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A Review on Conceptual Model of in Basin Plant to Increase Self –Purification of River

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Abstract: ***This paper aims to study of conceptual model of in basin plant that will helps to increase self purification rate of river. Now a days purification of river have become problem so the study on this is become important.***

The self-purification of natural water systems is a complex process that often involves physical, chemical, and biological processes working simultaneously. [(17)] Running water is capable of purifying itself with a distance through a process known as self-purification. This is the ability of the river to purify itself of sewage or other waste naturally. The process of self-purification mainly depends on absorption and dissolution of atmospheric oxygen from a water body surface. This self-purification cannot be depended upon to bring about complete purification, but it may well improve the water quality sufficiently. When disposal of sewage in the stream, the stream water is examined towards down streams, it will be observed that the quality of stream water successively changes. Near the place of disposal, the water will be polluted and it becomes purified after some travel towards the downstream side due to natural forces of purification.

Keywords: River Self Purification, Water Treatment, BOD, COD.

I. INTRODUCTION

River restoration is the process of managing rivers by various operations to reinstate natural processes to restore biodiversity, providing benefits to both people and wildlife. Reintroducing natural processes can reshape rivers to provide the diversity of habitats required for a healthy river ecosystem and ensure their long-term recovery by addressing the root cause of the issue. River degradation has led to an extensive loss of habitats and additional pressures on the aquatic and terrestrial species that use them. It also affects the quality of our drinking water, resilience to climate change and ability to store and hold back flood water. Damage to river systems has been so extensive that an urgent need has emerged, not only to conserve, but to restore these systems. In recent years, severe problem in front of whole nation is water pollution. We have seen that various national authorities are works for pollution control. Still the level of pollution day by day goes higher. Highest number of polluted rivers Maharashtra state has 49 polluted river stretches, highest in the country, which including Mithi, Ulhas, Vaitarna, Godavari, Bhima, Krishna, Tapi, Kundalika, Panchganga, Mula-Mutha, Pelhar and Penganga. 3,000 MLD of untreated sewage and industrial effluents are discharged into the state's water bodies daily. This causes serious impact on human health as well as environmental.[1] So it is necessary to conserve rivers by various human efforts and engineering techniques. Hence we are going to work for the restoration of river by implementing modern river restoration techniques on the basis of principles of self purification of streams.

A. Factors Affecting self- Purification

1) *Dilution:* When sufficient dilution water is available in the receiving water body, where the wastewater is discharged, the DO level in the receiving stream may not reach to zero or critical DO due to the availability of sufficient DO initially in the river water before receiving the discharge of wastewater.
2) *Current:* When strong water current is available, the discharged wastewater will be thoroughly mixed with stream water preventing deposition of solids. In the small current, the solid matter from the wastewater will get deposited at the bed following decomposition and reduction in DO.
3) *Temperature:* The quantity of DO available in stream water is more in cold temperature than in hot temperature. Also, as the activity of microorganisms is more at a higher temperature, hence, the self-purification will take less time at hot temperature than in winter.
4) *Sunlight:* Algae produces oxygen in the presence of sunlight due to photosynthesis. Therefore, sunlight helps in purification of the stream by adding oxygen through photosynthesis.

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5) *The rate of Oxidation:* Due to oxidation of organic matter discharged in the river DO depletion occurs. This rate is faster at a higher temperature and low at a lower temperature. The rate of oxidation of organic matter depends on the chemical composition of organic matter.

B. The process of Self-Purification of Stream

1) *Degradation Zone:* This zone is situated just near the outfall of sewage. The water is turbid with a dark color. The decomposition of solid matters take place in this zone and the anaerobic decomposition prevail.
2) *Active Decomposition Zone:* This zone is just after the degradation zone. The water is greyish and darker than the previous zone. The objectionable odors of hydrogen sulfide and other sulfur compounds prevail and scum may also be seen on the surface in this zone.
3) *Recovery Zone:* In this zone, the stabilization of organic matters takes place and BOD of water is reduced. The contents of dissolved oxygen start rising above 40% of the saturation value. The bacterial load decreases as the food supply of bacteria diminish.
4) *Clear Water Zone:* In this zone, the stream attains normal conditions as were prevailing before sewage was discharged into it.

Nowadays due to rapidly growing industrial and urban activities during the last five decades, most of the Indian rivers are subjected to indiscriminate discharge of effluents affecting water quality and aquatic life. Increasing pollution of rivers and other water bodies has become a matter of great concern in recent years. The industrial effluent, domestic and municipal sewage produces hazardous effects on aquatic life and ecosystem of the receiving water bodies.When a river is polluted, the water quality deteriorates, limiting water use and ecosystem functions, as only a few species are able to survive in the presence of chemicals, nutrients, salinity and other anthropogenic pollutants. However, the self-purification capacity of a river allows it to restore (partially or fully) its quality through the re-aeration and natural processes of degradation. The mechanisms of self-purification can be in the form of dilution of polluted water with an influx of surface and groundwater or through a certain complex hydrologic, biologic and chemical process.

II. LITERATURE

Compilation of Water Quality Data Recorded by MPCB ‘Water Quality Status of Maharashtra 2016-17’ (November 2017)[2]

In this study Maharashtra Pollution Control Board (MPCB), being the state nodal agency under Central Pollution Control Board (CPCB), regularly monitors the water quality across 294 WQMS (Water Quality Monitoring Stations) for both surface (176 on rivers, 36 on sea/creeks, 12 on drains, 4 dams) and groundwater (29 Borewells, 35 Dugwell, 1 Handpump, 1 Tubewell) under two programs of National Water Quality Monitoring Program (NWMP) and State Water Quality Monitoring Program (SWMP). Surface water samples are monitored once every month whereas the groundwater samples are monitored bi-annually. This report presents the statistical analysis of the data representing water quality monitored in the year 2016-17, along with illustrations and spatial representations to have an overview on the performance for quality of surface and ground water in the state. The report further discusses the highlights on the annual and seasonal performance of the Water Quality Index (WQI) for major basins (Tapi, Godavari, Krishna, and West Flowing)[2]

Nine water quality parameters selected for calculating the index included Water Quality Status of Maharashtra 2016-17

A. Dissolved Oxygen (DO)
B. Fecal Coliform (FC)
C. pH
D. Biochemical Oxygen Demand (BOD) (5-day)
E. Temperature change (from 1 mile upstream)
F. Total phosphate
G. Nitrate
H. Turbidity
I. Total Solids

In the year 2016-17, surface (rivers, sea, creek, and nallahs) water quality was monitored at about 228 locations (WQMS). The four major basins namely Tapi, Godavari, Krishna and West flowing rivers were considered to categorize the rivers in respective basins and sub-basins (Table No. 2). Based on the annual average WQI for the 228 WQMS, it was recorded that 127 WQMS were recorded to be in the ‘Good to Excellent' category while 58 WQMS were in ‘Medium to Good' category. As for the polluted categories around 34 and 9 WQMS were recorded in ‘Bad' and ‘Bad to Very Bad' categories respectively.

Bhim Singh Rawat, SANDRP ‘Maharashtra Rivers Review 2017: Multi-colored Rivers’ (March 8, 2018)[1]

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The report studied that Maharashtra has the highest number of polluted rivers. Maharashtra state has 49 polluted river stretches, highest in the country, which including Mithi, Ulhas, Vaitarna, Godavari, Bhima, Krishna, Tapi, Kundalika, Panchganga, Mula-Mutha, Pelhar, and Penganga. 3,000 MLD of untreated sewage and industrial effluents are discharged into the state s water bodies daily. According to a report by Union Environment Ministry, Maharashtra generates about 8,143 Million Liter per Day (MLD) which is almost 13 percent of the country sewage but claims to treats 5,160.36 MLD. In this way Maharashtra is releasing at least 3000 MLD untreated sewage in rivers, creeks and wetlands areas According to a 2015 report of the Central Pollution Control Board (CPCB) Maharashtra state with India s biggest economy, also has the highest number of polluted river stretches in the country. And, at 161, it also has the most number of cities and towns along polluted stretches Of the 156 locations where the CPCB has set up its monitoring units on the 49 rivers and tributaries in the state, 153 do not meet the water quality criteria, according to the CPCB. The MPCB has issued more than 5,300 show-cause notices to erring factories between 2011 and 2017. Toxic waste has been choking the state s rivers, and fishing communities complain that their daily catch is only 10% of what it used to be.

The report found, The pollution done by the rivers flowing in Mumbai city, Pune city, Kolhapur City, Nagpur city. And they also stated the cost spent on cleaning the river of some river.

Mumbai Rivers

Mithi Pollution River foams like Bengaluru lake As per MPCB water quality analysis the Mithi river is the most polluted in the city, almost 13 times the safe limit. Citizens said they spotted foam along the riverbanks in Sakinaka, Andheri and Sahar village in Santacruz.

Kasadi River Pollution: Taloja CETP Issue In Feb. 2017, after MPCB identified that chemical effluents from CETP at Taloja were polluting the Kasadi river, the board have directed to Maharashtra Industrial Development Corporation (MIDC) to cut 40 percent of the water supply to industrial plants from Feb. 1. [1]

Vaitarna River Igatpuri waste dumped in Mumbai rivers As per August 2017 report, piles of garbage, including medical waste, were being illegally deposited into a tributary of Vaitarna which is a part of the network of rivers that supplies water to Mumbai in Igatpuri.

Waldhuni, Ulhas Rivers Waldhuni river turns red due to pollution In Nov. 2017 Ulhasnagar s Waldhuni river turned blood-red in color on Nov 3, indicating a high level of pollution. Pune Rivers

Mula and Mutha have been converted into sewage carriers over the past few decades. Their banks have been encroached by builders and residents and their tributaries have been chocked by channelization.[1]

Kolhapur river

1)Panchganga River MPCB cut KMC power supply over Panchganga River pollutionMPCB disconnected electric supply to the Kolhapur Municipal Corporation building for an hour for releasing untreated sewage into the Panchganga river due to a pipeline burst in September.

The Bombay HC has appointed NEERI yet again to study and suggest long-term and immediate solutions to tide over the pollution of Godavari after Kumbh Mela.

Anil K. Dwivedi (January 2017)[3] has studied that more than 70% of fresh water from our country is converted and unfit for consumption. In this paper, the author mentioned the various studies made on water pollution in India like-Study of the chemical composition of wastewater in Amritsar city was conducted by Panesar et al. (1985) in which they have reported about the suitability of the water for various uses. Pollution in the Chambal river at Kota was studied by Olaniya et al. (1976) and the water was reported to be moderately polluted at most of the study sites. A comparative study of chemical characters of surface water in river Godavari, Krishna and Tungabhadra were conducted by Mitra (1982). A similar comparative study was conducted between rivers Ganga, Yamuna and Kali by Bhargava (1977) also. Chemistry of river Godavari was studying in Rajamundhary by Ganpati and Chacko (1951). Management of freshwater pond in Varanasi was conducted by Mishra (1993). Pollution in Gandak River at Samastipur was studied by Hakim (1984). In most of the studies, it has been a parallel reporting that the water quality is deteriorating day by day.

In this paper, the author mentioned that water pollution in India has now reached a critical point. Almost every river system in India is now polluted to a considerable extent. As assessed by the scientists of the National Environmental Engineering Research Institute (NEERI) Nagpur, nearly 70% of water in India is polluted (Martin, 1998). Pollution in river Ganga has been studied by a considerable number of scientists. Physico-chemical characterization of the same was studied in Mirzapur by Shukla (1989) and in Varanasi by Shukla et al. (1989). Both the works culminate into a common conclusion that the physicochemical properties of Ganga water has degraded continuously and still it is following the same suit. Bacteriological pollution was studied in river Ganga by Shukla et al. (1992) and in the river Varuna by Shukla et al. (1988). The reports favor the presence of a large number of pathogenic and non-pathogenic microorganisms in much beyond their excess limit. Quality of sewage water entering the river Yamuna was

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studied by Sharma et al. (1981). Quality of water of river Yamuna in Agra was studied by Sangu et al. (1984) and at Okhla by Mohan et al. (1965). The bacterial study in the Yamuna at Delhi was studied by Kaushik and Prasad (1964). Biological properties of river Yamuna is much poorer in most cities as compared to river Ganga. Study of river Gomati in India with respect to blue-green algae was conducted by Prasad and Saxena (1980). Similar studies in river Mahanadi was conducted in Orissa (Patra et al., 1984). Pollution in river Bhadra in Mysore was studied by David (1956). Study of pollution in selected rivers of Andhra Pradesh was conducted by Venkateshwarlu (1986). Pollution in the Tungabhadra reservoir was studied by Rao and Govind (1964). Physico-chemical properties of water of Hoogly estuary at various points was conducted by Basu (1966). Agrawal and Srivastava (1984) conducted pollution studies in Ganga and Yamuna at Allahabad.

Physico-chemical characters of Sone river was studied by Grover et al. (1988). Study of river Kali in Aligarh with respect to the biotic community was studied by Chatterjee et al. (1981). A similar study in river Alaknanda was conducted by Badola and Singh (1981). Similarly, Neyyar River was studied by Nair et al. (1989), and Kanhan river in Nagpur by Deshmukh et al. (1984). In the above studies, none of the rivers were reported to be pollution free.

In this research paper author stated the sources of pollution of water such as sewage discharge into the river, Industrial effluents discharged into the river without any pretreatment. And also stated water quality standards, components of polluted water like nutrient content, DO, BOD, COD, temperature, pH, turbidity. And concluded that the level of water pollution has reached the alarming stage. The quality of water in most part of the world has degraded, though the situation in India is more severe.

Robert Speed et. Al (2016) [4] In this book an overview of the history and evolution of river restoration, it sets out a framework for planning and implementing river restoration, and it addresses some key principles, issues, and methods for restoring rivers in the wider context of water resource management and river basin planning. The book includes a more detailed discussion of techniques and approaches to river restoration, including chapters on assessing river health, prioritizing restoration projects, restoration of urban rivers, and river restoration measures. They also took some case study on rivers.

The role of the river system, river restoration, Framework for strategic river restoration process and procedure of river restoration, Monitoring and Adaptive Management Costs, benefits and funding of river restoration, the relationship between river restoration, river ecosystems and human systems, River Health Assessment. Prioritizing restoration measures and projects, Urban Water Management and Restoration of Urban Rivers, Common measures for river restoration

They found that River restoration is now a common response to declining river health and its importance to water resources management can only be expected to grow. River restoration includes any action aimed at improving the health of a river, including improving ecosystem function and any related ecosystem services. River restoration is an important part of the water resources management system. It can assist with balancing the needs of people for freshwater ecosystem services with anthropogenic pressures on river ecosystems. This requires an understanding of the relationship between the way river functions and the demands and impacts people have on the river and River restoration is necessary where river systems have degraded to the point where they can no longer provide the services required of them. Restoration may be triggered by ecological considerations, social and cultural factors, economic drivers, the need to protect infrastructure and assets from water-related risks and, increasingly from the multi-faceted objective of achieving ‘water security'.

Sayali Joshi (28 May 2014)[6] studied Current status of Indian waters and cause of economic losses, Ecological restoration of streams and rivers, Phase□I Schemes for Varanasi study. This study found that BOD in the religious bathing area is high even after completion of the I. The is as high as 25 mg/l at the confluence of Ganga and Varuna.Fecal coliform varied from 70000 mpn/100ml to 1.5 million/100ml.In the unpolluted upstream area of Assi river 2mg/lof BOD and undetectable fecal coliform. Treated sewage coming out from STPs has BOD >50mg/l; suspended solids >100mg/l; fecal coliform levels remain very high.

About 90 percent of pollution into the holy river is caused by sewage generation while only about 5 to 6 percent of industrial effluents can be blamed for river pollution.

Green bridge system as an ecological and economic solution for the restoration of rivers and streams. Which is the horizontal eco-filtration system to treat the pollution flowing through the streams and rivers. Study of ecological restoration of Medi Kunta lake, Hyderabad. Eco-restoration of Ahar river, Udaipur 2010.

Which found that Ahar river takes 60 days to increase dissolved oxygen from 0 to 5 ppm. Currently, 11,500 oxygen is being transferred in the river by the bio-oxygenation process. They observed that, DO concentration increased from 0 mg/L (untreated stretch) to 11.4 mg/L (treated) and DO transfer in a day – 11500 kg in 1 km stretch of eco-technological treatment. Rasoolabad stream restoration project (2011-12)

Which found that the water quality is improved in just 7 days and COD is reduced after the restoration of the stream. Present status of Khan and Nag river, Indore

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The above report found that the amount of sewage is generated more than the capacity of those rivers. Lesson learned from ecological restoration projects done in Maharashtra and India. This report found that Indian water bodies have Dissolved Oxygen (DO) less than 1 ppm in most of the urban water bodies. Due to ecological restoration of the water bodies has increased Do, water quality is improved and this benefits to the farmers, fishers, villagers, river ecosystem and urban population.

Rajnee Naithani[7] observed that social, economic, religious and cultural significance of the Yamuna River and progressive degradation of its water quality, numerous conservation campaigns and the major cleaning up projects like the Yamuna Action Plan (YAP) I, II and III were undertaken for its restoration and conservation the Yamuna River illustrate that despite all the efforts the water quality in terms of DO and BOD is not fit for designated best uses in the Delhi and eutrophicated segments.

The Yamuna River in terms of two critical parameters viz Dissolved Oxygen and Biological Oxygen Demand from 2010 to 2012 show variations from segment to segment and also year to year. Generally, a healthy river should contain at least 5mg/l of Dissolved Oxygen (DO) and a maximum of 3mg/l of Biochemical Oxygen Demand (BOD) in its water. The Yamuna River in the Himalaya segment has good water quality with no discharge of sewage into it and shows good ecological health up to the upper segment, but gets polluted at the point when it enters Delhi (CPCB 2009; Upadhyay et al. 2010). It meets the primary water quality criteria and is suitable for its designated best uses.

Jay Samant [8] discussed that Maharashtra is now finding increasingly difficult to cope up with the growing water demand for irrigation, industry and even drinking purpose. At the same time the state, though bestowed with rich natural and manmade freshwater resource and biodiversity therein, finds difficult to conserve them due to increased pollution in most wetlands. The paper discusses the present scenario of freshwater wetlands in the state with a need for their environmental protection for the present and future. The paper deals with threats to these water resources and suggests their potential at the national and international level to protect and conserve the vital resource for sustainable development of the people and their existence with nature. They give District-wise distribution of wetlands in relation to rainfall zoning.

The paper studied that, the wetlands support a variety of coastal and inland aquatic plant and animal life along with the littoral and riparian biodiversity. The wetlands are credited with several benefits to the local environment such as influencing the local hydrological cycle, climatic regime, water purification, flood control, and giving stability to the shoreline. They studied about need, threats, a potential of wetland conservation. Maharashtra has great potential for coastal and inland wetlands. However, looking at the present poor status of most of the wetlands due to anthropogenic impacts it is high time immediate and appropriate actions are taken to protect and conserve these wetlands for sustainable today and future. The number of Inland Wetlands in Maharashtra, Coastal wetlands in Maharashtra, Inland wetland area under aquatic vegetation in Post Monsoon and Pre Monsoon Season in Maharashtra and Inland wetland area under turbidity levels in Post Monsoon and Pre Monsoon season in Maharashtra. Status of lake conservation projects approved under the National Lake Conservation Plan (NLCP), MoEF, Govt. of India.

III.CONCLUSION

The main aim of this review study is to study the effect of wastewater on the river ecosystem. The review of literature will help to study the water quality of rivers in India.

The water is a life-sustaining system and one of the most important environmental components. These scarce resources have to be preserved on the most priority basis. The increasing population and subsequently industrial and urban activities are unabatedly polluting all water bodies. A gradual increase in pollution of rivers and other water bodies has become a matter of great concern and scientists, technologists, engineers, environmentalists, social scientists, and activists all over the world have been engaged in the study of the river ecosystems.

From the reviews, we study, that domestic wastewater, municipal wastewater, industrial effluents and other waste materials from various sources disposed of in rivers impacts on self-purification process of the river system.

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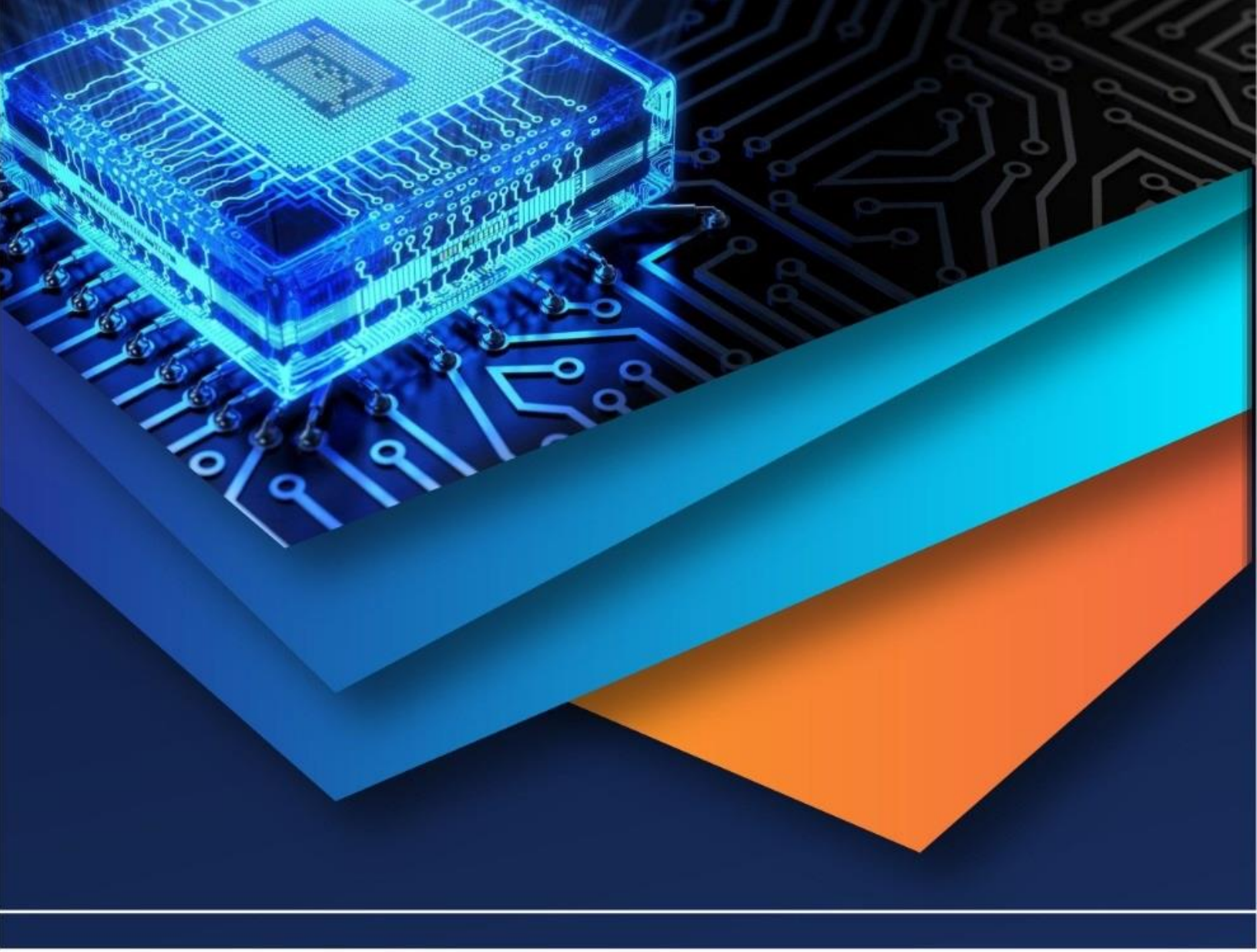

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