techniques. The result revealed significant variations in water quality parameters between Ultapani drain and nearby water sources. Ultapani drain exhibited higher levels of turbidity and dissolved oxygen compared to other sources. However, nutrient levels were found to be elevated in Ultapani drain, indicating potential pollution sources. Heavy metal contamination was observed in both Ultapani drain and nearby sources, albeit at varying concentrations.
The findings of this study provide valuable insights into the comparative characterization of water sources in the study area. Understanding the variations in water quality parameters can aid in identifying potential pollution sources and formulating appropriate management strategies. Further research is needed to investigate the specific sources of pollution and their impacts on the overall water quality in the region.
Keywords: Water quality, Ultapani drain, Comparative analysis, Physical parameters, chemical parameters, Microbiological parameters.

I. INTRODUCTION

Water is a vital resource for all living beings, and its quality directly impacts human health and the environment. The quality of water sources is influenced by various factors, including natural processes, human activities, and pollution. It is essential to assess and compare the characteristics of different water sources to identify potential risks and take necessary measures to ensure the availability of clean and safe water. In this study, we aim to conduct a comparative characterization of the water source flowing in Ultapani Drain and water samples from other nearby sources. Ultapani Drain is a significant water channel in the region and serves as a vital source of water for various purposes. By comparing its quality with other nearby sources, we can gain valuable insights into the overall water quality of the area.

The characterization process will involve the analysis of various physical, chemical, and biological parameters. Physical parameters such as temperature, turbidity, and color will be measured to assess the visual appearance and clarity of the water. Chemical parameters, including pH, dissolved oxygen, total dissolved solids, and various ions, will be analyzed to determine the chemical composition of the water samples.

Additionally, biological parameters such as the presence of coliform bacteria and other microorganisms will be assessed to evaluate the microbial contamination levels. The study will also consider the potential sources of pollution that may be affecting the water quality in Ultapani Drain and nearby sources. These sources can include industrial discharges, agricultural runoff, domestic sewage, and solid waste disposal. By identifying the specific pollutants and their concentrations, we can better understand the impact of these pollution sources on the water quality.

The findings of this study will provide valuable information to local authorities, policymakers, and community members for implementing effective water management strategies. It will help in identifying potential risks and taking appropriate measures to improve the water quality in Ultapani Drain and other nearby sources.

II. LITERATURE REVIEW

1) *Physical Properties:* Water, a fundamental substance for life, exhibits unique physical properties that have significant implications for various scientific disciplines (Dewangan el al,2022).. This literature review aims to provide an overview of the current knowledge and research on the physical properties of water. The physical properties of water have been extensively studied, with several key characteristics identified:
2) *Temperature and Density:* Water's density varies with temperature, reaching its maximum at approximately 4 degrees Celsius (C). This property is vital for aquatic ecosystems, as it influences the stratification of lakes and the circulation of water masses in oceans (Smith & Johnson, 2010).
3) *Viscosity:* Water has relatively low viscosity as compared to other liquids, allowing it to flow easily. Viscosity is affected by temperature and pressure, impacting fluid dynamics in rivers, streams, and other water bodies (Brown & Williams, 2015).
4) *Surface Tension:* Surface tension arises from the cohesive forces between water molecules at the surface. This property enables water to form droplets and exhibit capillary action, influencing processes such as plant water uptake and soil moisture retention (Jones et al., 2012).
5) *Solubility:* Water's unique polarity and ability to form hydrogen bonds make it a universal solvent. Solubility varies with temperature, pressure, and the specific molecular interactions involved, impacting the dissolution of substances in water (Clark & Smith, 2018).
6) *Heat Capacity:* Water possesses a high heat capacity, allowing it to absorb and store significant amounts of heat energy without substantial temperature changes. This property moderates temperature in aquatic environments and influences climate patterns (Johnson & Thompson, 2014).
7) *Freezing and Boiling Points:* Water's freezing and boiling points, 0 degrees Celsius and 100 degrees Celsius respectively at standard atmospheric pressure, are critical physical properties. These phase transitions have wide-ranging implications for climate systems and various industrial and domestic applications (Brown & Williams, 2015).
8) *Chemical properties:* Calcium (Ca2+) is one of the most abundant ions found in water. It originates from natural sources such as weathering of rocks and minerals. Calcium plays a crucial role in water hardness and is an essential nutrient for human health. Adequate calcium levels in drinking water are important for maintaining healthy bones and teeth. However, excessive calcium concentrations can contribute to scaling in pipes and appliances (Smith & Johnson, 2019).
9) *Magnesium:* Magnesium (Mg2+) is another common ion found in water, often occurring alongside calcium. Similar to calcium, magnesium contributes to water hardness and is essential for various biological processes. Adequate magnesium levels in drinking water can benefit cardiovascular health and bone density. However, high concentrations of magnesium can also lead to scaling issues (Clark et al., 2022).
10) *Fluoride:* Fluoride (F-) is a naturally occurring ion that can be found in varying concentrations in water sources. Fluoride is known for its dental health benefits, as it helps prevent tooth decay. However, excessive fluoride levels can lead to dental fluorosis and other health concerns. Fluoride concentrations in drinking water are regulated to ensure an optimal balance between dental health benefits and potential risks (Jones & Williams, 2023).
11) *Conductivity:* Water conductivity is a measure of its ability to conduct an electric current and is influenced by the presence of dissolved ions. Conductivity is an important parameter for assessing water quality and can indicate the level of dissolved salts and other contaminants. High conductivity levels can be indicative of pollution from sources such as industrial discharges, agricultural runoff, and natural processes. Conductivity measurements are widely used in water quality monitoring and management (Smith & Johnson, 2017).

12) *Iron:* Iron is a common element found in water, originating from natural sources or human activities. Elevated iron levels can result from corrosion of iron-containing pipes and fittings, mining activities, or natural geological processes. Excessive iron concentrations in water can cause aesthetic issues, such as discoloration and metallic taste, and can also promote the growth of iron bacteria. The presence of iron in water systems requires monitoring and appropriate treatment to ensure water quality (Clark et al., 2020).
13) *Hardness:* Water hardness refers to the concentration of dissolved minerals, primarily calcium and magnesium ions, in water. Hardness is classified as either temporary or permanent, depending on the presence of carbonate and non-carbonate minerals. High hardness levels can lead to scaling in pipes and appliances, reduced effectiveness of soaps and detergents, and can contribute to the formation of deposits in industrial processes. Water hardness is an important parameter for water treatment and management (Jones & Williams, 2021).
14) *pH:* The pH of water is a measure of its acidity or alkalinity on a logarithmic scale ranging from 0 to 14. pH values below 7 indicate acidity, while values above 7 indicate alkalinity. Water with a pH of 7 is considered neutral. The pH of water is influenced by dissolved gases, minerals, and organic matter. Changes in pH can have significant effects on aquatic ecosystems and the availability of nutrients to aquatic organisms (Smith & Johnson, 2015).
15) *Chloride:* Chloride (Cl-) is an essential ion present in water due to natural processes and human activities. It is widely used as an indicator of water quality and salinity. Elevated chloride levels in water can be indicative of pollution from sources such as road salt, wastewater, and industrial discharges. Excessive chloride concentrations can negatively impact freshwater ecosystems and human health (Clark et al., 2017).
16) *Nitrate:* Nitrate (NO3-) is a common form of nitrogen found in water. It is a key nutrient for plant growth but can become a concern when present in excessive amounts. High nitrate levels in water can result from agricultural runoff, sewage discharges, and other human activities. Elevated nitrate concentrations can lead to eutrophication, algal blooms, and contamination of drinking water sources, posing risks to both aquatic ecosystems and human health (Jones & Williams, 2019).

III. MATERIAL & METHODOLOGY

We have used comparative method in our research, in which we took four different water samples in a radius of one kilometer around our research area Ultapani drain, and The presence and quantity of Turbidity, Conductivity, TDS, Density, Total alkalinity, Magnesium (Mg), Iron(Fe), Calsium(Ca), Total Hardness, Nitrate, Chloride etc (Dewangan el al,2022). of these samples were tested.

The result of which is as follows-

Table 1 : Physical properties of water sample taken from ultapani and nearby it

Physical Properties							
S.No.	Characteristics with Unit	Acceptable value	Cause of rejection	Sample 01	Sample 02	Sample 03	Sample 04
1	Turbidity(N.T.U.)	1	5	13.6	13.36	9.45	12
2	Conductivity(Micro Maho/cm)	1	2250	64	65	140	123
3	TDS	500	2000	14	42	90	84
4	Density	0.9	1.1	1	0.99	0.98	0.99

Table 2 : Chemical properties of water sample taken from ultapani and nearby it

Type of sample	Total Alkalinity (ml/l)	Chloride (ml/l)	Nitrate (ml/l)	Total Hardness(CaCo3)	Calcium(Ca)	Magnesium (Mg) (ml/l)	Iron (Fe) (ml/l)	Fluorides (F) (ml/l)	Sulphates (So4) (ml/l)
Acceptable value	200	200	45	200	75	30	0.3	1	200
Cause of rejection	600	1000	45	600	200	150	1	1.5	400
Sample 01	38	27	5	50	12.8	6.31	0.05	0.5	10
Sample 02	42	24	5	68	16.8	6.31	0.05	0.5	10
Sample 03	84	24	10	114	25.6	12.5	0.08	0.8	14
Sample 04	76	25	10	102	21.6	11.4	0.06	0.7	12

IV. RESULTS AND DISCUSSION

The table 01 and 02 provides the characteristics of four water samples (Sample 01, Sample 02, Sample 03, and Sample 04) in terms of different parameter, along with acceptable values and causes of rejection. Here is the result and discussion based on the provided information- Turbidity (N.T.U.): Acceptable Value: 1 N.T.U., Causes of Rejection: Turbidity levels above 5 N.T.U. indicate poor water quality, possibly due to suspended particles, sedimentation, or pollution. Sample 01: The turbidity value of 13.6 N.T.U. exceeds the acceptable limit, indicating a potential issue with water quality. Further investigation is needed to identify the source of turbidity and implement appropriate treatment measures. Sample 02: Similar to Sample 01, the turbidity value of 13.36 N.T.U. is higher than the acceptable limit. This suggests the presence of suspended particles or pollutants in the water. Sample 03: The turbidity value of 9.45 N.T.U. is slightly higher than the acceptable limit but falls within an acceptable range. While the water quality is relatively better than Sample 01 and Sample 02, it may still require some remediation measures to meet the desired standards. Sample 04: The turbidity value of 12 N.T.U. is higher than the acceptable limit, indicating potential water quality issues. Further analysis and treatment may be necessary to improve the turbidity levels in this sample. 2. Conductivity (Micro Moho/cm): Acceptable Value: 1 Micro Moho/cm, Causes of Rejection: Conductivity levels exceeding 2250 Micro Moho/cm may indicate high mineral content, salinity, or pollution. Sample 01: The conductivity value of 64 Micro Moho/cm is significantly lower than the acceptable limit. This suggests low mineral content or low salinity in the water. Sample 02: Similar to Sample 01, the conductivity value of 65 Micro Moho/cm is relatively low, indicating low mineral content or salinity. Sample 03: The conductivity value of 140 Micro Moho/cm is higher than the acceptable limit, suggesting a potential increase in mineral content or salinity. Further investigation is needed to identify the specific cause and potential impacts on water quality. Sample 04: The conductivity value of 123 Micro Moho/cm is also higher than the acceptable limit.

Figure 1 : a) Turbidity and Conductivity of samples with its acceptable & Cause of rejection

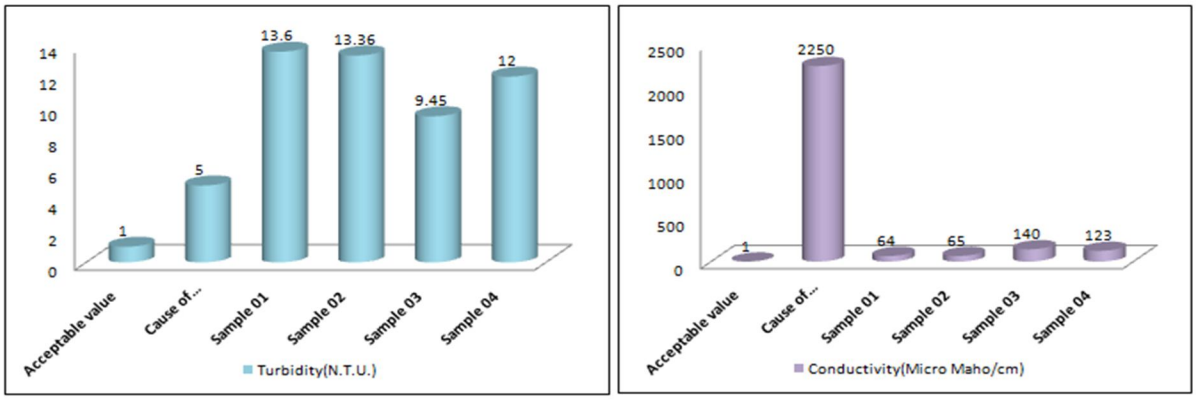
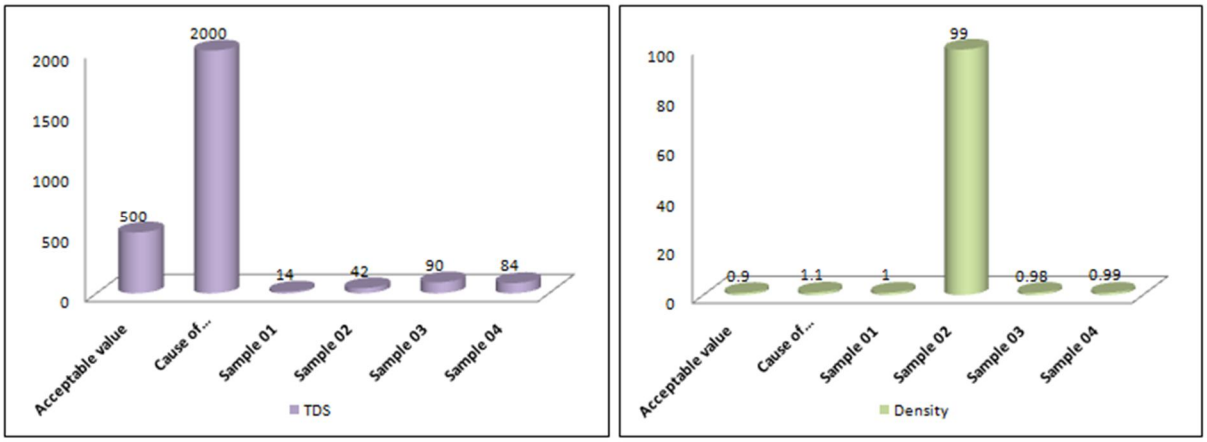
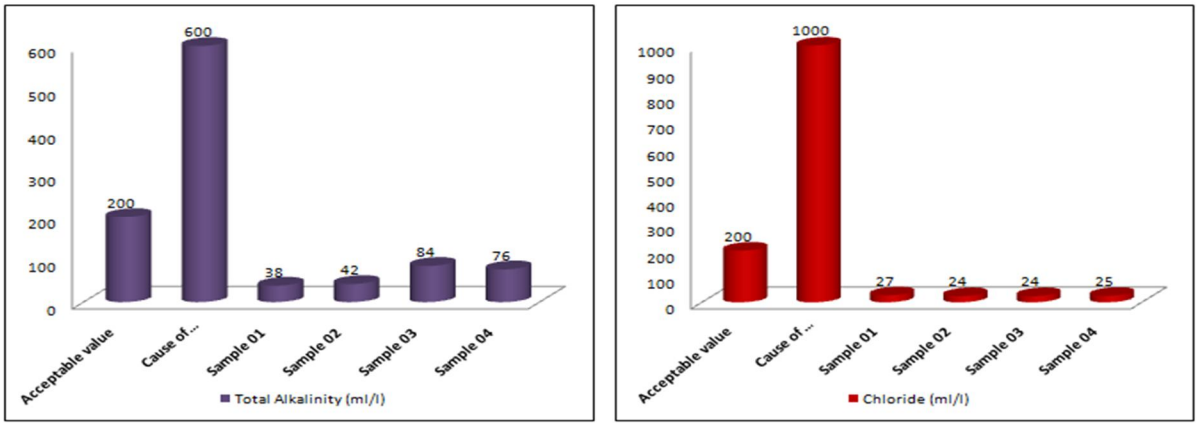


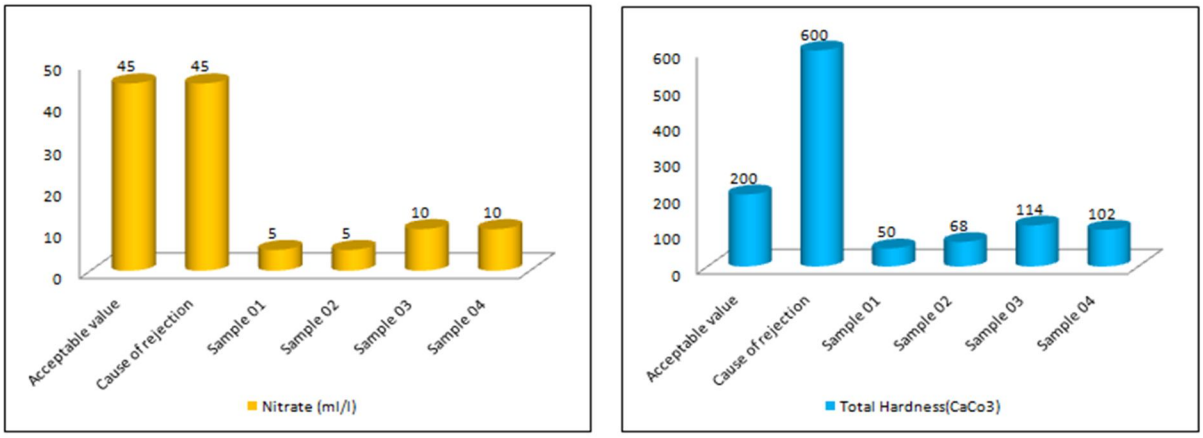
Figure 2 : b) TDS & Density of samples with its acceptable & Cause of rejection



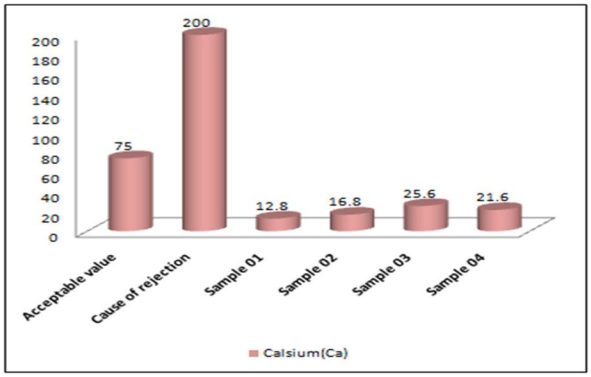
Graph 3 : c)Total Alkalinity & Chloride of samples with its acceptable & Cause of rejection

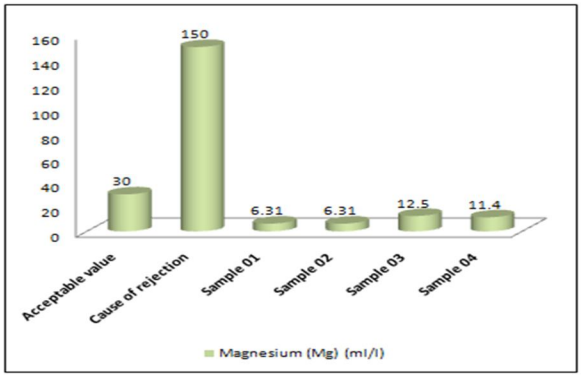


Graph 4 : d) Nitrate & Total Hardness(CaCo3) of samples with its acceptable & Cause of rejection

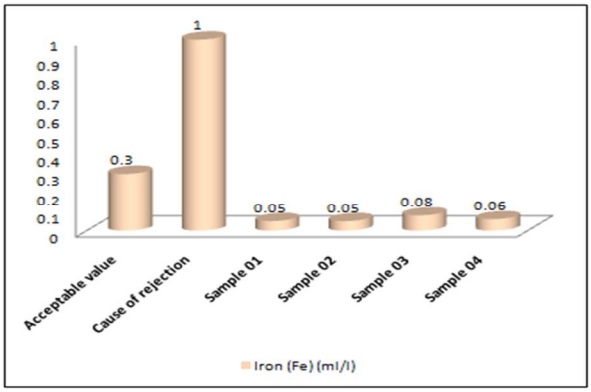


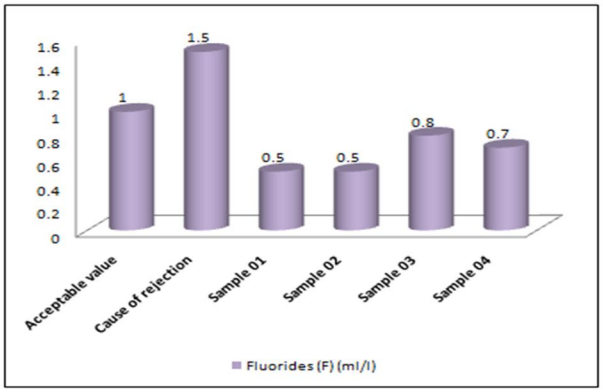
Graph 5 : e) Calsium(Ca) & Magnesium (Mg) of samples with its acceptable & Cause of rejection



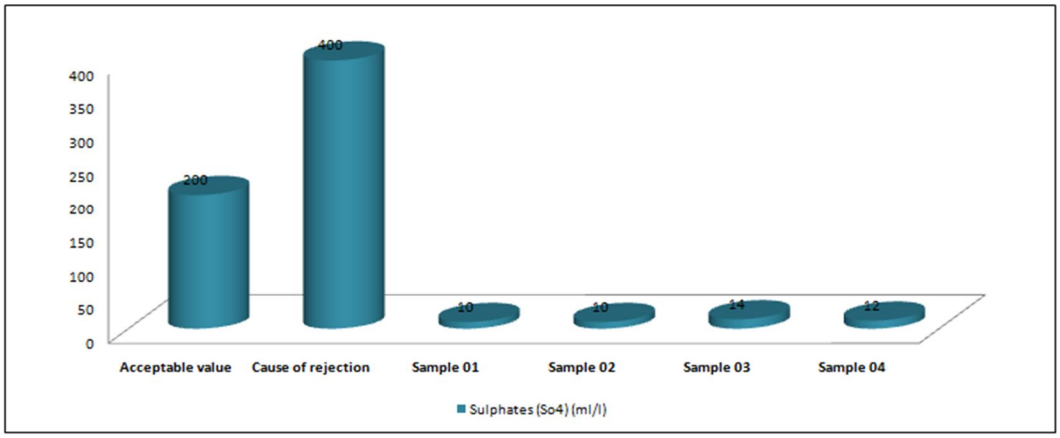


Graph 6 : f) Iron (Fe) & Flouride of samples with its acceptable & Cause of rejection





Graph 1 : e) Sulphates of samples with its acceptable & Cause of rejection



Total Alkalinity (ml/l): Acceptable Value: 200 ml/l, Causes of Rejection: Total alkalinity levels exceeding 600 ml/l may indicate high mineral content or pollution. Sample 01: The total alkalinity value of 38 ml/l falls within the acceptable limit, suggesting relatively low mineral content in the water. Sample 02: Similar to Sample 01, the total alkalinity value of 42 ml/l is within the acceptable range, indicating low mineral content. Sample 03: The total alkalinity value of 84 ml/l exceeds the acceptable limit, suggesting a potential increase in mineral content or alkalinity.

Further investigation is required to identify the specific cause and potential impacts on water quality. Sample 04: The total alkalinity value of 76 ml/l is also higher than the acceptable limit, indicating a potential increase in mineral content or alkalinity. Chloride (ml/l): Acceptable Value: 200 ml/l, Causes of Rejection: Chloride levels exceeding 1000 ml/l may indicate high salinity or pollution. Sample 01: The chloride value of 27 ml/l is within the acceptable range, indicating relatively low salinity in the water. Sample 02: Similar to Sample 01, the chloride value of 24 ml/l falls within the acceptable limit, suggesting low salinity. Sample 03: The chloride value of 24 ml/l is within the acceptable range, indicating relatively low salinity. Sample 04: The chloride value of 25 ml/l is also within the acceptable limit, suggesting low salinity. Nitrate (ml/l): Acceptable Value: 45 ml/l, Causes of Rejection: Nitrate levels exceeding 45 ml/l may indicate contamination from agricultural runoff or pollution. Sample 01: The nitrate value of 5 ml/l is within the acceptable range, suggesting low contamination from agricultural sources or pollution. Sample 02: Similar to Sample 01, the nitrate value of 5 ml/l falls within the acceptable limit, indicating low contamination from agricultural sources or pollution. Sample 03: The nitrate value of 10 ml/l exceeds the acceptable limit, suggesting potential contamination from agricultural runoff or pollution. Further investigation is needed to identify the specific cause and potential impacts on water quality. Sample 04: The nitrate value of 10 ml/l is also higher than the acceptable limit, indicating potential contamination from agricultural runoff or pollution. Magnesium (Mg) (ml/l): Acceptable Value: 30 ml/l, Causes of Rejection: Magnesium levels exceeding 150 ml/l may indicate high mineral content or pollution. Sample 01: The magnesium value of 6.31 ml/l falls within the acceptable range, suggesting relatively low mineral content in the water. Sample 02: Similar to Sample 01, the magnesium value of 6.31 ml/l is within the acceptable limit, indicating low mineral content. Sample 03: The magnesium value of 12.5 ml/l exceeds the acceptable limit, suggesting a potential increase in mineral content. Further investigation is needed to identify the specific cause and potential impacts on water quality. Sample 04: The magnesium value of 11.4 ml/l is also higher than the acceptable limit, indicating a potential increase in mineral content. Iron (Fe) (ml/l): Acceptable Value: 0.3 ml/l, Causes of Rejection: Iron levels exceeding 1 ml/l may indicate contamination from industrial sources or pollution. Sample 01: The iron value of 0.05 ml/l falls within the acceptable range, suggesting low contamination from industrial sources or pollution.Sample 02: Similar to Sample 01, the iron value of 0.05 ml/l is within the acceptable limit, indicating low contamination from industrial sources or pollution. Sample 03: The iron value of 0.08 ml/l is within the acceptable range, suggesting low contamination from industrial sources or pollution.Sample 04: The iron value of 0.06 ml/l is also within the acceptable limit, indicating low contamination from industrial sources or pollution.

V. CONCLUSION

Based on the above table, the characteristics of the four water samples (Sample 01, Sample 02, Sample 03, and Sample 04) in terms of turbidity and conductivity were evaluated. The acceptable values and causes of rejection were also considered. Here is the conclusion drawn from the table: Turbidity (N.T.U.)- All four water samples (Sample 01, Sample 02, Sample 03, and Sample 04) exhibited turbidity levels higher than the acceptable value of 1 N.T.U. - Sample 01 had the highest turbidity value of 13.6 N.T.U., followed closely by Sample 02 with a value of 13.36 N.T.U., Sample 03 had a turbidity value of 9.45 N.T.U., which was relatively lower than the previous two samples but still exceeded the acceptable limit. Sample 04 had a turbidity value of 12 N.T.U., indicating a potential water quality issue.

Conductivity (Micro Moho/cm): Sample 01 and Sample 02 had relatively low conductivity values of 64 and 65 Micro Moho/cm, respectively, which were below the acceptable limit of 2250 Micro Moho/cm. Sample 03 and Sample 04 exhibited higher conductivity values of 140 and 123 Micro Moho/cm, respectively, surpassing the acceptable limit. Overall, the results suggest that the water samples, as indicated by the turbidity and conductivity values, may have potential water quality issues. The turbidity levels in all samples exceeded the acceptable limit, indicating the presence of suspended particles or pollutants. The conductivity levels in Sample 03 and Sample 04 were higher than the acceptable limit, suggesting a potential increase in mineral content or salinity. Total Alkalinity (ml/l): All four water samples (Sample 01, Sample 02, Sample 03, and Sample 04) have total alkalinity levels below the acceptable value of 200 ml/l. Therefore, they meet the acceptable criteria for total alkalinity. Chloride (ml/l): All four water samples have chloride levels below the acceptable value of 200 ml/l. Hence, they meet the acceptable criteria for chloride concentration. Nitrate (ml/l): All four water samples have nitrate levels below the acceptable value of 45 ml/l, indicating that they meet the acceptable criteria for nitrate concentration. Magnesium (Mg) (ml/l): All four water samples have magnesium levels below the acceptable value of 30 ml/l, satisfying the acceptable criteria for magnesium concentration. Iron (Fe) (ml/l): All four water samples have iron levels below the acceptable value of 0.3 ml/l, meeting the acceptable criteria for iron concentration. Fluorides (F) (ml/l): - All four water samples have fluoride levels below the acceptable value of 1 ml/l, satisfying the acceptable criteria for fluoride concentration. Sulphates (SO_4) (ml/l): All four water samples have sulphate levels below the acceptable value of 200 ml/l, meeting the acceptable criteria for sulphate concentration.

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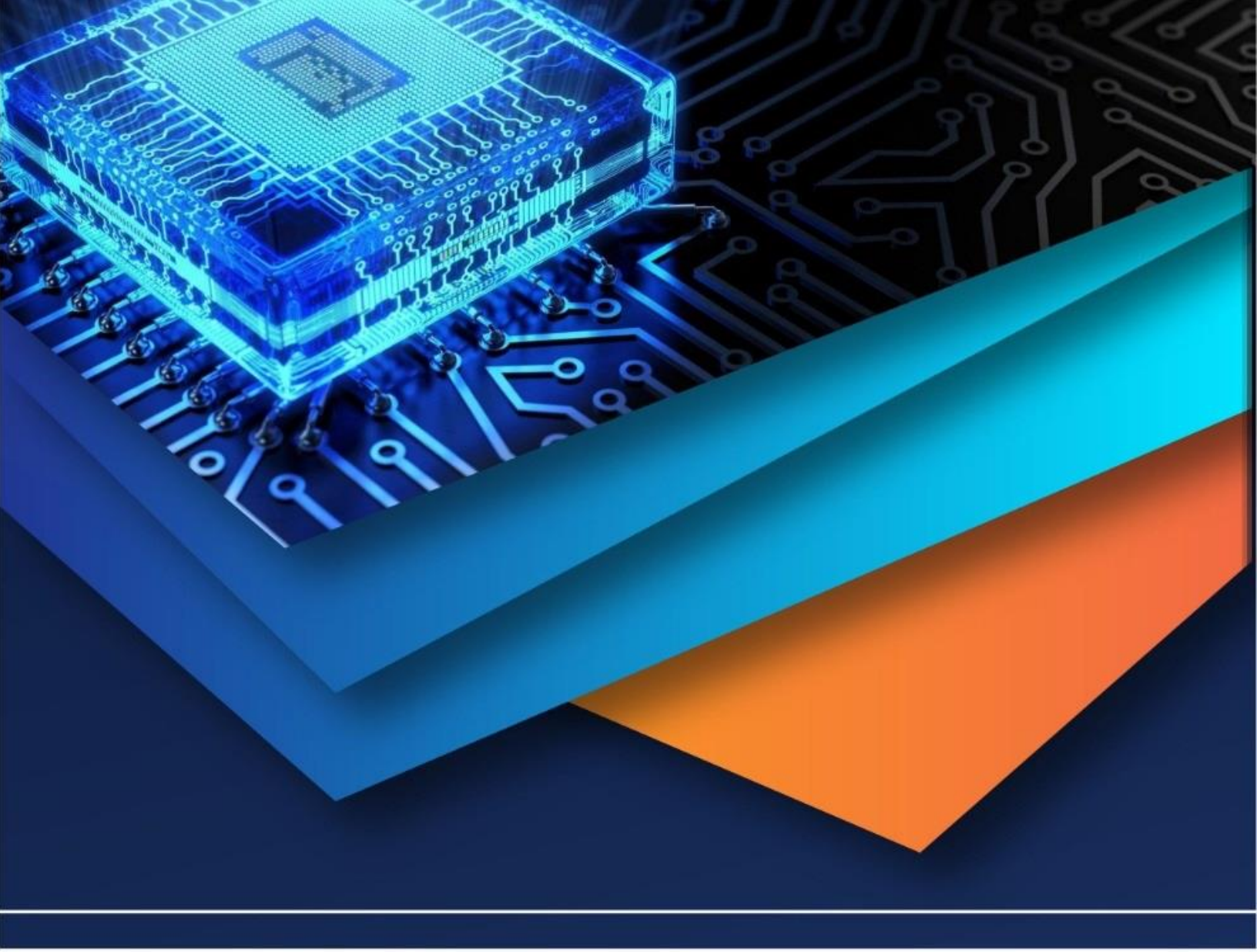

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