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# Effect of Low Frequency Electromagnetic Field on Glycogen Content in Vital Organs of the Fresh Water Fish, Rasboradaniconius (Hamilton, 1822)

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***Abstract:*** ***Freshwater fish Rasboradaniconius was exposed to low frequency electromagnetic field (LF-EMF) for 7 and 15 days to estimate the glycogen content in vital organs. In the present study, it is found that, the significant decline (P<0.05) in glycogen content for 7 days exposure it was in order Brain< Heart< Testis< Ovary< Gills< Intestine< Muscles< Kidney< Liver viz. 07.5312*±0.1157< 12.0820*±0.0337< 18.8894*±0.1207< 27.5116*±1.7155< 32.3926*±0.5283< 33.7180*±0.0667< 40.7205*±0.1530< 41.7205*±0.0578< 48.1035*±0.1204 mg/100mg and for 15 days exposure it was Brain< Heart< Testis< Ovary< Gills< Intestine< Kidney< Muscles< Liver viz. 02.9995*±0.0333< 6.0656*±0.1204< 12.5255*±0.0883< 12.6413*±0.0883< 15.3217*±0.0333< 18.0792*±0.0334< 19.1398*±0.0883< 20.8079*±12.013< 21.6466*±0.0578 mg/100mg.Since, the LF-EMF exposure affects glycogen metabolism in various tissues of Rasboradaniconius.***
***Keywords: Glycogen, Rasboradaniconius, low frequency electromagnetic field.***

## I. INTRODUCTION

During the last few decades various behavioural, biochemical and physiological changes have been reported by several workers on the aquatic animals mostly in fishes to low frequency electromagnetic field. There are many underwater current cables passing under the sea and these electrical current induce static magnetic fields around the cables and its effects on many invertebrate and vertebrate species (Bochert and Zettler, 2004). The exposure to static magnetic field could influence the survival rate and fitness of flounder, *Plathichthysflesus* animals of the Baltic Sea. The physiological and biochemical alterations observed in an animal under any physiological stress can be correlated with the structural and functional changes of cellular proteins.

Since many low electromagnetic fields have directly influence on metabolic processes, it is possible that, they may only modify the existing signal transduction procession in cell membrane, thus producing both transduction and biochemical amplification of the effects of the field itself (Luben, 1991). The exposure of the animals to 50 Hz, 0.2 mT magnetic field resulted in the decrease of RBCs membrane elasticity and permeability and changes in the molecular structure of Hb (Ali*et. al.*, 2003). Some studies also suggest that power frequency magnetic field of 0.6mT applied to humans has an effect on cognitive function as has been suggested by animal studies (Preece*et. al.*, 1998). Some reports show that, an increased risk of breast cancer in females is associated with 50 Hz magnetic field exposure (Forssen, *et. al.*, 2000; Kliukiene*et. al.*, 2004), brain cancer in adult and children (Gurney, and Van Wijngaarden, 1999). In spite of the fact that, the biochemical studies of the fish tissues has drawn the attention of several researchers but the information regarding the detection and estimation of proteins, lipids, carbohydrates and enzymes in the various digestive organs of fishes are limited.

Hence, it is essential to understand the significance alteration or changes in tissues exposure to Low frequency magnetic field on biochemical contents in freshwater fish, *Rasboradaniconius* are less studied, but may contribute to the understanding of the underlying basic mechanisms in the living cells. The study presented in this paper was focused on the biochemical changes induced by low frequency electromagnetic field exposure to freshwater fish, *Rasboradaniconius* for 7 days and 15 days durations.

## II. MATERIAL AND METHODS

### *A. Experimental Setup*

The freshwater fish, *Rasboradaniconius* were collected from local lake, near to the Aurangabad, Maharashtra and brought them to the laboratory in an oxygenated polythene bags. The healthy adult specimens of *Rasboradaniconius* ranging in length from 10 to 12 cm were selected randomly and acclimatized for the laboratory conditions for experimental purpose. Water was replaced regularly and the fishes were fed daily.

*B. Exposure to LF-EMF*

An experimental aquarium was set up with a LF- EMF device made up of concentric coils connected to a solenoid plates. The solenoid plates were winded with 400 turns of 1.6 mm diameter copper wire. The aquarium was filled with 20 L de chlorinated water and the LF- EMF device was immersed in the aquarium. Then it was driven by the 50 Hz power line with a load of 200W bulb so as to establish the low frequency electromagnetic field. Another aquarium is maintained without LF- EMF device for control.


Figure- 1: Freshwater fish, *Rasboradaniconius* (Hamilton, 1822)

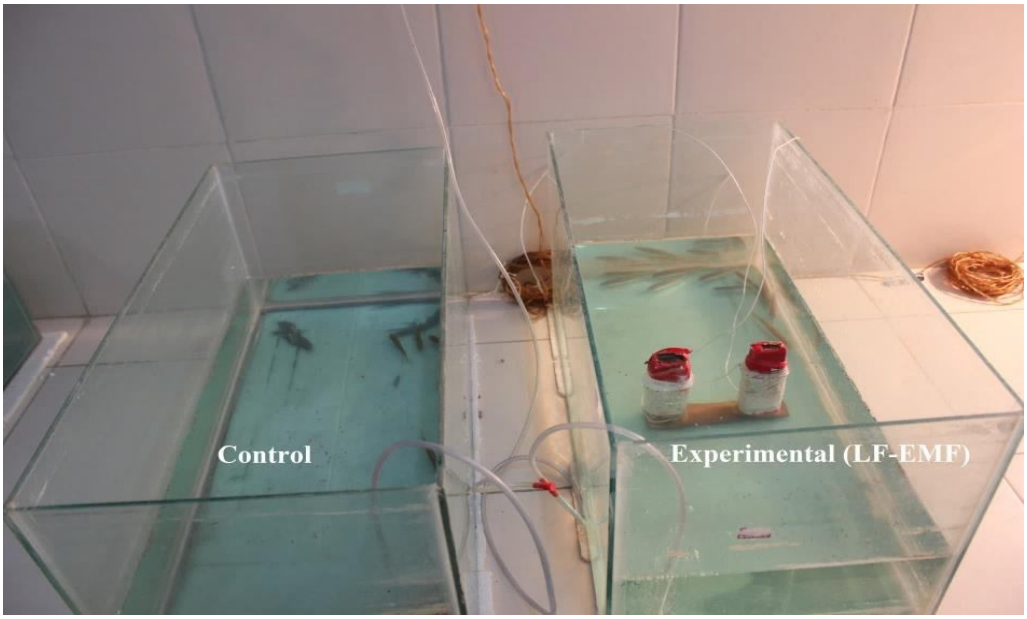


Figure- 2: Control and treatment set up of (LF-EMF) exposure to *Rasboradaniconius* under laboratory condition.

*C. Estimation of glycogen:*

Wet tissues of the muscle, gills, brain, heart, gut, liver, kidney, testis and ovary of the freshwater fish *Rasboradaniconius* were taken for the estimation of glycogen. Glycogen was estimated by Anthrone reagent method as given by Dezwaan and Zandee (1972).The statistical analysis of the results were done by, One-way Analysis of Variance (ANOVA) using the software package, SPSS (16.0 version) to test the level of significance ($P<0.05$).

## III. RESULTS AND DISCUSSION

Glycogen is the secondary long term storage form of glucose in animals and energy reserve that can be quickly mobilized to meet a sudden need for glucose. When it is needed for energy, glycogen is broken down and converted again in to glucose. Glycogen phosphorylases is the primary enzyme of glycogen breakdown. For the next 8–12 hours, glucose derived from liver glycogen is the primary source of blood glucose used by the rest of the body as fuel. Liver convert glycogen in to glucose for use throughout the body including the central nervous system that's why glycogen is the essential biomolecule for animal. In present study the comparative data of the glycogen content of both that is control and experimental fishes have been summarized in the table 1.

| Sr. No. | Tissues | LF-EMF field exposure period | | | |
|---|---|---|---|---|---|
| | | 7 days | | 15 days | |
| | | Control | Experimental | Control | Experimental |
| 01 | Brain | 16.2087* ± 0.1530 | 07.5312* ± 0.1157 | 04.0987* ± 0.0883 | 02.9995* ± 0.0333 |
| 02 | Heart | 16.9607* ± 0.0578 | 12.0820* ± 0.0337 | 12.2363* ± 0.1767 | 6.0656* ± 0.1204 |
| 03 | Testis | 27.8944* ± 0.1735 | 18.8894* ± 0.1207 | 15.3410* ± 0.0578 | 12.5255* ± 0.0883 |
| 04 | Ovary | 36.1864* ± 0.0334 | 27.5116* ± 1.7155 | 27.7595* ± 0.0334 | 12.6413* ± 0.0883 |
| 05 | Gills | 39.7924* ± 0.1204 | 32.3926* ± 0.5283 | 30.7677* ± 0.1204 | 15.3217* ± 0.0333 |
| 06 | Gut | 45.6353* ± 0.1204 | 33.7180* ± 0.0667 | 25.9565* ± 0.2651 | 18.0792* ± 0.0334 |
| 07 | Muscles | 48.0264* ± 0.1735 | 40.7205* ± 0.1530 | 30.5748* ± 0.1669 | 20.8079* ± 12.013 |
| 08 | Kidney | 51.7288* ± 0.1735 | 41.7205* ± 0.0578 | 44.0540* ± 0.1456 | 19.1398* ± 0.0883 |
| 09 | Liver | 59.6158* ± 0.1859 | 48.1035* ± 0.1204 | 55.2632* ± 0.6134 | 21.6466* ± 0.0578 |

Values are expressed in mg/100mg of wet tissue weight (Mean ± SD); (* indicate P<0.05)

Table- 1: Glycogen content in different tissues of *Rasboradaniconius* exposed to low frequency electromagnetic field.

The result indicates that, there is a significant decrease in the glycogen content in all vital organs as the exposure duration increased. The freshwater fish *Rasboradaniconius* exposed to low frequency electromagnetic field showed a significant decreased (P<0.05) level of glycogen in all vital organs like muscle, gills, brain, heart, gut, liver, kidney, testis and ovary tissues when compared control with experimental. Decline in order of glycogen content in tissue for 7 days exposure was Brain< Heart< Testis< Ovary< Gills< Intestine< Muscles< Kidney< Liver viz. 07.5312*±0.1157< 12.0820*±0.0337< 18.8894*±0.1207< 27.5116*±1.7155< 32.3926*±0.5283< 33.7180*±0.0667< 40.7205*±0.1530< 41.7205*±0.0578< 48.1035*±0.1204 mg/100mg and for 15 days exposure it was Brain< Heart< Testis< Ovary< Gills< Intestine< Kidney< Muscles< Liver viz. 02.9995*±0.0333< 6.0656*±0.1204< 12.5255*±0.0883< 12.6413*±0.0883< 15.3217*±0.0333< 18.0792*±0.0334< 19.1398*±0.0883< 20.8079*±12.013< 21.6466*±0.0578 mg/100mg.

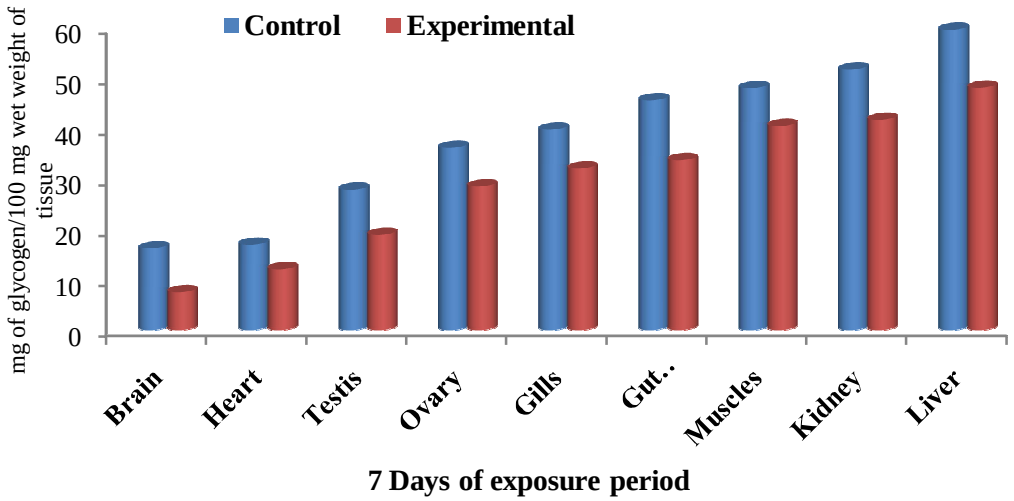


Figure-2: Glycogen content in different tissues of *Rasboradaniconius* after7 days exposure to low frequency electromagnetic field

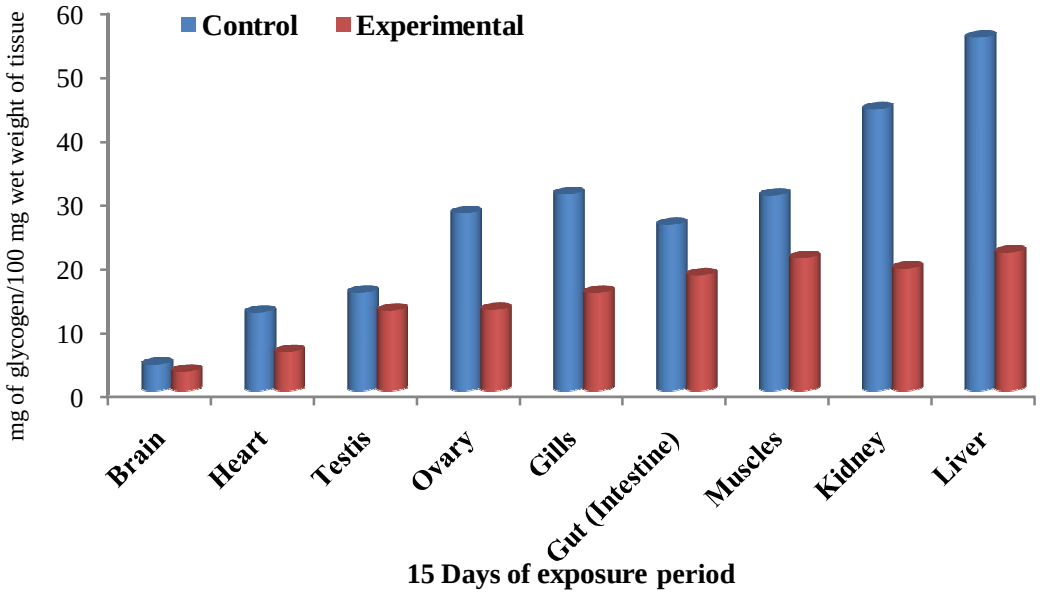


Figure- 3: Glycogen content in different tissues of *Rasbora daniconius*after15 days exposure to low frequency electromagnetic field

In the present study it is observed that after exposure of the LF-EMF on *Rasboradaniconius*lead to decline in glycogen content. After exposure of *Rasboradaniconius*to LF-EMF for 7 and 15 days the decline glycogen content is observed in various tissues. After 7 days exposure the decline trend in glycogen content was Brain< Heart< Testis< Ovary< Gills<Intestine< Muscles< Kidney< Liver and for 15 days exposure it was Brain< Heart< Testis< Ovary< Gills< Intestine< Kidney< Muscles< Liverat significant level decreased $P<0.05$. More scientific reports are focused on the stimulation of living organisms, including plants, in maize plants biochemical changes induced by extremely low frequency magnetic field during their early ontogeny stages (first 12 days of growth) Stimulatory effect on the photosynthesis was noticed to the magnetic energy dose increasing, suggesting putative stimulation of photosynthesis process, while the nucleic acid biosynthesis seems to be inhibited however their electromagnetic energy could trigger complex synergetic cellular mechanisms that finally can lead to the growth disturbing (Mihaelaracuciu*et. al*., 2006).The long term exposure of electromagnetic field on rat the affecting parameters like body weight, blood glucose and fatty acid metabolism. Exposure appears to modify blood glucose content in adult rat 12 and 72 weeks old the rat glycogen amount in hepatocytes cytoplasm was higher and diffusely distributed (Gabriele *et. al*., 2008). Study of microscopic sections of white *rabbit* liver, exposed to magnetic field with of 700 MilyGausintensity and 100 Hz frequency, some cells were seen around lobular central vein having high amount of glycogen near central vein is more and it shows no glycogen discharging thus, the electromagnetic field decreases amount of glycogen in liver (Nafisisaeid, 2010).The electromagnetic field at 50 Hz may modify cell membrane morphology and interfere with initiation of the signal cascade pathway and cellular adhesion (Manni*et. al*., 2002).The EMF do not have disturbed effects in liver organ, but vaculation of the cytoplasm was reported in this work that because of glycolgenolysis inhibition by EMF (Zare*et. al*., 2007). Neveen, (2002) has stated that the ultrathin sections of mouse of liver showed highly affected hepatocytes. An opaque cytoplasmic matrix, severe reduction in cytoplasmic organelles, depletion of glycogen, few mitochondria and large electro translucent spaces were observed. Thus, the pattern of reduction in the total amount of glycogen due to exposure of LF EMF can be observed and this corroborates with the earlier findings. Pakhre*et. al*., (2016) was observed that the significant reduction in glycogen content in different tissues like, gill, liver, muscle and kidney of fresh water fish *Channagachua* in exposure of quinalphos. Gijare*et al*., (2011)observed the notable alteration in liver and intestine glycogen of *Ophiocephaluspunctatus*exposed to sub-lethal concentration of cypermethrin. The glycogen content was analysed from the tissues of experimental and control fish the significant decrease of glycogen content in the gills, kidney and brain and the moderate decline was observed in gonads, muscles whereas slight change found in liver and intestine (Ganeshwade*et al*., 2011).

## IV. CONCLUSION

The present study was concluded that, the LF-EMF significant decline ($P<0.05$) glycogen content in vital tissues of fresh water fish, *Rasboradaniconius* and it was indicates that, the all vital organs used glycogen as energy source for metabolism; and it was

drastically affected due to exposure to LF-EMF. Among wet tissues, higher glycogen content was observed in liver in control and treated fish and is acceptable because liver is the major storage site of glycogen.

## V. ACKNOWLEDGEMENT

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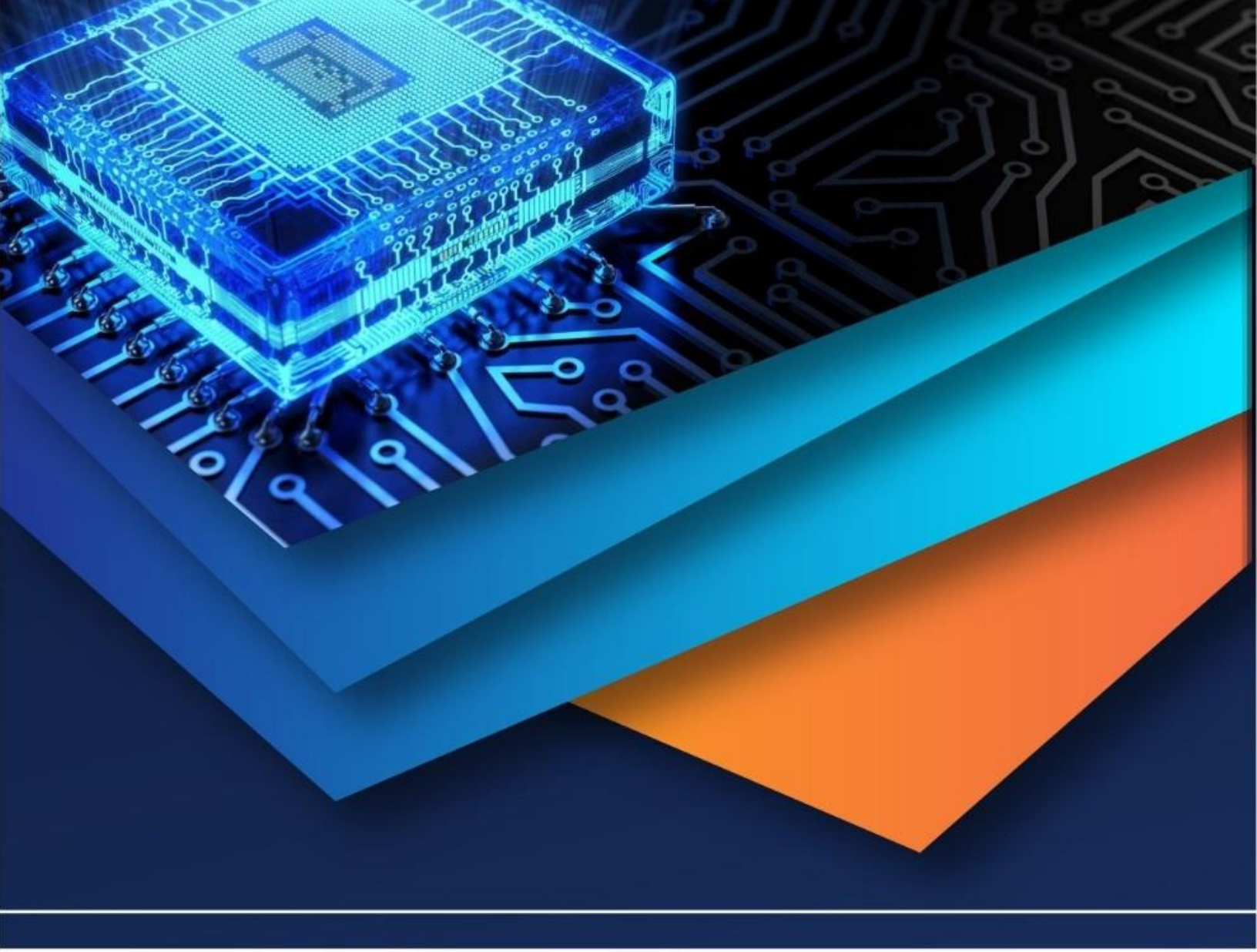

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