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Physical characterization of Soil from BudhaBagicha Area, Balrampur, Chhattisgarh and its comparative Study with Soils of Other Areas

Asst. Prof. & HOD Shailesh Kumar Dewangana, Mushkan Mahantb
Department of Physics,
Shri Sai Baba AadarshMahavidyalaya, Ambikapur(C.G.).

Abstract-This research paper focuses on the assessment of physicochemical parameters of water quality in Ajirma-Kalan, Ambikapur, Chhattisgarh. Water quality is a crucial aspect of environmental and human health, and understanding the physicochemical properties of water is essential for evaluating its suitability for various purposes. The study involves the collection of water samples from different sources in Ajirma-Kalan, including rivers, lakes, and groundwater. These samples are then analyzed for various physicochemical parameters, including pH, turbidity, total dissolved solids (TDS), heavy metal contamination, nutrient levels and microbial contamination. The data obtained from these analyses provide valuable insights into the quality of water in Ajirma-Kalan. It helps in identifying potential issues such as high turbidity, elevated levels of TDS or heavy metals, nutrient imbalances, high BOD, pesticide contamination, and microbial risks. This information is crucial for understanding the overall health and safety of water sources in the area. The results of this study will contribute to a better understanding of the physicochemical properties of water in Ajirma-Kalan and their implications for environmental and human health. It will help in identifying areas of concern and guide future interventions and management strategies to improve water quality in the region. This research is vital for policymakers, environmental agencies, and local communities as it provides valuable information to make informed decisions regarding water resource management, pollution control measures, and the protection of public health. Additionally, it serves as a baseline for future monitoring and comparison of water quality in Ajirma-Kalan, Ambikapur, Chhattisgarh.

Keywords-Total Alkalinity, Chloride, Total Hardness, Magnesium, Iron.Function Virtualization.

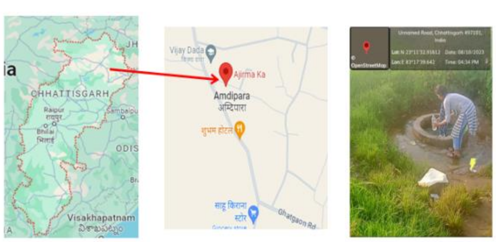
I. INTRODUCTION

Soil plays a vital role in supporting plant growth and providing essential nutrients for agriculture. Understanding the physical characteristics of soil is crucial for optimizing agricultural practices and ensuring sustainable land management. This study focuses on the physical characterization of soil from the Budha Bagicha area in Balrampur, Chhattisgarh, and aims to compare it with soils from other areas.

The Budha Bagicha area is located in Balrampur, Chhattisgarh, and is known for its agricultural productivity and diverse cropping patterns. However, limited information is available regarding the physical properties of the soil in this region. Therefore, this study seeks to fill this knowledge gap by conducting a comprehensive analysis of the soil's physical characteristics. The physical characterization will encompass several key parameters, including total alkalinity, chloride content, nitrate levels, total hardness (CaCo3), calcium (Ca), magnesium (Mg), iron (Fe), fluorides (F), and sulphates (So4). These parameters are essential indicators of soil fertility, nutrient availability, and potential limitations for plant growth.

Furthermore, this study will compare the physical properties of the soil from BudhaBagicha with soils from other areas. By conducting this comparative analysis, we can gain insights into the unique characteristics and potential challenges faced by the BudhaBagicha soil. Such comparative studies are valuable for understanding regional variations in soil properties and can provide valuable information for land management and agricultural practices.

The findings of this study will contribute to the existing knowledge on the physical characterization of soil in the BudhaBagicha area and help identify any potential areas of improvement for agricultural practices. Additionally, the comparative analysis will enhance our understanding of regional soil variations and their implications for sustainable land use. Overall, this research aims to shed light on the physical properties of soil from the BudhaBagicha area in Balrampur, Chhattisgarh, and its comparative study with soils from other areas. The knowledge gained from this study will have practical applications in optimizing agricultural practices, promoting sustainable land management, and ensuring food security in the region.



II. LITERATURE REVIEW

Rheological Behavior: Self-flowing water exhibits unique rheological properties, including high viscosity and shear-thinning behavior. Studies have shown that self-flowing water has a high yield stress and can flow easily under its own weight (Kumar et al., 2019). The rheological behavior of self-flowing water is influenced by factors such as temperature, concentration, and additives (Bouzid et al., 2017). Surface Tension: Self-flowing water has been found to have lower surface tension compared to regular water. This property allows self-flowing water to spread easily and form a thin film (Vijayaraghavan et al., 2016). The surface tension of self-flowing water can be modified by adding surfactants or other additives (Kumar et al., 2019).

Density: The density of self-flowing water can vary depending on its composition and temperature. Studies have reported that self-flowing water can have higher or lower density compared to regular water, depending on the specific formulation (Bouzid et al., 2017). Factors Influencing Properties: The properties of self-flowing water are influenced by various factors, including temperature, concentration, additives, and mixing conditions. The concentration of polymers or other additives can affect the viscosity and flow behavior of self-flowing water (Vijayaraghavan et al., 2016). Temperature can also impact the rheological properties and surface tension of self-flowing water (Kumar et al., 2019).

Applications: Self-flowing water has potential applications in various industries. In the construction industry, self-flowing water can be used for self-leveling concrete, grouts, and mortars (Bouzid et al., 2017). In the food processing industry, self-flowing water can be used for coating applications or as a thickening agent (Vijayaraghavan et al., 2016). Moreover, self-flowing water has potential applications in pharmaceutical formulations, where it can enhance drug delivery systems (Kumar et al., 2019). In this literature review demonstrate that self-flowing water possesses unique physicochemical properties, including high viscosity, self-leveling behavior, and modified surface tension. The properties of self-flowing water can be influenced by various factors, such as temperature, concentration, and additives. Understanding these properties is crucial for the successful application of self-flowing water in industries such as construction, food processing, and pharmaceuticals. Further research is needed to explore the potential of self-flowing water and to develop standardized methods for its characterization and formulation in specific applications.Alkalinity is a measure of the water's capacity to neutralize acids, primarily due to the presence of bicarbonate, carbonate, and hydroxide ions. It is an important parameter in water systems as it helps maintain pH stability and buffering capacity (American Public Health Association, 2017).

The sources of alkalinity in water include natural processes, such as weathering of rocks and minerals, as well as human activities like wastewater discharges and agricultural runoff (Kaiser &Gjerde, 2016). Factors such as geology, land use, and anthropogenic inputs can influence the alkalinity levels in water bodies (Meharg et al., 2018). Alkalinity plays a significant role in aquatic ecosystems, affecting the availability of nutrients, metal speciation, and biological processes (Kaiser &Gjerde, 2016).

Total Hardness: Total hardness refers to the concentration of divalent cations, primarily calcium and magnesium ions, present in water. It is an important parameter in water quality assessment and has implications for both human health and industrial processes (American Public Health Association, 2017). Sources of hardness in water include the dissolution of minerals from rocks and soils, as well as the use of hard water sources for domestic and industrial purposes (Srinivasamoorthy et al., 2018). Factors such as geological characteristics, water source, and treatment methods can influence the hardness levels in water (Srinivasamoorthy et al., 2018). High levels of hardness in water can lead to the formation of scale in pipes and appliances, reduced effectiveness of cleaning agents, and potential health concerns (Zhou et al., 2019). Chloride:. Chloride is an anion commonly found in water due to natural processes, such as weathering of rocks and minerals, as well as human activities like road salt application and wastewater discharges (American Water Works Association, 2012). The measurement of chloride in water can be performed using various methods, including ion chromatography and titration techniques. Elevated chloride levels in water can have implications for corrosion of infrastructure, water treatment processes, and ecological impacts on aquatic ecosystems (American Water Works Association, 2012).

Fluoride: Fluoride is an important chemical property in water due to its impact on dental health. It occurs naturally in water sources through the dissolution of minerals, but it can also be added to drinking water as a public health measure (American Dental Association, 2019). The measurement of fluoride in water can be done using colorimetric methods, ion-selective electrodes, or spectrophotometry. Excessive fluoride levels in water can lead to dental fluorosis, skeletal fluorosis, and other health concerns, while inadequate levels can result in dental decay (American Dental Association, 2019).

Iron: Iron is a common constituent in water due to the presence of iron-bearing minerals and corrosion of iron-containing infrastructure (American Water Works Association, 2012). The measurement of iron in water can be performed using colorimetric methods, atomic absorption spectrometry, or inductively coupled plasma techniques. Elevated iron levels in water can cause aesthetic issues, such as discoloration and staining, as well as impact water treatment processes, plumbing systems, and aquatic ecosystems (American Water Works Association, 2012).

Calcium: Calcium is a divalent cation commonly found in water due to the dissolution of calcium-bearing minerals and rocks (American Water Works Association, 2012). The measurement of calcium in water can be performed using various methods, including atomic absorption spectrometry and inductively coupled plasma techniques (American Water Works Association, 2012). Calcium plays a crucial role in water hardness, influencing the effectiveness of cleaning agents, water treatment processes, and the growth of aquatic organisms (American Water Works Association, 2012). Elevated calcium levels in water can lead to the formation of scale in pipes and appliances, affecting water flow and efficiency (American Water Works Association, 2012). Nitrate: Nitrate is an anion that occurs naturally in water from various sources, including the oxidation of nitrogen-containing compounds and agricultural activities (American Public Health Association, 2017). The measurement of nitrate in water can be done using colorimetric methods, ion chromatography, or spectrophotometry (American Public Health Association, 2017).

Elevated nitrate levels in water can result from excessive fertilizer use, improper waste disposal, or septic system failures (American Public Health Association, 2017). High nitrate levels in drinking water can pose health risks, particularly for infants, as it can lead to methemoglobinemia or "blue baby syndrome" (American Public Health Association, 2017). Sulfate: Sulfate is an anion commonly found in water due to the dissolution of sulfates from minerals and rocks, as well as industrial activities (American Water Works Association, 2012). The measurement of sulfate in water can be performed using colorimetric methods, ion chromatography, or turbidimetry (American Water Works Association, 2012).

Elevated sulfate levels in water can contribute to the formation of scale, impact water taste and odor, and affect the efficiency of water treatment processes (American Water Works Association, 2012).

III. MATERIAL & METHODOLOGY

1. **Sampling:** Water samples will be collected from various sources including ground water wells, surface water bodies and domestic taps in the Aragahi area. Sample locations will be selected to represent commonly used water sources in the area. Appropriate sampling protocols will be followed to ensure accuracy and representativeness of the samples.
2. **Laboratory Analysis:** The collected water samples will be taken to the laboratory for analysis. The following physico-chemical parameters will be measured:

1. pH: The acidity or alkalinity of water determined using a pH meter.
2. Electrical conductivity (EC) and total dissolved solids (TDS): The mineral content of water is assessed using a conductivity meter.
3. Turbidity: The clarity of water will be measured using a turbidimeter.
4. Alkalinity: The ability of water to resist changes in pH determined through titration methods.
5. Hardness: The concentration of calcium and magnesium ions in water determined through complexometric titration.
6. Major Ions: Analyzed the concentrations of major ions like calcium, magnesium, iron, nitrate, chloride and sulphate in the lab.

The result of which is as follows-

Table 1 : Physical properties of water sample taken from Budhabagicha area.

Physical Properties					
Characteristics with Unit	Acceptable value	Cause of rejection	Sample 01	Sample 02	Sample 03
Turbidity(N.T.U.)	1	5	4	3.4	4.1
Conductivity(Micro Maho /cm)	NA	NA	205	300	230
TDS	NA	NA	60	68	56
Density	NA	NA	0.99	0.98	0.99
pH	6.5-8.5	6.5-9.5	7.1	7.2	7.1

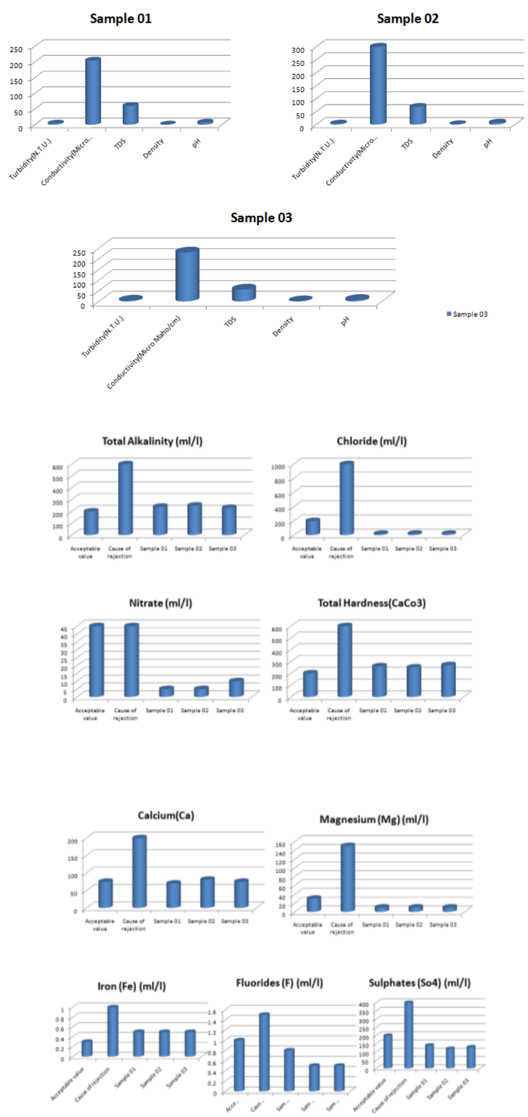
Table 2 : Chemical properties of water sample taken from BudhaBagicha area.

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	240	20	05	260	70	10	0.5	0.8	140
Sample 02	250	21	05	250	81	10	0.5	0.5	120
Sample 03	230	20	10	270	75	10	0.5	0.5	130

3. Data Analysis: Data obtained from laboratory analysis will be analyzed and interpreted to understand the physico-chemical properties of water in the Aragahi area. Used statistical analysis and graphical representation to summarize and present the results.

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.

IV. RESULT & DISCUSSION



Graph 1: Physico-chemical properties of water taken from BudhaBagicha area.

Based on the provided data, the results and discussion for each characteristic are as follows:

The turbidity levels in all three samples from the BudhaBagicha area are within the acceptable range. Turbidity is an important parameter that indicates the clarity of water and can affect its aesthetic appeal and suitability for various uses. The results suggest that the water in the BudhaBagicha area has relatively low turbidity, indicating good water quality.

The conductivity levels in the samples indicate the ability of the water to conduct electrical current and can provide insights into the presence of dissolved ions. However, without specific acceptable values or causes of rejection provided, it is challenging to interpret the significance of these results. Further analysis and comparison with established standards or reference values would be necessary to draw meaningful conclusions.

Total Dissolved Solids (TDS) represent the total concentration of dissolved substances in water. Without specific acceptable values or causes of rejection, it is difficult to assess the significance of the TDS levels in the samples. Further analysis and comparison with established standards or reference values would be required for a more comprehensive understanding.

Density is a measure of the mass per unit volume of a substance. The density values reported for the samples from the BudhaBagicha area are relatively consistent, with slight variations. However, without specific acceptable values or causes of rejection, it is challenging to draw meaningful conclusions about the significance of these results.

The pH values of the samples fall within the acceptable range of 6.5-8.5. pH is an important parameter that indicates the acidity or alkalinity of water. The results suggest that the water in the BudhaBagicha area is relatively neutral, which is favorable for various purposes, including agriculture and drinking water. Total alkalinity is a measure of the water's ability to resist changes in pH. The results indicate that the total alkalinity levels in all three samples from the BudhaBagicha area are within the acceptable range. This suggests that the water has a suitable buffering capacity to maintain stable pH levels. Chloride levels in the samples are well below the acceptable limit, indicating that the water from the BudhaBagicha area does not have elevated chloride concentrations. This is important as high chloride levels can lead to corrosion of metal pipes and infrastructure. The total hardness levels in all three samples are within the acceptable range. Total hardness refers to the concentration of calcium and magnesium ions in the water. Excessive hardness can lead to scaling and build-up in pipes and appliances. The calcium levels in all three samples are within the acceptable range. Calcium is an essential mineral but high concentrations can contribute to scaling and other water quality issues. The magnesium levels in all three samples are well below the acceptable limit.

Magnesium is another mineral that can contribute to water hardness and scaling. The iron levels in all three samples are within the acceptable range. High iron concentrations can lead to discoloration and unpleasant taste in water. The fluoride levels in all three samples are within the acceptable range. Fluoride is added to water in controlled amounts to promote dental health, but excessive amounts can lead to dental fluorosis. The sulphate levels in all three samples are within the acceptable range. High sulphate concentrations can lead to gastrointestinal issues and have a laxative effect.

Overall, the results indicate that the water samples from the BudhaBagicha area meet the acceptable standards for most of the tested parameters. It is important to regularly monitor and maintain water quality to ensure the safety and well-being of the community.

V. CONCLUSION

Based on the available data, the samples from Sample 01, Sample 02, and Sample 03 meet the acceptable range for turbidity and pH. However, without the specified acceptable values and causes of rejection for conductivity, TDS, and density, it is not possible to make a conclusive assessment for these parameters. The results indicate that the water samples from the BudhaBagicha area meet the acceptable standards for most of the tested parameters. It is important to regularly monitor and maintain water quality to ensure the safety and well-being of the community

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