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Characterization of White Soil in the Batwahi Area of Chhattisgarh: An Analysis of Physico-Chemical Properties

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Abstract: This abstract presents a summary of the study titled "Characterization of White Soil in the Batwahi Area of Chhattisgarh: An Analysis of Physico-Chemical Properties." The study aims to investigate the physico-chemical properties of white soil in the Batwahi area of Chhattisgarh, India, in order to better understand its composition and potential agricultural suitability.The research methodology involved collecting soil samples from various locations within the Batwahi area and conducting laboratory analyses to determine key physico-chemical properties. These properties include pH value, conductivity, total alkalinity, chlorides, nitrates, CaCO3 content, calcium, magnesium, iron, fluorides, and sulfates(Dewangan, et al.,2022).
Preliminary results indicate that the pH value of the white soil in the Batwahi area falls within the acceptable range for agricultural purposes. Conductivity levels are relatively low, suggesting good water retention capacity. Total alkalinity and chlorides are within acceptable limits, indicating favorable soil conditions(Dewangan.,2022).. Nitrates are below detectable levels, implying minimal contamination.The CaCO3 content in the white soil is relatively low, which may affect its calcium availability for plant growth. Calcium and magnesium levels are within acceptable ranges, contributing to soil fertility. Iron is not detected in the analyzed samples, suggesting low iron content. Fluoride levels are slightly elevated but still within permissible limits. Sulfate levels are within acceptable ranges, indicating favorable soil conditions.The findings of this study will contribute to a better understanding of the physico-chemical properties of white soil in the Batwahi area of Chhattisgarh. This knowledge will be valuable for soil management and agricultural practices in the region, aiding in sustainable land use planning and crop productivity enhancement. Further analysis and interpretation of the data are needed to draw comprehensive conclusions and provide recommendations for soil conservation and agricultural practices in the Batwahi area.
Keywords: Conductivity, pH, Carbon, Copper, Zinc, Iron, Manganese, Boron, Molybdenum.

I. INTRODUCTION

The Batwahi area, located in the Surguja district of Chhattisgarh, India, is known for its unique white soil composition. White soil, also known as leached soil or laterite, is characterized by its distinct pale color and is found in various regions across the country. Understanding the physico-chemical properties of white soil in the Batwahi area is crucial for effective soil management and sustainable agricultural practices in the region. The physico-chemical properties of soil play a vital role in determining its fertility, water-holding capacity, and nutrient availability. Therefore, a comprehensive analysis of these properties is essential to assess the agricultural suitability and potential limitations of the white soil in the Batwahi area. By characterizing the soil, researchers can gain insights into its composition, nutrient content, pH levels, and other important factors that impact plant growth and productivity.

This study aims to investigate the physico-chemical properties of white soil in the Batwahi area, with a focus on parameters such as pH value, conductivity, total alkalinity, chlorides, nitrates, CaCO3 content, calcium, magnesium, iron, fluorides, and sulfates. By analyzing these properties, the study aims to provide valuable information for soil management practices, crop selection, and sustainable land use planning in the Batwahi area.

The findings of this research will contribute to a better understanding of the white soil composition in the Batwahi area, providing insights into its agricultural potential and limitations. It will also serve as a foundation for future studies on soil conservation, nutrient management, and strategies for enhancing crop productivity in this region. Ultimately, this research aims to support sustainable agriculture practices and promote the overall well-being of the farming community in the Batwahi area of Chhattisgarh.

Geographical location of research area- Latitude: 23.080208^0 and Longitude: 83.312776^0.

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II. LITERATURE REVIEW

1) *pH:* The pH of white soil plays a crucial role in its chemical reactivity and nutrient availability. Acidic pH conditions can enhance the solubility of certain elements and affect the stability of minerals in white soil (Kabata-Pendias and Pendias, 2001). Alkaline pH conditions can lead to the formation of calcium carbonate deposits in white soil (Kabata-Pendias and Pendias, 2001).
2) *Conductivity:* Electrical conductivity (EC) is a measure of the ability of white soil to conduct an electric current and is influenced by the presence of dissolved ions. High electrical conductivity can indicate the presence of soluble salts in white soil, which can impact plant growth and soil fertility (Rhoades et al., 1992). Excessive salt accumulation and high electrical conductivity can lead to soil degradation and reduced agricultural productivity (Rhoades et al., 1992).
3) *Organic Carbon Content:* White soil is typically low in organic carbon content due to its formation process and mineral composition (Bergaya et al., 2006). Organic carbon content can vary depending on the specific location and the extent of organic matter input into the soil. Organic carbon plays a vital role in soil fertility and nutrient availability. Higher levels of organic carbon in soil can enhance its nutrient-holding capacity and improve nutrient availability to plants (Brady and Weil, 2008). Organic carbon acts as a source of energy and food for soil microorganisms, promoting their activity and contributing to nutrient cycling processes (Brady and Weil, 2008).
4) *Copper (Cu):* High levels of copper in white soil can lead to toxicity, affecting plant growth and soil health. Copper toxicity can cause root damage, reduced nutrient uptake, and impaired physiological processes in plants (Alloway, 2013). - The presence of excess copper in soil can also have adverse effects on soil microorganisms, disrupting soil microbial communities and their functions (Khan et al., 2019).
5) *Zinc (Zn):* Zinc is an essential micronutrient for plant growth, but excessive levels of zinc can be harmful to white soil and plants. High levels of zinc can induce toxicity symptoms in plants, such as stunted growth, chlorosis, and reduced yield (Alloway, 2013). Zinc toxicity can also affect soil microbial communities and their activities, leading to imbalances in nutrient cycling processes (Khan et al., 2019).
6) *Iron (Fe):* Iron is crucial for various metabolic processes in plants, including chlorophyll synthesis and electron transport. White soil may naturally contain iron, but its availability to plants can be influenced by soil pH and other factors. In alkaline soils, iron availability is often limited, leading to iron deficiency in plants, which is characterized by chlorosis (yellowing) of leaves (Marschner, 2012). Soil amendments or chelating agents may be applied to enhance iron availability in white soil for better plant nutrition (Marschner, 2012).
7) *Manganese (Mn):* Manganese is essential for several enzymatic reactions in plants, including photosynthesis and nitrogen metabolism. White soil may naturally contain manganese, but its availability can be influenced by soil pH and other factors. High soil pH can reduce manganese availability, leading to manganese deficiency symptoms in plants, such as interveinal chlorosis (Marschner, 2012). Acidifying soil amendments or foliar application of manganese can help alleviate manganese deficiency in white soil (Marschner, 2012).
8) *Boron (B):* Boron is important for various physiological processes in plants, including cell wall formation, membrane integrity, and carbohydrate metabolism. White soil may naturally contain boron, but its availability to plants can be influenced by soil pH, organic matter content, and other factors. Boron deficiency in white soil can lead to various symptoms in plants, such as poor root development, stunted growth, and abnormal fruit development (Marschner, 2012). Excessive boron levels in soil can be toxic to plants, causing leaf burn, necrosis, and reduced yield (Marschner, 2012).
9) *Molybdenum (Mo):* Molybdenum is a component of enzymes involved in nitrogen metabolism and plays a crucial role in nitrogen fixation in legumes. White soil may naturally contain molybdenum, but its availability to plants can be influenced by soil pH, organic matter content, and other factors. Molybdenum deficiency in white soil can lead to symptoms such as yellowing of leaves, reduced growth, and impaired nitrogen fixation in legumes (Marschner, 2012).

III. MATERIAL & METHOD

Soil testing is an important process to assess soil fertility, nutrients and pH levels. It helps determine specific requirements for plant growth and allows proper amendments and fertilization. Here is a basic method of soil testing:

1) *Sample Collection:* Use a clean sampling tool (such as a soil auger or shovel) to collect soil samples. Collect several samples from different areas of the farm or garden to get a representative sample.Take samples at the appropriate depth for most agricultural and horticultural purposes, usually 6-8 inches.

2) *Sample Preparation:* Remove any plant debris, stones or roots from the soil sample. Mix the collected soil samples thoroughly in a clean container, breaking up clumps to ensure uniformity.
3) *Test Parameters:* Determine the specific parameters you want to test for, such as soil pH, nutrient levels (nitrogen, phosphorus, potassium, etc.), and organic matter content. pH testing can be done using a pH meter or soil pH testing kit. Nutrients can be analyzed through laboratory testing or by using soil testing kits available for specific nutrients. The amount of organic matter can be estimated through methods such as the loss-on-ignition technique or commercially available soil organic matter tests.
4) *Laboratory Testing:* Since we do not have a modern soil laboratory in our lab, we sent the soil samples to a nearby soil testing center. After testing, the soil testing center gave the following results, which are as follows:-

Table 1: Physico-chemical properties of white soil.

S.No.	Physio-chemical properties	Unit	Value in White Soil		Level Description/ Critical Level
			Sample A	Sample B	
01	Electrical Conductivity	Ds/m	0.47	0.27	Less than 1.0-Normal
02	pH-value	pH-Scale	6.44	6.35	Neutral 7
03	Carbone (C)	Kg/Hactare	0.44	0.41	Less than 0.50- Lower
04	Zinc (Zn)	mg/Kg	0.3	0.2	0.6
05	Cupper (Cu)	mg/Kg	0.1	0.2	0.2
06	Iron (Fe)	mg/Kg	1.5	1.2	4.5
07	Manganese (Mn)	mg/Kg	0.3	0.8	3.5
08	Boron (B)	mg/Kg	0.2	0.2	0.5
09	Molybdenum (Mo)	mg/Kg	0.1	0.1	0.2

IV. RESULT & DISCUSSION

Based on the data obtained from Table 1, these parameters can be discussed graphically in the following manner.-

Chart 1: Electrical Conductivity & pH value of sample with its critical level.

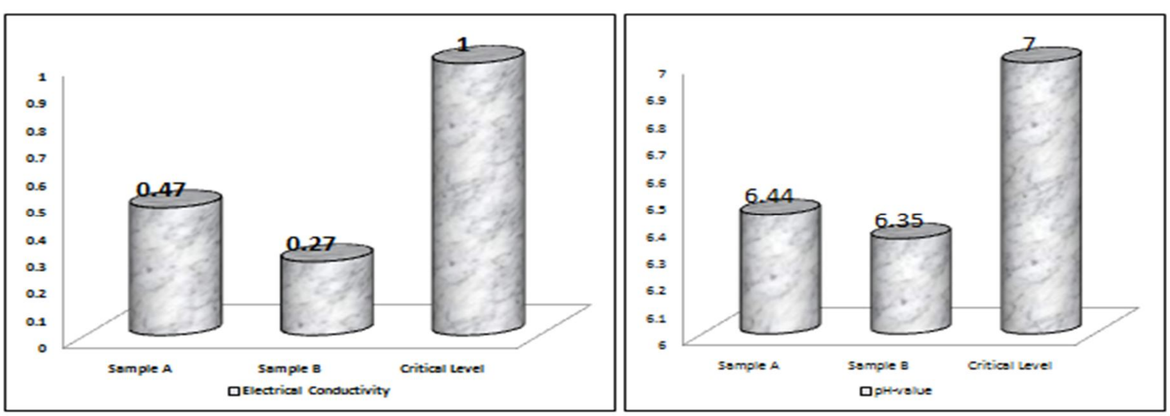


Chart 2: Carbon & Zink of sample with its critical level.

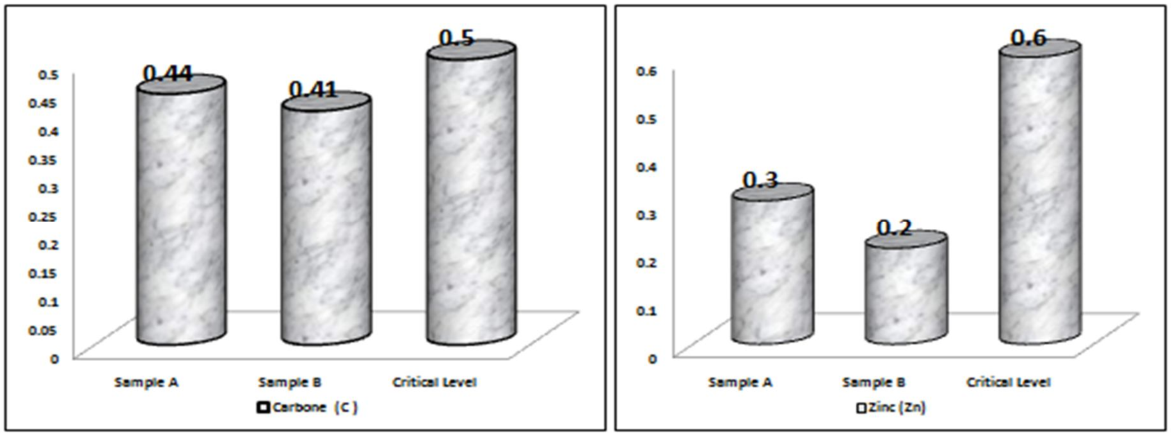


Chart 3 : Copper Iron of sample with its critical level.

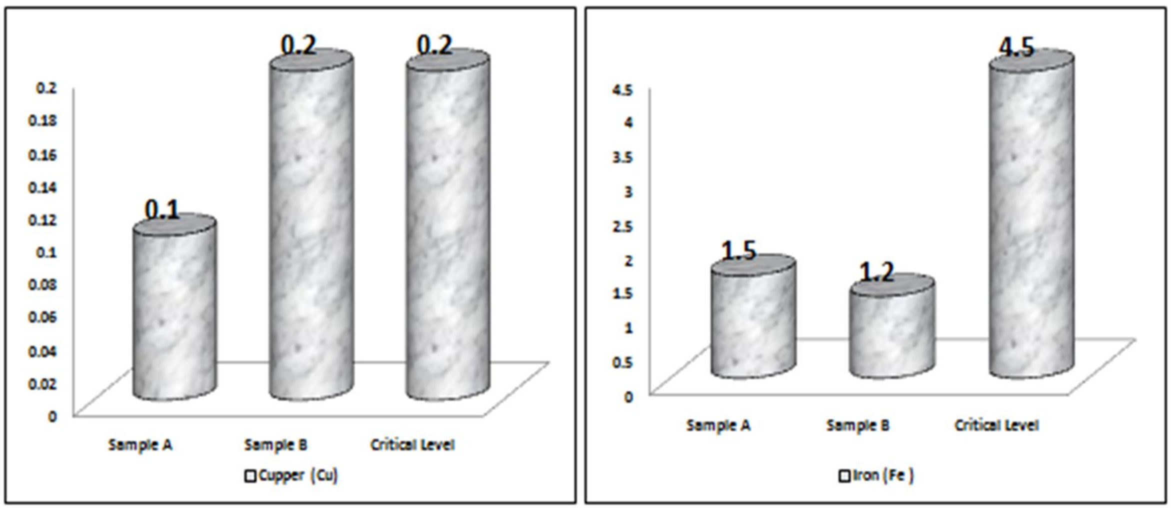


Chart 2: Manganese & Boron of sample with its critical level.

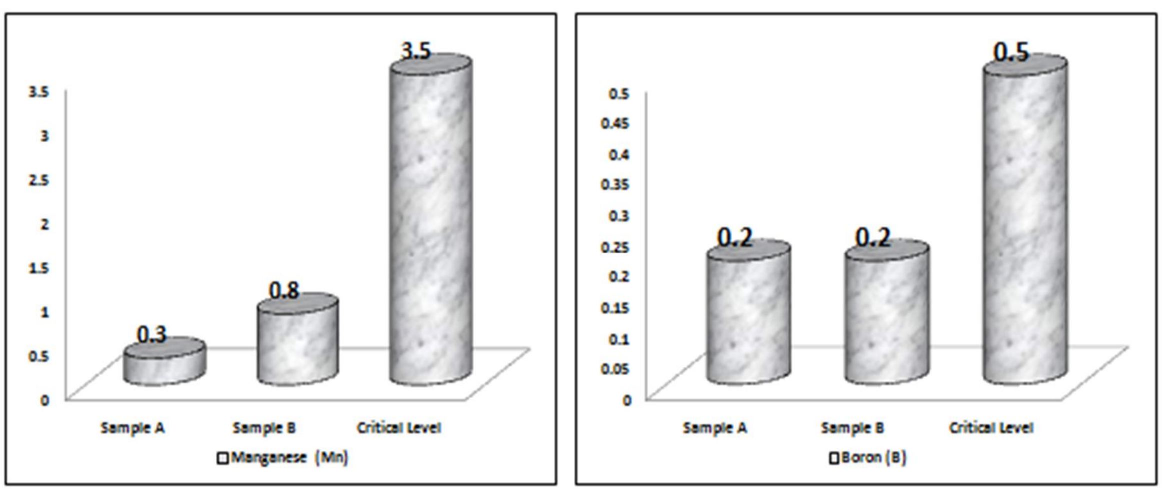
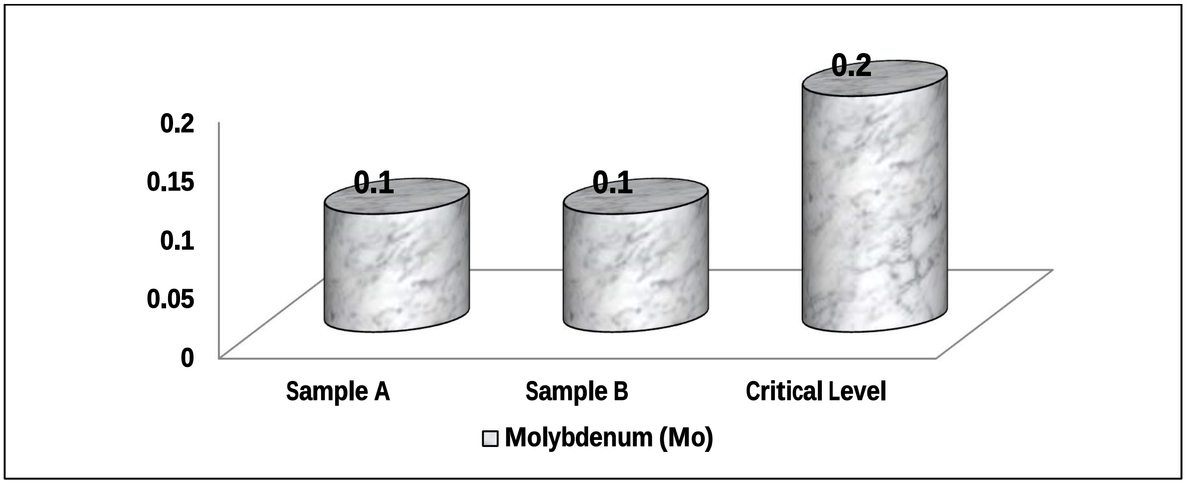


Chart 3: Molybdenum of sample with its critical level.



1) *Electrical Conductivity (EC):* Both Sample A (0.47) and Sample B (0.27) have electrical conductivity values below the critical level (1). This suggests that the water sources have relatively low levels of dissolved salts and minerals, which can be beneficial for various uses, such as irrigation or drinking water.
2) *pH-value:* Sample A has a pH value of 6.44, while Sample B has a pH value of 6.35. Both values are below the critical level of 7. Slightly acidic pH levels can impact aquatic ecosystems, potentially affecting the health and behavior of aquatic organisms.
3) *Carbon (C):* Sample A (0.44) and Sample B (0.41) both have carbon levels below the critical level of 0.5. Low carbon content can indicate lower levels of organic matter or pollution in the water, which can contribute to better water quality.
4) *Zinc (Zn), Copper (Cu), Iron (Fe), Manganese (Mn), Boron (B), Molybdenum (Mo):* Both Sample A and Sample B have levels of these elements below their respective critical levels. This suggests that the water sources have relatively low concentrations of these elements, which is generally desirable to prevent potential toxicity to aquatic organisms or adverse effects on water quality.

V. CONCLUSION

Based on the data obtained from Table 01, the following conclusions can be drawn: Electrical Conductivity (EC): The EC value in both sample A (0.47) and sample B (0.27) is below the critical level of 1, indicating that the salt content in the soil is relatively low. pH-value: The pH value of both Sample A (6.44) and Sample B (6.35) is within the desired range of 7 or below, indicating neutral to slightly acidic soil pH. Carbon (C): The carbon levels in both Sample A (0.44) and Sample B (0.41) are below the critical level of 0.5, which suggests that the amount of organic matter in the soil may be relatively low. Zinc (Zn): Zinc levels in both sample A (0.3) and sample B (0.2) are below the critical level of 0.6, indicating possible zinc deficiency in the soil. Copper (Cu): The copper level in both sample A (0.1) and sample B (0.2) is below the critical level of 0.2, indicating possible copper deficiency in the soil. Iron (Fe): Iron levels in both sample A (1.5) and sample B (1.2) are above the critical level of 4.5, indicating adequate iron content in the soil. Manganese (Mn): The level of manganese in sample A (0.3) is below the critical level of 3.5, while sample B (0.8) is within the desired limit. Boron (B): Boron levels in both sample A (0.2) and sample B (0.2) are below the critical level of 0.5, indicating possible boron deficiency in the soil. Molybdenum (Mo): Molybdenum levels in both sample A (0.1) and sample B (0.1) are below the critical level of 0.2, suggesting possible molybdenum deficiency in the soil.

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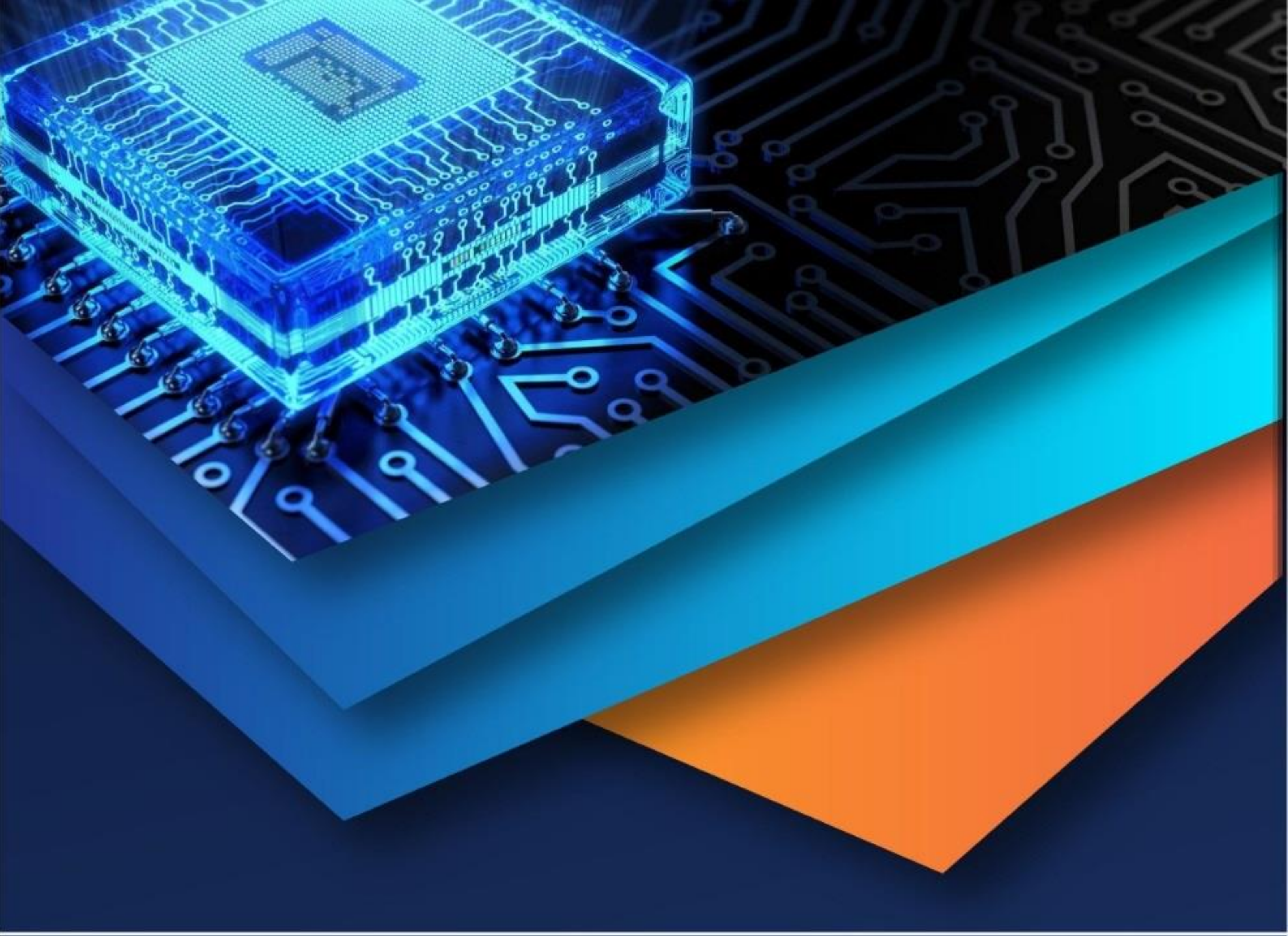

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