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Improvement in Technologies for Assessment of Drinking Water Quality in Rural Areas of Manikpur Block in District Chitrakoot (U.P.)

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Abstract: ***Drinking water is a basic requirement for life and survival of animals and plants. Unpotable water results in many water borne diseases viz: diarrhoea, fluorosis, cholera, colitis, etc. these ailments potentially constrain human resource development and productivity, especially of the poor. However, around 22 percent of households in India lack access to safe drinking water sources, like tap, hand-pump and tube well (Census 2001). Low income communities which rely on untreated surface and ground waters supplies for the domestic uses are the most exposed to the impact of poor water quality. Availability of potable water will ensure the sustainability of socio-economic development. However, more than 90% of the rural population uses untreated ground water. Nearly half of the population is not at all aware of the water borne diseases affecting their health. Having in view the current drawbacks of portability of water in entire Bundelkhand region. The present study in this regard was carried out in rural area of Manikpur Block in Chitrakoot (U.P.). The Block comprises 62 villages which are facing great shortage of drinking water as regards its quality and availability. The only resource is ground water from deep strata, which is unsuitable due to rocks, erosions; they release Fluoride, Iron etc. The recent improvement in technologies regarding assessing such water were followed as per water quality indices (WQI's) and GIS techniques viz: physico-chemical factors- colour, turbidity, taste, odour, conductivity, pH, D.O., B.O.D, Ammonical nitrogen, Nitrate, Fluoride, Iron and bacteriology. i.e E.coli, total coliform, besides meteorological data were also considered during the course of study March-June, 2014.***
Keywords: ***Water quality indices (WQI's), GIS, Physico-chemical factors, Bacteriology and meteorology.***

I. INTRODUCTION

Safe and adequate quantity of drinking water is an essential input for life. Aqua is the base of all life and an abundant compound on the earth's surface. Fortunately 71% of the earth surface is covered by surface water. But unfortunately only 3% of fresh water is available as drinking and other purposes. Earth's approximate water volume (the total water supply of the world) is 136000000 km^3. Surface water categories are two i.e. marine and fresh water. It is present on the surface as well as water table. Seas and oceans are major source of water, these contain approximately 97% of total as water sea water, whereas rest 3% water is fresh water. It is found in forms of ice, glaciers, rivers, reservoirs etc. But 2% of water is frozen in glaciers and ice and only 1% of water is available for us. Surface fresh water is 0.4% and only 0.6% as ground water, but the entire ground water is not available for us, some part of it is taken out by drilling for the various uses. Thus less than 1% of water is in utilization. Obviously the crisis of water exists. Approximately 1.3 Arab people are in crisis for drinking water at present time. Times of India reported (March 2007).

Water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water, rock water interaction time, mineral weathering, ion exchange process and sub-surface geochemical processes. Temporal changes in the source and nature of the recharged water, hydrologic and human factors may cause periodic changes in groundwater quality (Milovanovic, M., 2007). Due to the unavailability of surface water at many places, groundwater is the only alternative source of good quality water in rural areas. While access to drinking water in India has increased over the past decade, the tremendous adverse impact of unsafe water on health continues (WHO/UNICEF 2004; Singh et al., 2012).

At present the availability of drinking water is a great threat for the society all over India. The average annual requirement of fresh water in the country in 1985 was 540 km^3 which has been increased to 750 km^3 by 2000 A.D. and will be 1050 km^3 by 2025 A.D. The 2001 Census reported that 68.2 per cent of households in India have access to safe drinking water.

According to latest estimates, 94 per cent of the rural population and 91 per cent of the people living in urban areas have access to safe drinking water. Data available with the Department of Drinking Water Supply shows that of the 1.42 million rural habitations

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in the country, 1.27 million are fully covered (FC), 0.13 million are partially covered (PC) and 15,917 are not covered (NC).However, coverage refers to installed capacity, and not average actual supply over a sustained period or the quality of water being supplied which is the most essential part.

One of the most critical challenges that face rural villages is to secure an adequate source of water in terms of quantity and quality. With increasing growth of the population the per capita water availability has fallen from over 5,000 m3/year to about 1,700 m3/year. This results in is due to massive over-exploitation of groundwater mostly to meet irrigation demand, resulting in an increasing scarcity for drinking water during summer months. The status of groundwater development is more than 100% in the States of Delhi, Haryana, Punjab and Rajasthan. More than

15% of the total blocks in the States of Andhra Pradesh, Delhi, Gujarat, Haryana, Karnataka, Punjab, Rajasthan and Tamil Nadu are over-exploited or critical in terms of ground water development. Due to deeper drilling of aquifers, drinking water sources are increasingly becoming contaminated with natural contaminants like fluoride, arsenic and salinity.

The Government of India launched the National Rural Drinking Water Quality Monitoring and Surveillance Programme in February 2006. This envisages institutionalization of community participation for monitoring and surveillance of drinking water sources at the grassroots level by gram panchayats and Village Water and Sanitation Committees, followed by checking the positively tested samples at the district and state level laboratories. One major problem when it comes to addressing the problems related to water is that the provisions for water are distributed across various ministries and institutions. With several institutions involved in water supply, intersectoral coordination becomes critical for the success of any programme. A report of world health organization (2002) says that around 700000 Indians die each year from diarrhoea. In foreign countries like U.S. polluted water is filtered in various stages to make it fit for drinking purpose. Whereas in India this advanced technology is not being done. Here only a very simple process for minor purification water is adopted in which polluted water is purified by using disinfectants such as Chlorine, Bleaching powder. The contaminated Drinking water is hazardous for human beings. It may be fatal also. The untreated water may cause defects in nervous system, organ damage reproductive effects and cancer like fatal diseases water with nitrates at sufficiently high levels, can result in potentially fatal alternations in the haemoglobin of infants and very young children called blue baby syndrome.

According to the Central Pollution Control Board (2000), 90% of the water supplied in Indian towns and cities are polluted out of which only 1.6% gets treated.

Bundelkhand region is already facing surface water crisis along with ground water which can be used for various needs but it is already lower water table than other places. Besides draught in last seven years and this year too has caused more deeper strata of the ground water due to lack of percolation of less rain water.

As regards Chitrakoot district is one of the district of Chitrakoot Dham mandal. This whole region lies in the Vindhya region which is plateau geographically Manikpur Block in District Chitrakoot is facing crisis of potable water as well as irrigational water because only two small rivers which have little volume of water. Manikpur block and Tehsil is facing greatest shortage of drinking and irrigational water in the whole Chitrakoot district. The area of cultivation is very less the major area is much plateau forest of low economic value. Tendu patta plants which are used in bidi works are much, Besides tribal races/tribals as “Kol” are found as major population. The economic condition is very low. The aera is well known as “Patha”. So this area needs exhenstic research work for the betterment of the society.

Having inview unpotability of water assessment of Drinking water is taken for the present study at rural areas of Manikpur Block at Chitrakoot (U.P.). This is a burning problem for the human life.

To meet out the crisis of water Patha Pey Jal Pariyojna was established in 1974 but it also has not been proved effective. So a number of hand pumps and tube wells were set to ful fill the shortage of drinking water ,especially in rural areas in Manikpur Block. Besides shortage of water in this area Drinking water is also contaminated which causes various water born-diseases viz – Diarrhoea, Cholera, Typhoid , hepatitis, colic dysentery etc. As no physico –chemical and microbiological analysis has been done yet in this Block . So this important work was carried out scientifically to find out the pollution problems along with the suggestions for proper management on the drinking water. By taking all scientific parameters under the above heads along with metereological conditions. All the measures for fulfilling the deficiencies were chalked out ,by which the drinking water might be suitable for healthy life.

II. MATERIAL AND METHODS

Samples were collected from March 2014 to June 2014 particularly in pre-monsoon season. The studies were carried out for three

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months during the end of winter season to summer season. Selections of seven different stations were identified and seven water samples were collected at sites and assigned as S1, S2, S3, S4, S5, S6, and S7. The main aim of the study was to investigate the physico-chemical characteristics of water samples in rural areas of Manikpur Block in Chitrakoot district (U.P.), because most of these samples are located in the rural areas of the Manikpur Block. Sample sites are described in Table 1. Samples were collected from the sites in between 10:00 a.m. to 11:30 a.m. Sample for the analysis of dissolved oxygen was collected in BOD bottle (250 ml), by Winkler's 'A' and Winkler's 'B' solution at site.

The parameters like Temperature and Turbidity was recorded at the site. For the analysis of other chemical parameters, the samples were collected in plastic can and carried to the laboratory on same day .

Table 1: Table1. Description of water sampling sites

Sampling Code	Source	Location
S1	Hand-pump	In front of chiraunjiya house in Rural Sarhat Village
S2	Hand-pump	In the campus of Primary Vidyalaya in Hela Village
S3	Hand-pump	In front of Shivpujan Singh House in Rampur Village.
S4	Hand-pump	In front of Shivlakhan House in Gopipur Village.
S5	Hand-pump	Near Hanuman mandir in Ranipur Village.
S6	Hand-pump	in the campus of Primary Vidyalaya in Shekhapur Village.
S7	Hand-pump	Ghati kolan , Ghati in Saraiya Village.

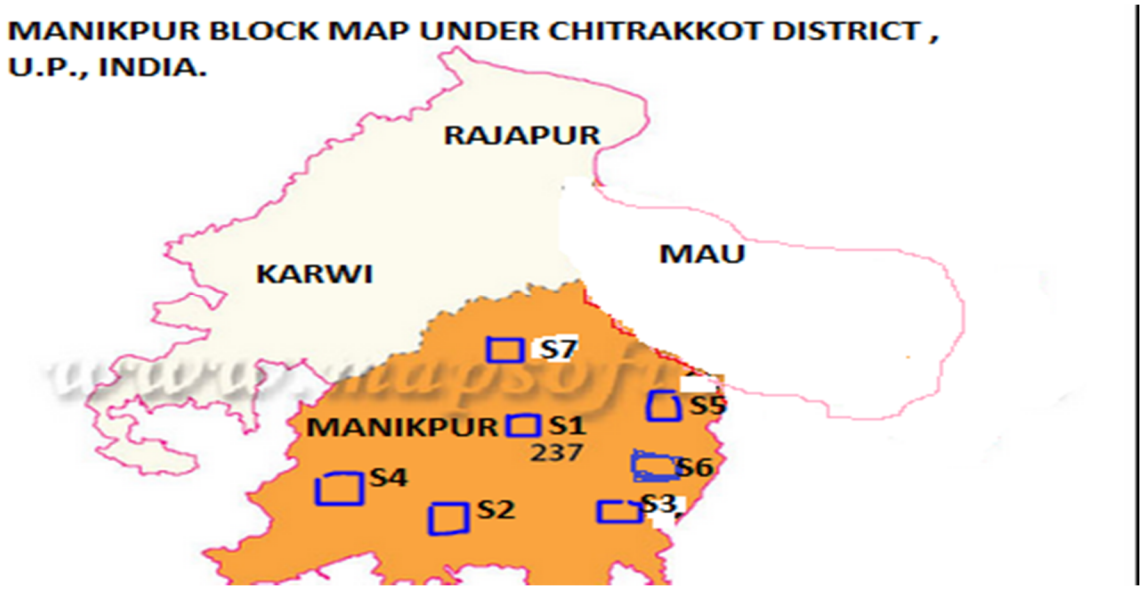

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Table 2: Values of physico-chemical parameters of seven sampling stations of Rural areas of Manikpur Block, Chitrakoot district(U.P.)

S.No	Parameter Studied	Site S1	Site S2	Site S3	Site S4	Site S5	Site S6	Site S7
1	pH	8.2	8.7	8.5	8.4	8.7	8.1	8.5
2	T.A.(mg/l)	542	536	425	565	537	463	515
3	C.O.D (mg/l)	4.62	4.92	5.61	4.32	5.36	5.12	5.14
4	D.O (mg/l)	6.9	5.2	5.8	6.3	4.2	4.8	5.3
5	CHLORIDES (mg/l)	127	138	142	125	142	131	127
6	FLOURIDES (mg/l)	0.69	0.58	0.52	0.64	0.68	0.64	0.59
7	TOTAL HARDNESS (mg/l)	226	338	256	324	229	258	290
8	TOTAL DISSOLVE SOLIDS (mg/l	286	552	227	245	315	346	318
9	TURBIDITY(NTU)	1.9	2.2	1.6	1.4	1.9	2.1	2.5
10	IRON (mg/l)	0.48	0.75	0.42	0.59	0.65	0.66	0.72
11	TASTE/ ODOUR	Unsatisfactory	Unsatisfactory	Satisfactory	Satisfactory	Unsatisfactory	Unsatisfactory	Unsatisfactory

Table : 3 Values of Bacteriology test during the study period .

M.P.N(Org/l)	Site S1	Site S2	Site S3	Site S4	Site S5	Site S6	Site S7
Total coliform Bacteria	892	796	852	856	782	752	724
E.Coli	536	548	578	625	512	612	502

The Physico-chemical parameters along with micro-organism viz.– MPN/SPC of Coliform bacteria will be analysed as per the standard methods given in American Public Health Association (APHA), American Water Works Association (AWWA) and Water Environment Federation (WEF) 21st 2005.

Physical parameters – Colour, turbidity, Chemical factors -pH, total hardness, fluorides, D.O., T.D.S, Cl^-, Nitrate, Iron etc.

III. RESULT AND DISCUSSION

The examined physico-chemical and bacteriological parameters showed considerable variations in different samples. The observations are depicted in table-2 and 3.

A. PH

The effect of P^H on the chemical and biological nature of water makes for determinations is very important. It is defined as-log

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[H^+], and measured as intensity of acidity or alkalinity on a scales ranging from 0-14. The freee H^+ are more it is expressed acidic (i.e P^H<7), while more OH- ions is expressed as alkaline (i.e P^H>7). Ph value of surface and ground water ranged from 8.1 to 8.7. The acidic medium of water is quite harmful. Whereas alkaline medium above 7 to 9.5 is suitable for fish culture and other biota.

B. Turbidity

It shows light-transmitting properties of water and is comprised of suspended and colloidal material, which is concerned with health. This is unsafe for consumption and industrial use also. In the course of study turbidity was observed 1.4 to 2.5 N.T.U.

C. Odour/Taste

It is felt in colored water which is unsuitable for drinking. The cause is the leaching organic materials and chemicals near water resources. As S3, S4, water was satisfactory, whereas S1,S2, S5,S6, S7 it was of unsatisfactory taste.

D. Total hardness

It is an important parameter in decreasing the toxic effect. During the course of study it was found to be in the range of 226-338 mg/lit. Which is within the desirable limit as compared with BIS?

E. TDS

These are in dissolved state in solution. Water with high dissolved solids generally are of inferior potability and may inducean unfavourable physiological reaction in the transient consumer. The TDS of all the samples were in the range of 227 to 552 mg/lit.

F. D.O

Dissolved oxygen (DO) ranged from 4.2 to 6.9 mg/lit. It may be present in water due to direct diffusion from air and photosynthetic activity of autotrophs in surface water. Concentration of D.O is one of the most important parameters of indicate water purity.

G. Fluoride

Its high concentration causes dental fluorosis and lower concentration (<0.8 mg/l) causes dental carries, sources of fluoride are found in coke, glass, and ceramic, electronic, pesticide and fertilizers. Fluoride of all the samples were in range 0.52 to 0.69 mg/l.

H. Chloride

The presence of chloride in natural waters can mainly be attributed to dissolution of salt deposits in the form of ions (Cl^-). High chloride content has a deleterious effect on metallic pipes. Chloride was found to be in the range of 125 to 142 mg/l.

I. C.O.D

Variation of COD (mg/l) of different sites in rural areas of Manikpur Block Chitrakoot district is varied from 4.32 to 5.61 mg/l (ppm).

J. Iron

Iron is also very important to human and other organisms, as it is partially responsible for transporting oxygen through the bloodstream. Iron is easily dissolved in water and can be found naturally occurring in water bodies. Iron is an essential element for human nutrition and metabolism. But in large quantities results in toxic effect like haemochromoitosis in tissues if more iron accumulation takes place. The maximum permissible limit of Fe in drinking water is 0.3 ppm. Iron content of different sites in rural areas of Manikpur Block Chitrakoot district is in the range of 0.42 to 0.75 mg/l, which is very high compared to standard values. Water sample from the sites in rural areas of Manikpur Block contain high value of Fe. The high concentration of Iron may be due to high percentage of pyrites.

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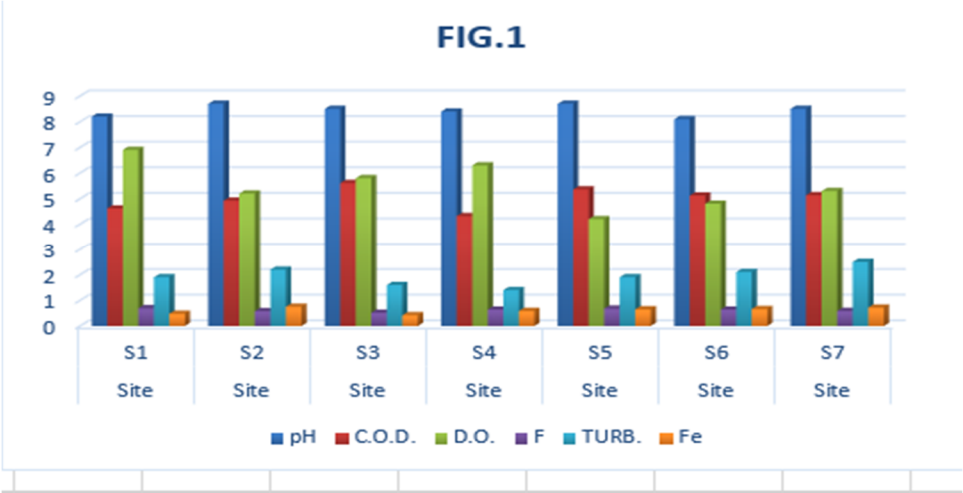
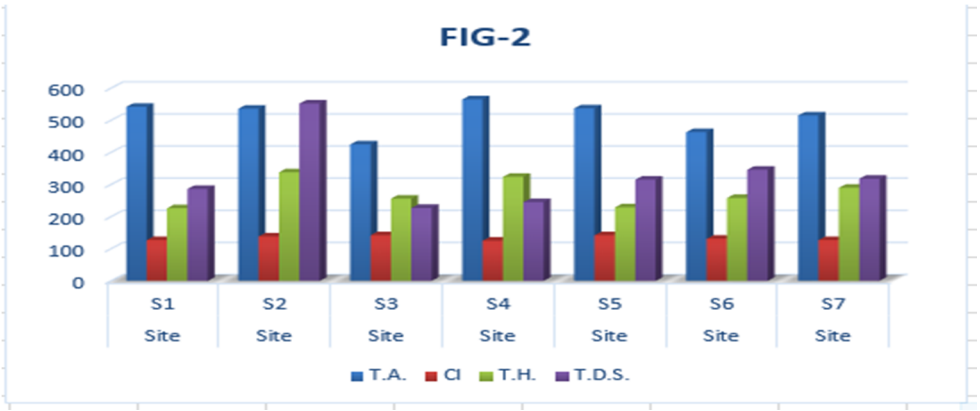
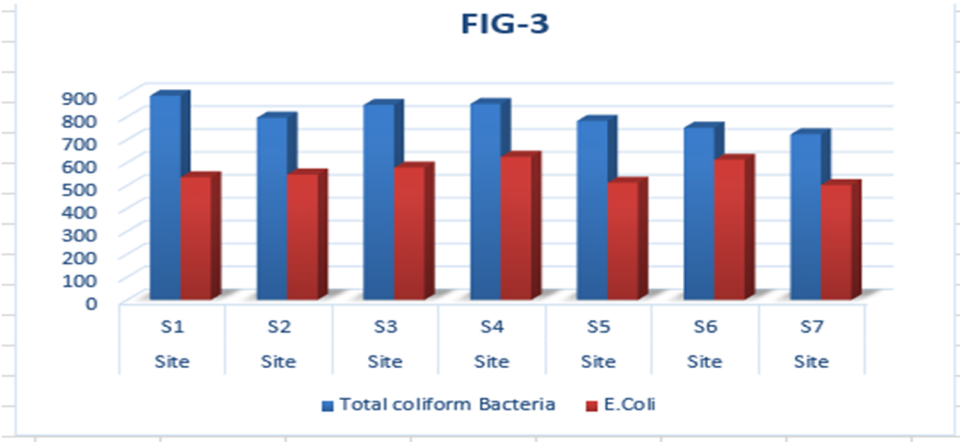
Graphical representation of seasonal variations in Physico-chemical and Bacteriological Parameters of Drinking Water in Manikpur Block , Chitrakoot, U.P.(S1 to S7).







K. Alkalinity

An anionic radical such as carbonates, bicarbonates, hydroxide and phosphate contributes to increase in alkalinity. Variation of alkalinity (mg/l) of different sites in rural areas of Manikpur Block is varied from 425 to 565 mg/l (ppm).

L. Bacteriological taste

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1) *Total coliform bacteria:* In the present study of total coli.(MPN) in ground water, it was counted from 724 to 892.
2) *Escherichia coli:* In the present study of Escherichia coli in ground water, it was counted from 502 to 625.

Both the above bacteria are very harmfull to Human health.

IV. CONCLUSION

As per the improved technologies the water of hand pumps which have excess of Iron, Fluoride and bacteria mainly on the basis of physico-chemical of bacteriological study, it should be treated to remove these following the criteria of WQI'S and B.I.S method. So, drinking water should not be used before its prior treatment in the area of study. Because untreated water might cause water borne diseases.

V. ACKNOWLEDGEMENT

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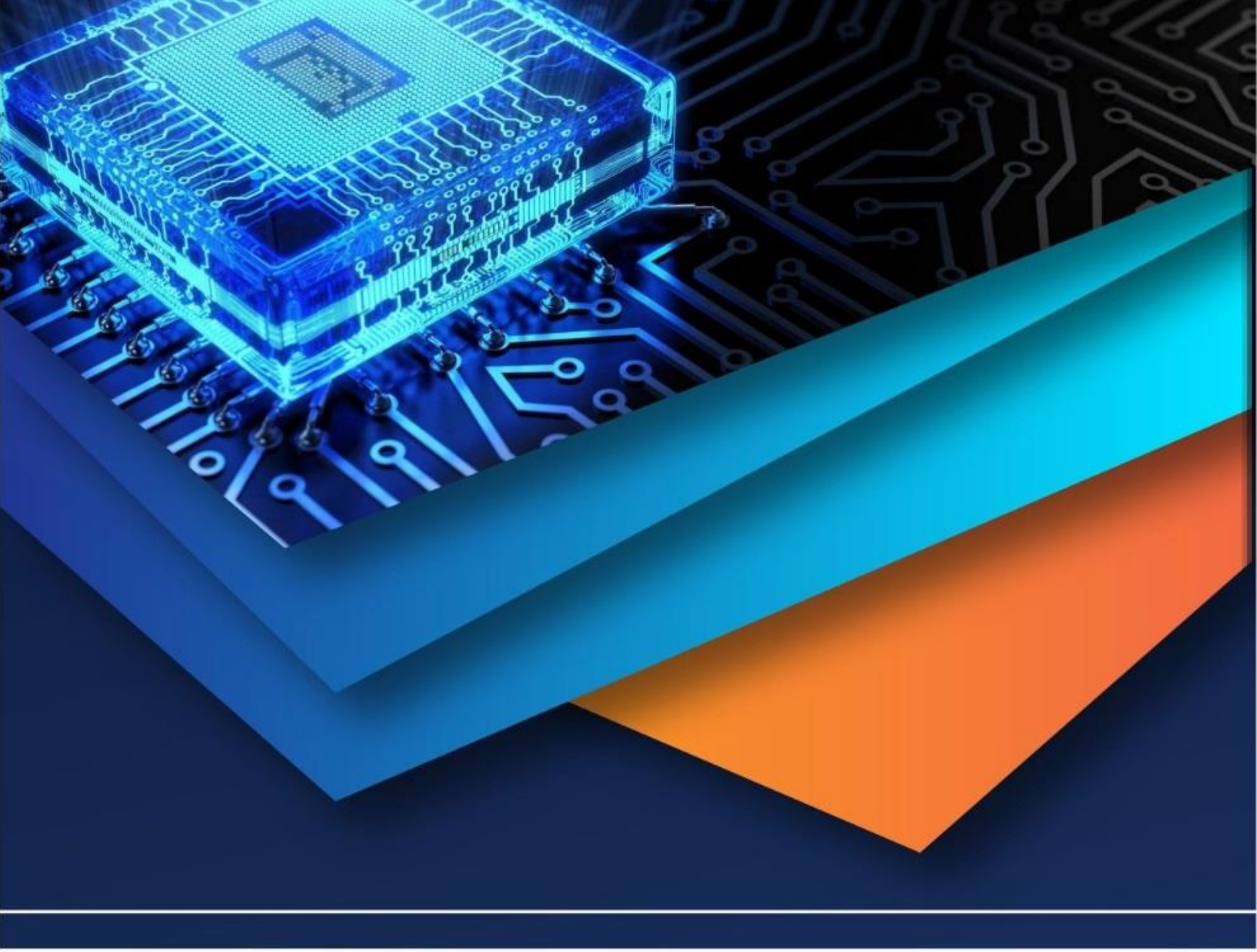

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