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Study of Effects of Leachate

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Abstract: ***Leachate in landfill can be defined as a liquid that passes through a landfill a has extracted dissolved and suspended matter from it. Leachate generation is a major problem for municipal solid waste (MSW) landfills in many countries and it causes significant threat to surface water and ground water. To find the effect of leachate in the ground, ground water sample was collected from the surrounding areas of 1 km radius away from Kodungaiyur landfill and the samples were tested for various parameters such as colour, turbidity, pH, conductivity, total dissolved solids, total hardness, calcium, magnesium, chloride, sulphate, nitrate, fluoride, potassium, COD and BOD. Eight samples were collected from 1km away were collected. The parameters were compared with IS 10500:2012. The analysis helps us to understand how much the ground water is affected by the percolation of leachate.***

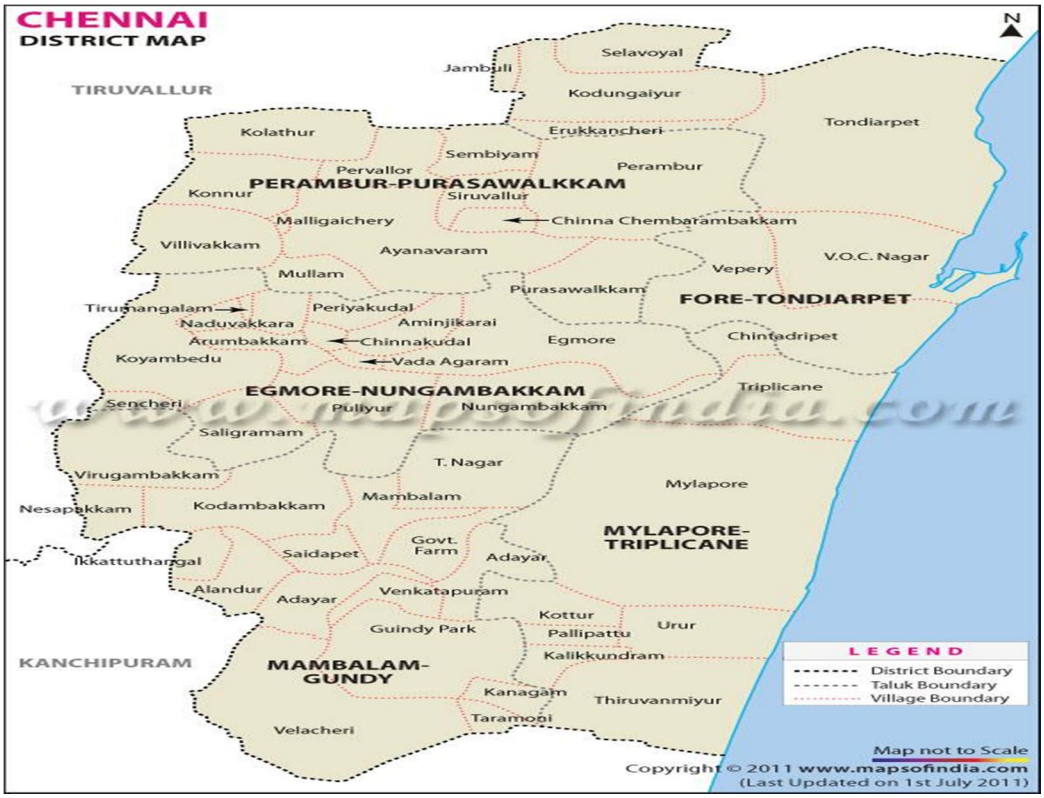
Keywords: Leachate, Hardness, Chloride, TDS, BOD, and COD.

I. INTRODUCTION

Leaching occurs when water percolates through any permeable material. Leachate generation is a major problem for municipal solid waste landfill in both developed and developing countries and it has a significant threat to surface water and ground water. Huge amount of solid waste is generated daily and its management is a tedious task. Solid waste generation has witnessed an increasing trend parallel to the development of industrialization, urbanization and rapid growth of population. The solid waste management encompasses everything from collection, transportation and disposal of waste.

In the present study the impact of leachate percolation on groundwater were analyzed an unlined landfill at Kodungaiyur, Chennai, Tamil Nadu. The physio chemical and biological parameters were tested from the collected leachate and groundwater samples.The maximum value was found at the sample which was collected from the distance 1km away from the dump yard.

II. METHODOLOGY



Chennai district map with Kodungaiyur location.

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Samples collected location

The Kodungaiyur dumping yard located at the northern part of Chennai city is in operation since 1980. Initially the leachate generated from the Chennai city has been dumped in Kodungaiyur dumpsite. Due to urbanization, increase in population, changes in lifestyle and consumption pattern, the problem of water waste management in Chennai has been increased. So two other major, Perungudi in south and Kodungaiyur in north have been proposed and being used as open dumps for disposal of Municipal Water Waste from the Chennai city.In this study Kodungaiyur dump site is taken as a study area. It lies between 13.1362° N latitude and 80º14' 06.34" E longitudes. Open dumping and leveling by bulldozer is the method of waste disposal. The dumping site covered about 30 ha in 1995.3 and increased to 54.75 ha in 2002.4 which is twice that of the area in 1995. The dumping area is estimated to be 117 ha in 2009 which is again twice as that of in 2002.

After the collection of ground water sample, the samples were tested for there physiochemical and biological parameter such as colour, turbidity, pH ,conductivity, total dissolved solids, total hardness, Calcium, Magnesium, Chloride, Sulphate, Nitrate, Fluoride, Potassium, Chemical oxygen demand (COD) and Biochemical oxygen demand (BOD).

The parameters where tested by the Indian standards procedure.The test procedure for, Colour is IS 3025 (part 7)-1983,Turbidity is IS 3025 (part 10)-1984, pH is IS 3025 (part 11)-1983, Conductivity is IS 3025 (part 14)-1984, Total dissolved solids is IS 3025 (part 16)-1984, Total hardness is IS 3025 (part 21)-2009, Calcium is IS 3025 (part 32)-1991, Magnesium is APHA 23RD Edition 3500-Mg B, Chloride is IS 3025 (part 32)-1988, Sulphate is APHA 23RD Edition 4500, Nitrate is APHA 23RD Edition 4500, Fluoride is APHA 23RD Edition 4500 F B&D, Potassium is IS 3025 (part 45)-1993, Chemical oxygen demand (COD) is IS 3025 (part 58)-2006 and Biochemical oxygen demand (BOD). Leachate was collected from the kodungaiyur dump yard. The collected samples were tested for the physical, chemical and biological properties.

III. RESULTS AND DISCUSSIONS

To find the effect of leachate in ground water, we have collected the ground water from the surrounding of the landfill. Within 1km from the Kodungaiyur landfill, 4 stations were selected and we have collected the ground water from the individual houses. The depth of the ground water is 60ft to 80ft.A Total of twelve samples were collected, from 1km away from the Kodungaiyur dump yard. All the samples were collected in a bottle which was cleaned and air dried before collection.

The test procedures which followed to find the parameter of the ground water were Indian standards and APHA. The pH value of the study area lies between 6.4 to 7.24 which were within the desirable limit.The highest value of pH found at G2 and minimum value of pH found at G12. The value of electrical conductivity value in the study area ranged between 1907mg/l to 3420 mg/l and maximum value was observed at G1. The TDS value of the sample water was high at G9 (5394 mg/l) and low at site G12 (1015 mg/l).

All the samples were exceeding the permissible limit and TDS generally represents the amount of suspended and dissolved particles present in water. The high value of the total hardness 460 mg/l was recorded at the site G2 and the minimum value was recorded at G1. The calcium and magnesium was in the range of 28 mg/l to 156mg/l and 36.5 mg/l to 143 mg/l. Majority of the samples were above the acceptable limit as per IS 10500:2012. The presence of chloride in the sample was in the range of 138 mg/l to 1092 mg/l.

S. NO	PARAMETER	UNIT	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
1	COLOUR	HAZEN	70	69	62	66	68
2	TURBIDITY	NTU	59.6	52	37	49.8	51
3	pH at 25º	-	7.07	7.24	6.98	7.18	6.96
4	CONDUCTIVITY AT 25º C	µS/c m	3420	3146	2874	3280	3256
5	TOTAL DISSOLVED SOLIDS	mg/l	2024	1839	2225	2413	2343
6	TOTAL HARDNESS	mg/l	220	460	290	358	432
7	CALCIUM	mg/l	28.0	72	140	93	156
8	MAGNESIUM	mg/l	36.5	94	112	73	89
9	CHLORIDE	mg/l	373	297	221	339	356
10	SULPHATE	mg/l	681	593	547	603	702
11	NITRATE	mg/l	3.48	2.68	1.69	2.03	2.4
12	FLUORIDE	mg/l	1	0.67	0.72	0.97	0.62
13	POTASSIUM	mg/l	16	15	12	18	18
14	COD	mg/l	26	24	20	21	19
15	BOD	mg/l	5	5	4	5	6

Ground water analysis of the sample 1 to 6 (samples from 1km away).

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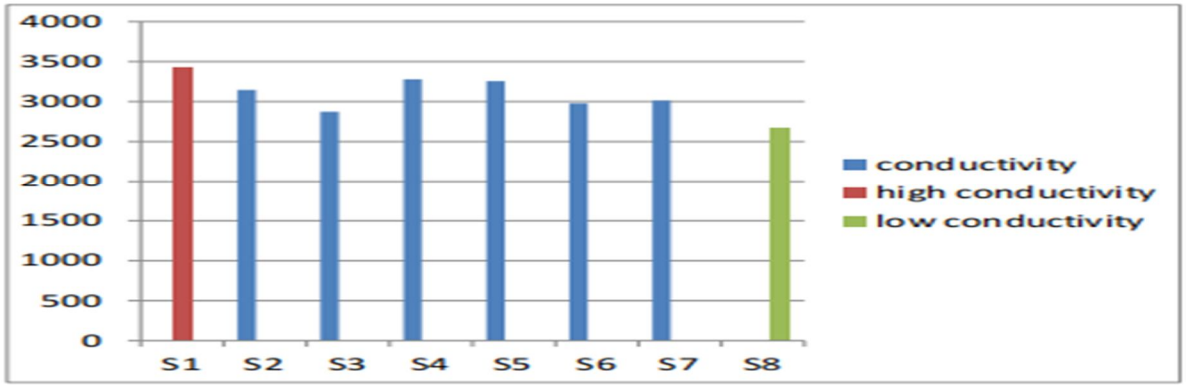
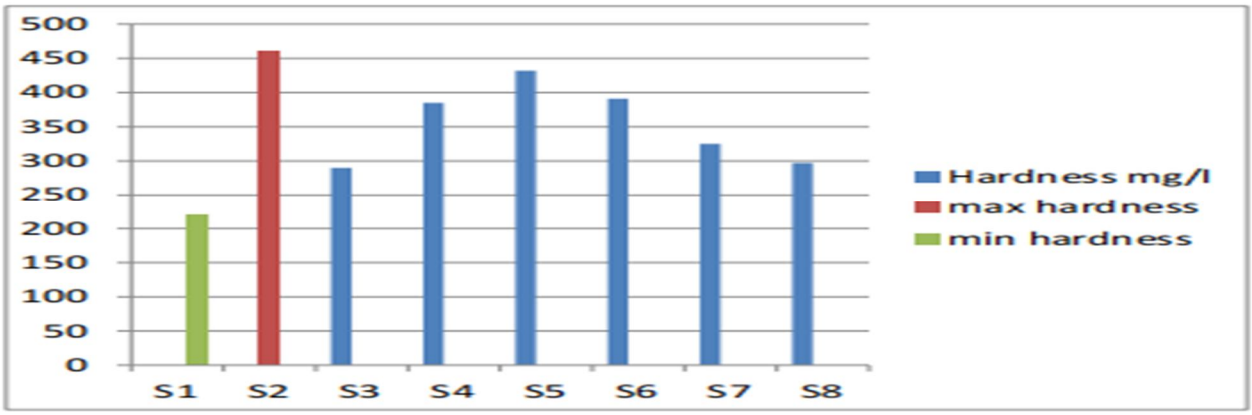
S. NO	PARAMETER	UNIT	Sample 6	Sample 7	Sample 8
1	COLOUR	HAZEN	65	62	60
2	TURBIDITY	NTU	48	39	31
3	pH at 25º	-	7.1	6.8	7.4
4	CONDUCTIVITY AT 25º C	µS/c m	2978	3013	2678
5	TOTAL DISSOLVED SOLIDS	mg/l	2603	2817	2169
6	TOTAL HARDNESS	mg/l	391	325	297
7	CALCIUM	mg/l	108	84	79
8	MAGNESIUM	mg/l	89	135	108
9	CHLORIDE	mg/l	387	343	293
10	SULPHATE	mg/l	653	597	590
11	NITRATE	mg/l	2.6	2.58	2.23
12	FLUORIDE	mg/l	0.80	0.79	0.91
13	POTASSIUM	mg/l	16	15	12
14	COD	mg/l	24	18	18
15	BOD	mg/l	5	6	5

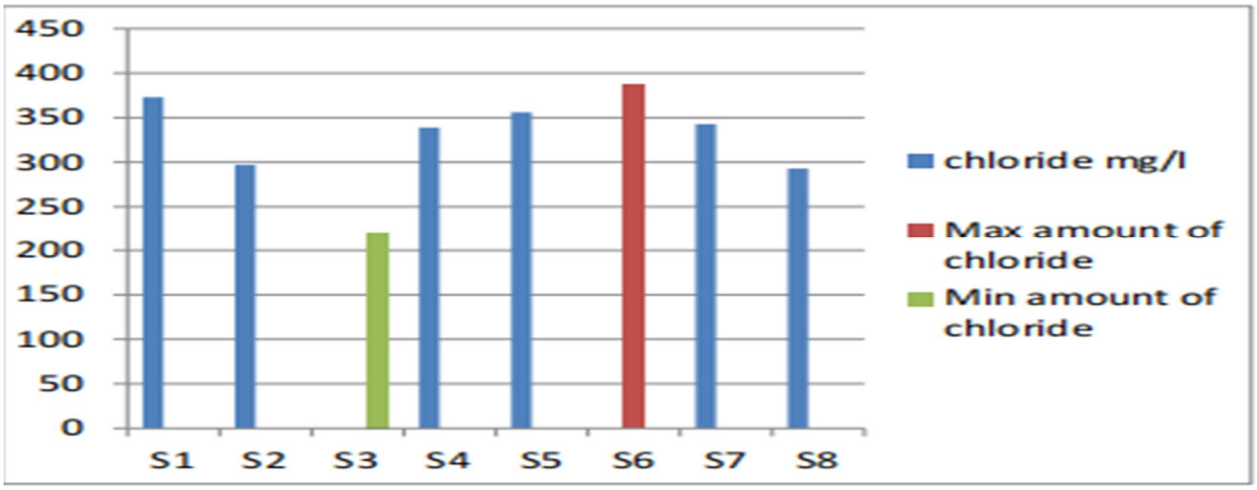
Ground water analysis of the sample 6 to 8 (sample from 1km away)



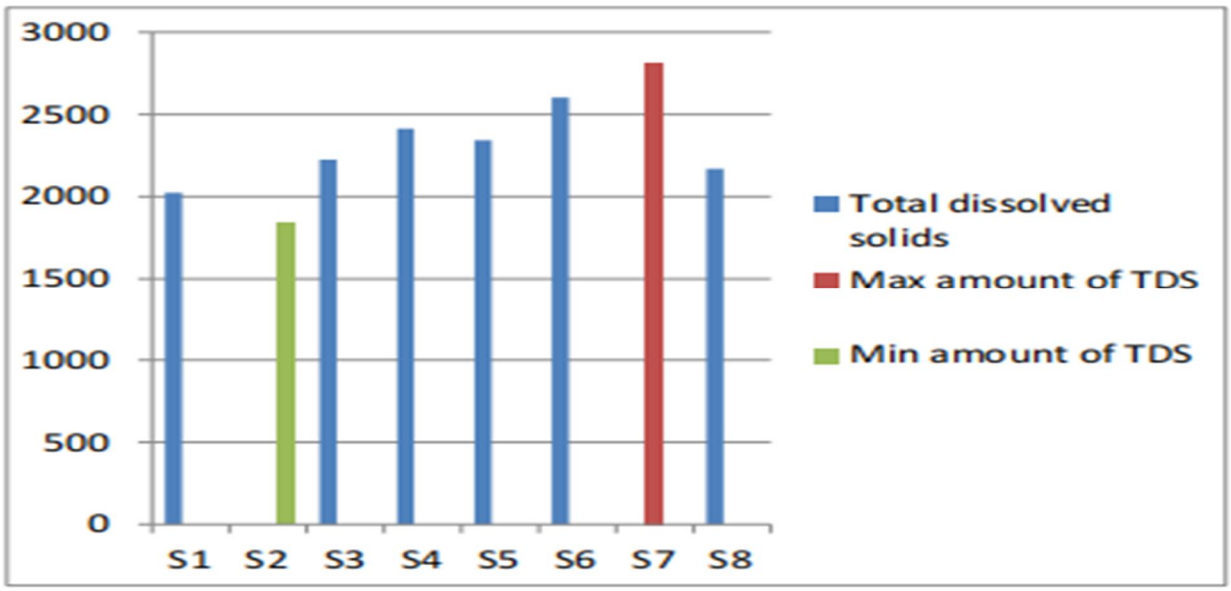
Graphical representation of Conductivity of water sample collected from 1km away from the site



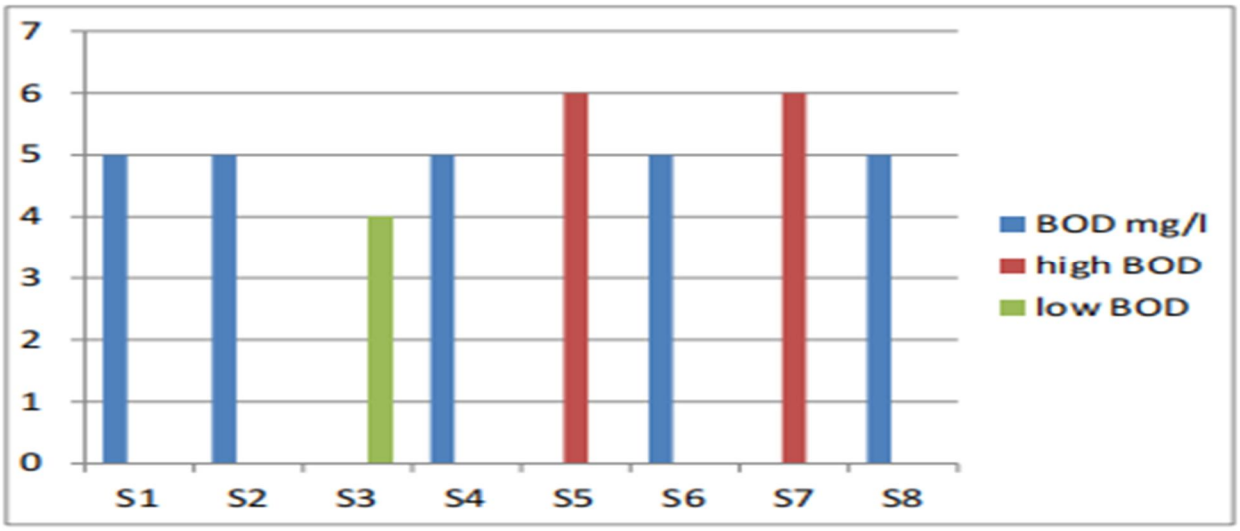
Graphical representation of Hardness of water sample collected from 1km away from the site



Graphical representation of Chloride of water sample collected from 1km away from the site



Graphical representation of Total dissolved solids of water sample collected from 1km away from the site



Graphical representation of BOD of water sample collected from 1km away from the site

IV. CONCLUSIONS

The permissible amount of the chloride content in ground water should be 250 mg/l. An excess of chloride in water sample usually taken as the index of pollution and considered as tracer for ground water contamination.The range of sulphate, nitrate, fluoride and potassium are 221 mg/l to 681 mg/l, 0.37 mg/l to 10 mg/l, 0.38 mg/l to 1 mg/l and 10 mg/l to 22 mg/l respectively. The Biochemical oxygen demand was very high in the samples which were collected near 1km away from the dump yard.The parameter was compared to IS 10500:2012. This helps us to find the contamination of the ground water due to percolation of leachate from the landfill site. With the help of the leachate characteristic, physico-chemical treatment, the separation of suspended particles from the liquid phase is usually accomplished by coagulation,flocculation and sedimentation. Coagulation-flocculation processes have been widely used as alternative treatment to remove leachate pollutants such as BOD, COD, TSS, heavy metals, colour, and nitrogen compounds prior to other treatment methods.

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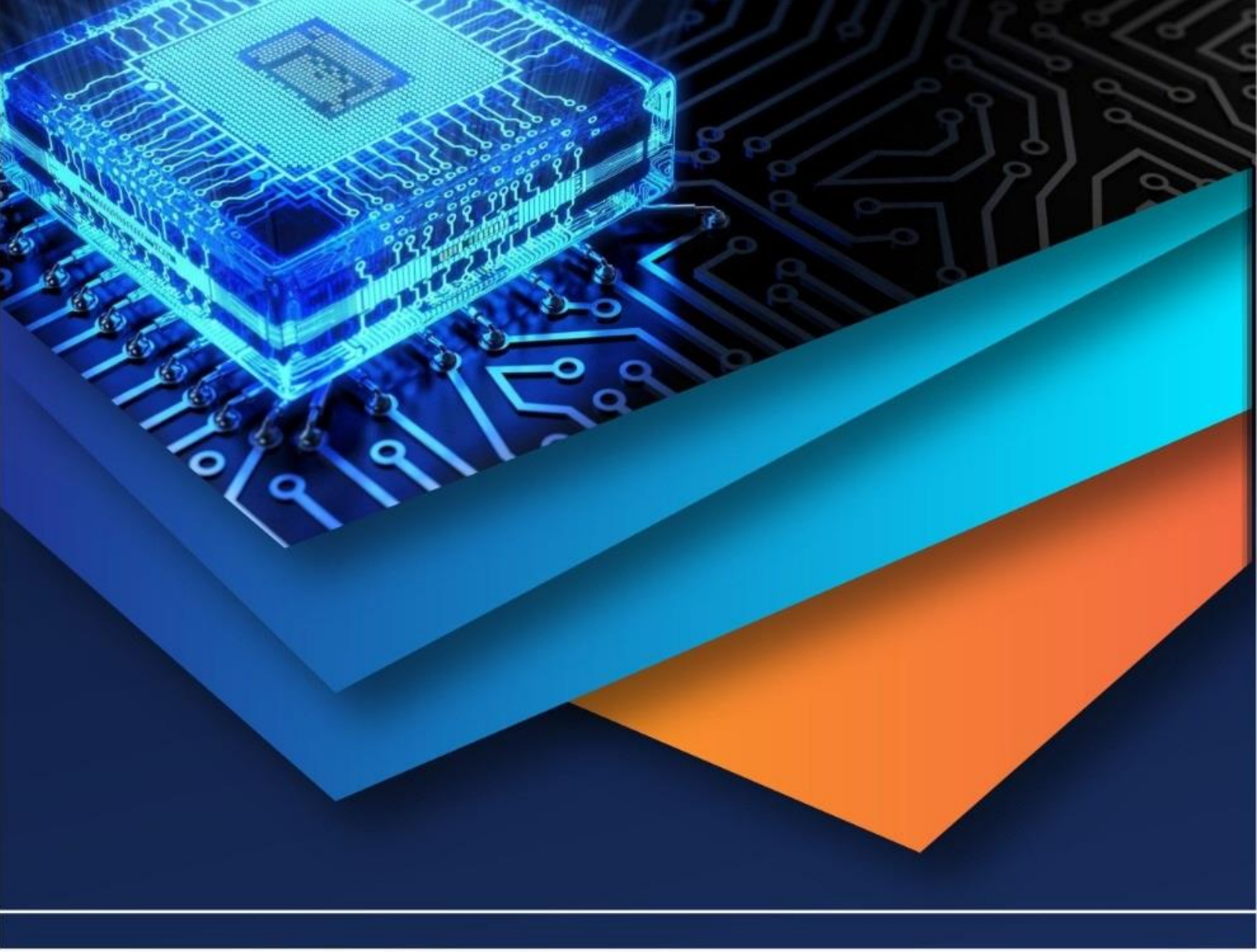

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