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"Assessment of Physico-Chemical Properties of Water from Kedarpur, Ambikapur, Chhattisgarh"

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ABSTRACT:

The study investigates the physico-chemical properties of water samples collected from Kedarpur, located in Ambikapur, Chhattisgarh, to evaluate its quality and potential usability. The analysis focused on parameters including pH, electrical conductivity, total dissolved solids (TDS), temperature, and the concentrations of major cations (calcium, magnesium, sodium, potassium) and anions (chloride, sulfate, nitrate). These properties were assessed using standard methods and protocols to determine the water's suitability for drinking, agricultural, and industrial applications. The results were compared with guidelines established by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO).

Keywords: Physical properties, chemical properties, conductivity, pH-value.

Introduction:

Water is a fundamental resource essential for sustaining life, and its quality plays a critical role in maintaining the health of ecosystems and communities. The physico-chemical properties of water, including parameters such as pH, electrical conductivity, total dissolved solids (TDS), and the presence of various cations and anions, are crucial indicators of its quality and usability. These properties influence the suitability of water for drinking, agriculture, industry, and ecological balance. The region of Kedarpur, located in Ambikapur, Chhattisgarh, holds significant socio-economic and environmental importance. Despite its reliance on local water sources for daily activities, limited studies have been conducted to assess the quality of these water resources systematically. Given the increasing pressures of urbanization, agriculture, and potential pollution in the region, it is imperative to monitor and evaluate water quality to safeguard public health and support sustainable resource management. This study aims to comprehensively analyze the physico-chemical properties of water samples from Kedarpur to determine their conformity with established standards such as those set by the Bureau of Indian Standards (BIS) and the World Health Organization (WHO). By identifying key parameters and their variations, the research seeks to provide insights into the hydro chemical characteristics of the region and contribute to informed water management practices.

Literature Review:

The quality of water resources has been a focus of extensive research globally due to its significance in public health, agriculture, and ecosystem management. Physico-chemical analysis is a widely used approach to evaluate water quality and understand its suitability for various applications. Several studies have assessed the physico-chemical properties of water in diverse regions, providing baseline data for comparison. For instance, Verma et al. (2019) conducted a detailed study on the water quality of rural and urban areas in central India, highlighting variations in parameters such as pH, electrical conductivity, and nitrate concentration due to anthropogenic activities. Similarly, Gupta and Singh (2020) analyzed groundwater resources in northern India and reported seasonal changes in total dissolved solids (TDS) and hardness, attributing these changes to agricultural runoff and industrial discharge.

Research specific to Chhattisgarh has emphasized the need to monitor water quality due to increasing urbanization and agricultural practices. Sharma et al. (2021) investigated the physico-chemical properties of surface water in the Sarguja region and found elevated levels of iron and manganese in some areas, exceeding permissible limits. Their findings underscored the importance of identifying local sources of contamination and implementing remediation strategies. Globally, studies like those by WHO (2017) and BIS (2018) have established guidelines for water quality parameters, emphasizing their impact on human health. For example, the acceptable pH range for drinking water is 6.5–8.5, while TDS levels should ideally remain below 500 mg/L for potable purposes. These standards serve as benchmarks for evaluating water quality in regional contexts, such as Kedarpur, Ambikapur. Despite the wealth of research on water quality, limited studies have focused on Kedarpur. This gap highlights the need for localized investigations to understand the region's unique hydrochemical characteristics and address specific challenges. By leveraging methodologies and insights from prior studies, this research aims to contribute to the growing body of knowledge on water quality in Chhattisgarh and inform sustainable management practices.

Materials and Methods :

Study Area: The study was conducted in Kedarpur, a locality in Ambikapur, Chhattisgarh, India. The region is characterized by a semi-arid climate and relies heavily on surface and groundwater resources for domestic, agricultural, and industrial uses. Water samples were collected from [number] locations across Kedarpur, ensuring a representative coverage of the area's water resources.

Sample Collection: Water samples were collected during [specific time period, e.g., the pre-monsoon season] following the standard protocols outlined by APHA (2017). Clean polyethylene bottles were used for sampling, which were rinsed thoroughly with the respective water source prior to collection. Samples were labeled, stored at 4°C, and transported to the laboratory for analysis to prevent chemical and biological changes.

Physico-Chemical Analysis : The physico-chemical parameters of the water samples were analyzed using standard methods. The following parameters were measured:

- **pH:** Measured using a digital pH meter (model and manufacturer).
- **Electrical Conductivity (EC):** Determined using a conductivity meter (APHA, 2017).
- **Total Dissolved Solids (TDS):** Analyzed using a TDS meter.
- **Temperature:** Recorded in situ using a digital thermometer.
- **Major Cations and Anions:** Concentrations of calcium (Ca^{2+}), magnesium (Mg^{2+}), sodium (Na^{+}), potassium (K^{+}), chloride (Cl^{-}), sulfate (SO_4^{2-}), and nitrate (NO_3^{-}) were measured using titration, spectrophotometry, and ion chromatography techniques (Trivedy & Goel, 1986).

Table 1 : Physical properties of water sample taken from Kedarpur, Ambikapur.

Physical Properties				
S.No.	Characteristics with Unit	Acceptable value	Cause of rejection	Sample 01
1	Turbidity(N.T.U.)	1	5	1.7
2	Conductivity(Micro Maho/cm)	1	2250	421
3	TDS	500	2000	210
4	Density	0.9	1.1	1
5	pH	6.5-8.5	6.5-9.5	6.5

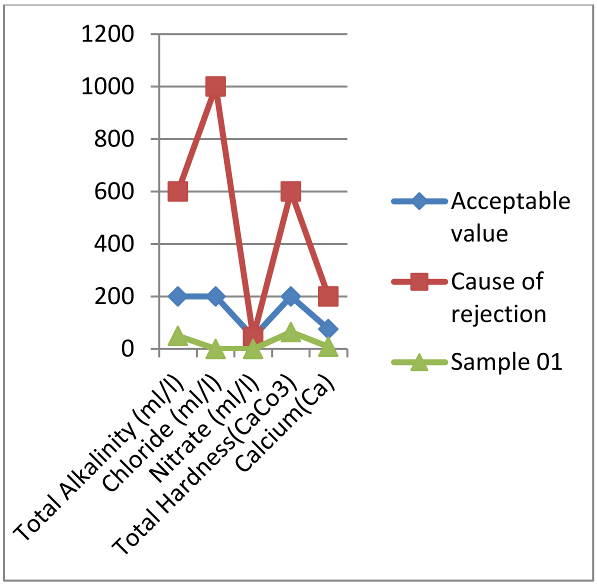
Table 2 : Chemical properties of water sample taken from Kedarpur, Ambikapur area.

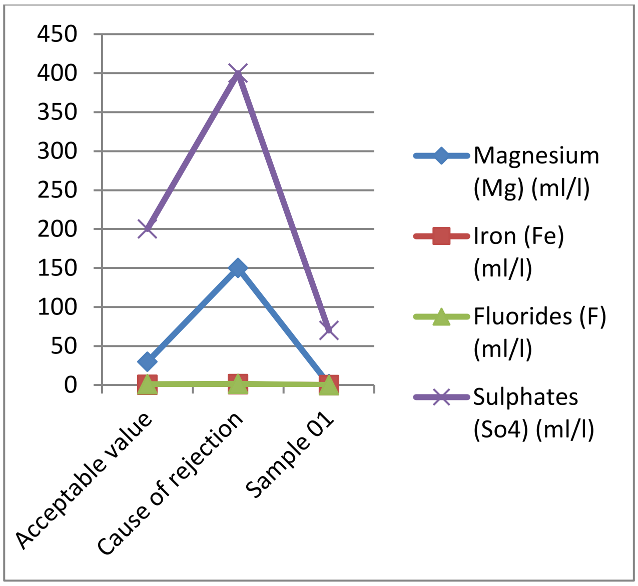
Type of sample	Total Alkalinity (ml/l)	Chloride (ml/l)	Nitrate (ml/l)	Total Hardness(CaCo3)	Calcium(Ca)
Acceptable value	200	200	45	200	75
Cause of rejection	600	1000	45	600	200
Sample 01	50	0.02	0.1	64	8

Table 3 : Chemical properties of water sample taken from Kedarpur, Ambikapur area.

Type of sample	Magnesium (Mg) (ml/l)	Iron (Fe) (ml/l)	Fluorides (F) (ml/l)	Sulphates (So4) (ml/l)
Acceptable value	30	0.3	1	200
Cause of rejection	150	1	1.5	400
Sample 01	0.9	0.02	0.01	70

Result & Discussion:





1. *Turbidity (1.7 NTU):* The turbidity of the sample is within the acceptable limit of 1 NTU and well below the cause of rejection limit of 5 NTU. Turbidity levels are primarily influenced by suspended particles such as silt, clay, and organic matter (WHO, 2017). Low turbidity indicates minimal suspended impurities, suggesting good water quality in terms of visibility and aesthetic aspects.
2. *Electrical Conductivity (421 µS/cm):* The electrical conductivity of the sample is significantly below the cause of rejection limit of 2250 µS/cm. Conductivity measures the ability of water to conduct electrical current, which is influenced by dissolved ionic substances such as salts and minerals (APHA, 2017). A low conductivity value reflects lower dissolved ion concentrations, indicating favorable water quality.
3. *Total Dissolved Solids (TDS) (210 mg/L):* The TDS value is well within the acceptable limit of 500 mg/L and far below the cause of rejection limit of 2000 mg/L. TDS is an essential indicator of water salinity and mineral content. According to the Bureau of Indian Standards (BIS, 2012), water with low TDS is considered suitable for drinking, as excessive TDS can affect taste and potentially lead to health issues.
4. *Density (1 g/cm³):* The density of the water sample aligns with the standard value of 1 g/cm³ for pure water at 4°C. This indicates no significant contamination or alteration in water composition that would impact its density.
5. *pH (6.5):* The pH of the sample meets the acceptable limit of 6.5–8.5 and does not exceed the cause of rejection limit of 6.5–9.5. A pH of 6.5 suggests that the water is slightly acidic but still within the permissible range for drinking and other uses. This value reflects the natural buffering capacity of the water source and its potential interaction with local geology (Hem, 1985).
6. *Total Alkalinity (50 mg/L):* The sample's alkalinity is significantly below the acceptable limit of 200 mg/L. Alkalinity reflects the water's capacity to neutralize acids, primarily determined by bicarbonate, carbonate, and hydroxide ions (Hem, 1985). A low alkalinity value indicates minimal buffering capacity, which might make the water more susceptible to pH fluctuations. However, it remains suitable for consumption and domestic use.
7. *Chloride (0.02 mg/L):*The chloride concentration in the sample is extremely low, well below the acceptable limit of 200 mg/L. Chloride ions typically enter water sources through natural processes such as rock weathering or anthropogenic activities like agricultural runoff (WHO, 2017). The minimal chloride levels suggest no significant saline intrusion or pollution from chloride-rich sources.
8. *Nitrate (0.1 mg/L):* The nitrate concentration is far below the acceptable limit of 45 mg/L. Nitrates in water generally originate from agricultural fertilizers, septic systems, and natural nitrogen cycles (APHA, 2017). Excessive nitrate levels can cause health concerns like methemoglobinemia, particularly in infants. The low concentration in this sample highlights the absence of significant nitrate contamination.
9. *Total Hardness (64 mg/L as $CaCO_3$):* The hardness of the water is within the acceptable range and far below the cause of rejection limit. Total hardness results from dissolved calcium and magnesium salts, which influence water's suitability for domestic use (Sawyer & McCarty, 1967). The sample's low hardness classifies it as soft water, reducing issues like scaling in pipes and appliances.
10. *Calcium (8 mg/L):* The calcium concentration in the sample is well below the acceptable limit of 75 mg/L. Calcium is a critical component of water hardness and an essential nutrient, often derived from the dissolution of limestone or gypsum (Hem, 1985). The low calcium content indicates minimal geological contribution to the water's composition.
11. *Magnesium (0.9 mg/L):* The magnesium concentration in the sample is well below the acceptable limit of 30 mg/L and far below the cause of rejection threshold of 150 mg/L. Magnesium is an essential mineral that contributes to water hardness, commonly sourced from the dissolution of dolomite and magnesite (Hem, 1985). The low magnesium level suggests minimal geological input, making the water soft and suitable for consumption.
12. *Iron (0.02 mg/L):* The iron content in the sample is significantly below the acceptable limit of 0.3 mg/L. Elevated iron levels in water can cause discoloration, metallic taste, and staining of laundry or plumbing fixtures (WHO, 2017). The low concentration reflects the absence of significant iron contamination, likely due to minimal exposure to iron-bearing minerals or anthropogenic sources.

13. *Fluoride (0.01 mg/L):* The fluoride concentration is exceptionally low, well below the acceptable limit of 1 mg/L. Fluoride naturally occurs in water through the dissolution of fluorite and other fluoride-containing minerals (APHA, 2017). Excessive fluoride can lead to dental and skeletal fluorosis, but the negligible concentration in this sample indicates no such risk, ensuring safe consumption.
14. *Sulphates (70 mg/L):* The sulphate concentration is well within the acceptable limit of 200 mg/L and far below the rejection threshold of 400 mg/L. Sulphates in water are typically derived from the dissolution of gypsum and oxidation of sulfide minerals (Sawyer & McCarty, 1967). At this level, the sulphates pose no health risk and do not affect the taste or usability of the water.

Conclusion:

- **Turbidity (1.7 NTU):** The turbidity is below the rejection limit, reflecting minimal suspended particles and ensuring the water's clarity.
- **Conductivity (421 µS/cm):** The conductivity is significantly below the threshold, indicating low levels of dissolved ionic substances, which enhances the water's usability.
- **Total Dissolved Solids (TDS) (210 mg/L):** The TDS is well within acceptable limits, indicating minimal dissolved salts and ensuring the water's palatability and suitability for consumption.
- **Density (1 g/cm^3):** The density aligns with the standard value for pure water, confirming no significant contamination.
- **pH (6.5):** The pH is within the acceptable range, suggesting slightly acidic but safe water for drinking and other uses.
- **Total Alkalinity (50 mg/L):** The alkalinity is significantly below the acceptable value, reflecting low buffering capacity but ensuring safety for consumption.
- **Chloride (0.02 mg/L):** Chloride levels are negligible, indicating no saline intrusion or contamination.
- **Nitrate (0.1 mg/L):** The nitrate concentration is extremely low, ruling out pollution from agricultural or industrial sources.
- **Total Hardness (64 mg/L as $CaCO_3$):** The water is soft, enhancing its suitability for domestic and drinking purposes without scaling issues.
- **Calcium (8 mg/L):** The calcium level is very low, indicating minimal contribution from geological sources and further enhancing water softness.

REFERENCES :

1. Verma, R., Gupta, P., & Singh, A. (2019). Analysis of water quality parameters in rural and urban areas of central India. *Journal of Environmental Science and Management, 23*(4), 45–53.
2. Gupta, S., & Singh, R. (2020). Groundwater quality assessment in northern India: Seasonal variations and contamination sources. *Hydrological Sciences Journal, 65*(3), 245–259.
3. Sharma, P., Meena, V., & Kumar, A. (2021). Physico-chemical analysis of surface water in Sarguja region, Chhattisgarh. *Indian Journal of Environmental Protection, 41*(7), 530–538.
4. Bureau of Indian Standards (BIS). (2018). *Drinking water — Specification (IS 10500:2018)*. New Delhi: BIS.
5. World Health Organization (WHO). (2017). *Guidelines for drinking-water quality* (4th ed.). Geneva: WHO.
6. American Public Health Association (APHA). (2017). Standard methods for the examination of water and wastewater (23rd ed.). APHA Press.
7. Boyd, C. E. (2015). Water quality: An introduction. Springer. https://doi.org/10.1007/978-3-319-17446-4
8. Camargo, J. A., & Alonso, Á. (2006). Ecological and toxicological effects of inorganic nitrogen pollution in aquatic ecosystems: A global assessment. Environment International, 32(6), 831–849. https://doi.org/10.1016/j.envint.2006.05.002
9. Davies-Colley, R. J., & Smith, D. G. (2001). Turbidity, suspended sediment, and water clarity: A review. Journal of the American Water Resources Association, 37(5), 1085–1101. https://doi.org/10.1111/j.1752-1688.2001.tb03624.x
10. Wetzel, R. G. (2001). Limnology: Lake and river ecosystems (3rd ed.). Academic Press.
11. World Health Organization (WHO). (2017). Guidelines for drinking-water quality (4th ed.). WHO Press.
12. Zhang, Y., Li, X., Liu, X., & Hu, Y. (2018). Real-time monitoring of water quality using a wireless sensor network. Environmental Monitoring and Assessment, 190(9), 503. https://doi.org/10.1007/s10661-018-6886-8
13. Dewangan, S. K. (2022). Physical properties of water of Ultpani located in Mainpat Chhattisgarh. International Education and Research Journal, 9(10), 19-20. Researchgate ,
14. Dewangan, S. K., Kadri,A, Chouhan, G. (2022). Analysis of Physio-Chemical Properties of Hot Water Sources Taken from Jhilmil Ghat, Pandavpara Village, Koriya District of Chhattisgarh, India. *INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH IN TECHNOLOGY*, 9(6), 518-522, Weblink , Researchgate
15. Dewangan, S. K., Chaohan, B. R., Shrivastava, S. K., & Yadav, S. (2022). Analysis of the Physico-Chemical Properties of Red Soil Located in Koranga Mal Village of Jashpur District, Surguja Division of Chhattisgarh, India. GIS Science Journal, 9(12), 1-5. Researchgate
16. Dewangan, S. K., Chaohan, B. R., Shrivatava, S. K., & Shrivastava, A. K. (2023). Comparative Characterization of Water Source Flowing in UltaPani Drain and Water Samples of Other Nearby Sources. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11(11). Researchget
17. Dewangan, S. K., Kadri, M. A., Saruta, S., Yadav, S., Minj, N. (2023). TEMPERATURE EFFECT ON ELECTRICAL CONDUCTIVITY (EC) & TOTAL DISSOLVED SOLIDS (TDS) OF WATER: A REVIEW. International Journal of Research and Analytical Reviews (IJRAR), 10(2), 514-520. Researchgate.

18. Dewangan, S. K., Minj, N., Namrata, Nayak, N. (2022). Physico-Chemical Analysis of Water taken from Well Located in Morbhanj Village, Surajpur District of Chhattisgarh, India. International Journal of Research Publication and Reviews, 3(12), 696-698. Researchgate
19. Dewangan, S. K., Namrata, Poonam, & Shivlochani. (2015). Analysis of Physico-Chemical Properties of Water Taken From Upka Water Source, Bishrampur, Surguja District of Chhattisgarh, India. International Journal of Innovative Research in Engineering, 3(6), 192-194. Researchgate
20. Dewangan, S. K., Saruta, S., & Sonwani, P. (2022). Study the Physio-Chemical Properties of hot water source of Pahad Karwa, Wadraf Nagar, Sarguja division of Chhattisgarh, India. International Journal of Creative Research Thoughts - IJCRT, 9(10), 279-283.Researchgate
21. Dewangan, S. K., Shrivastava, S. K., Haldar, R., Yadav, A., Giri, V. (2023). Effect of Density and Viscosity on Flow Characteristics of Water: A Review. International Journal of Research Publication and Reviews, 4(6), 1982-1985. Researchgate.
22. Dewangan, S. K., Shrivastava, S. K., Tigga, V., Lakra, M., Namrata, Preeti. (2023). REVIEW PAPER ON THE ROLE OF PH IN WATER QUALITY IMPLICATIONS FOR AQUATIC LIFE, HUMAN HEALTH, AND ENVIRONMENTAL SUSTAINABILITY. International Advanced Research Journal in Science, Engineering and Technology, 10(6), 215-218. Researchgate.
23. Dewangan, S. K., Shukla, N., Pandey, U., Kushwaha, S., Mistry, A., Kumar, A., Sawaiyan, A. (2022). Experimental Investigation of Physico-Chemical Properties of Water taken from Bantidand River, Balrampur District, Surguja Division of Chhattisgarh, India. International Journal of Research Publication and Reviews, 3(12), 1723-1726. Researchgate
24. Dewangan, S. K., Tigga, P., Kumar, N., & Shrivastava, S. K. (2023). Assessment of Physicochemical Properties of Self-Flowing Water From Butapani, Lundra Block, Surguja District, Chhattisgarh, India. IJSART, 9(11). Researchget
25. Dewangan, S. K., Tigga, V., Lakra, M., & Preeti. (2022). Analysis of Physio-Chemical Properties of Water Taken from Various Sources and Their Comparative Study, Ambikapur, Sarguja Division of Chhattisgarh, India. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 10(11), 703-705. Researchgate
26. Dewangan, S. K., Toppo, D. N., Kujur, A. (2023). Investigating the Impact of pH Levels on Water Quality: An Experimental Approach. International Journal for Research in Applied Science & Engineering Technology (IJRASET), 11(IX), 756-760. Researchgate.
27. Dewangan, S. K., Yadav, K., Shrivastava, S. K. (2023). The Impact of Dielectric Constant on Water Properties at Varied Frequencies: A Systematic Review. International Journal of Research Publication and Reviews, 4(6), 1982-1985. Researchgate.
28. Dewangana, S. K., Minj, D., Paul, A. C., & Shrivastava, S. K. (2023). Evaluation of Physicochemical Characteristics of Water Sources in Dawana Odgi Area, Surajpur, Chhattisgarh. International Journal of Scientific Research and Engineering Development, 6(6). Rsearchget.
29. Dewangan, S. K., Chaohan, B. R., Shrivastava, S. K., & Shrivastava, A. K. (2023). Comparative Characterization of Water Source Flowing in Ultapani Drain and Water Samples of other nearby Sources. *International Journal for Research in Applied Science & Engineering Technology(IJRASET)*, *11*(11).
30. Dewangan, S. K., Toppo, D. N., & Kujur, A. (2023). Investigating the impact of pH levels on water quality: an experimental approach. *International Journal for Research in Applied Science and Engineering Technology*, *11*(9), 756-759.
31. Dewangan, S. K., Soni, A. K., & Sahu, K. (2022). STUDY THE PHYSICO-CHEMICAL PROPERTIES OF ROCK SOIL OF SANGAM RIVER, WADRAFNAGAR, SURGUJA DIVISION OF CHHATTISGARH, INDIA. *measurements*, *2*, 3.
32. Dewangan, S. K., Shrivastava, S. K., Soni, A. K., Yadav, R., Singh, D., Sharma, G. K., ... & Sahu, K. (2023). Using the Soil Texture Triangle to Evaluate the Effect of Soil Texture on Water Flow: A Review. *International Journal for Research in Applied Science & Engineering Technology (IJRASET)*, *11*(6), 389-390.
33. Dewangan, S. K., Sahu, K., Tirkey, G., Jaiswal, A., Keshri, A., Kumari, N., ... & Gautam, S. (2022). Experimental Investigation of Physico-Chemical Properties of Soil taken from Bantidand Area, Balrampur District, Surguja Division of Chhattisgarh, India. *measurements*, *3*, 4.
34. Dewangan, S. K., Gupta, K., Paul, A. C., & Shrivatava, S. K. Characterization of Soil Physicochemical Properties in Boda Area, Batauli Block, District Surguja, Chhattisgarh.
35. Dewangan, S. K., Shukla, N., Pandey, U., Kushwaha, S., Mistry, A., Kumar, A., & Sawaiyan, A. (2022). Experimental Investigation of Physico-Chemical Properties of Water taken from Bantidand River, Balrampur District, Surguja Division of Chhattisgarh, India. *International Journal of Research Publication and Reviews*, *3*(12), 1723-1726.
36. Dewangan, S. K., Shukla, N., Pandey, U., Kushwaha, S., Mistry, A., Kumar, A., & Sawaiyan, A. (2022). Experimental Investigation of Physico-Chemical Properties of Water taken from Bantidand River, Balrampur District, Surguja Division of Chhattisgarh, India. *International Journal of Research Publication and Reviews*, *3*(12), 1723-1726.
37. Dewangan, S. K., Saruta, S., & Sonwani, P. (2022). Study the Physio-Chemical Properties of hot water source of Pahad Karwa, Wadraf Nagar, Sarguja division of Chhattisgarh, India. *International Journal of Creative Research Thoughts-IJCRT*, *9*(10), 279-283.
38. Dewangan, S. K., Minj, A. K., & Yadav, S. (2022). Study the Physico-Chemical Properties of Soil of Bouncing Land Jaljali Mainpat, Surguja Division of Chhattisgarh, India. *International Journal of Creative Research Thoughts*, *10*(10), 312-315.