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A Review of Anti-Fungal Cream

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Abstract: ***This study aimed to develop a cream utilizing natural ingredients for treating fungal skin infections and improving overall skin health. The formulation represents an herbal medicinal cream containing antifungal agents, providing a systematic approach to managing cutaneous fungal infections. Topical application remains the preferred delivery method for such conditions. Creating a localized drug delivery system with systemic potential offers significant advantages over conventional administration routes. The cream incorporates botanical components recognized for their antifungal efficacy, including Aloe vera, Neem, Tulsi, and Pot Marigold (calendula) oil. The base formulation consists of beeswax, liquid paraffin, borax, and methyl paraben, with rose oil added for fragrance. The combination of these extracted natural ingredients produces a potent antifungal effect. The formulated herbal antifungal cream underwent rigorous evaluation for both efficacy and safety. Comprehensive assessments were conducted on various physicochemical parameters: physical appearance (color, odor, texture, state), pH, spreadability, homogeneity, removability, after-feel, smear type, irritancy, and antifungal activity. The final medicated cream demonstrated optimal viscosity and color, complemented by a functional rose water aroma. The global prevalence of fungal infections is rising, currently affecting 20-25% of the population and contributing to 30-50% of worldwide mortality. Contributing factors include low socioeconomic status, overcrowding, poor sanitation, and nutritional deficiencies. Trophic conditions further promote the proliferation of fungal diseases. For centuries, medicinal herbs have served as crucial resources in both traditional and contemporary medicine for managing infectious and non-infectious dermatological conditions. These plants contain active phyto constituents like polyphenols and antioxidants, which minimize adverse reactions and support the body's natural detoxification mechanisms. Antifungal creams effectively reduce inflammation, prevent wrinkles and acne, enhance blood circulation and cellular metabolism, and are suitable for sensitive, dry, and delicate skin types. Common ingredients in antifungal formulations include Asafoetida, Liquorice, Neem, Karanji oil, Alcohol, Stearic acid, Water, Bees wax, and Methyl paraben.***

Keywords: Fungal infection, Antifungal Cream, herbal formulation, Neem, Liquorice.

I. INTRODUCTION

Fungal infections represent a significant global health burden, responsible for over 1.5 million annual fatalities worldwide. Societal neglect often contributes as a primary factor in fungal pathogenesis. Recent decades have witnessed a substantial increase in the frequency, morbidity, and mortality associated with fungal infections. Mycosis, the medical term for fungal infections, encompasses various skin and pore health conditions caused by diverse fungal microorganisms. With thousands of fungal species inhabiting air, soil, water, plants, and even the human body, they can manifest as skin rashes or bumps. Common manifestations include ringworm, athlete's foot, yeast infections, and jock itch. Particularly dangerous species like Aspergillus can lead to life-threatening conditions. Their contagious nature enables person-to-person transmission.[1]Immunocompromised individuals demonstrate increased susceptibility, with approximately 20-25% of the global population affected by dermatophytosis. This common fungal infection can rapidly damage tissues, organs, and nerves, accounting for 30-50% of global deaths, especially in tropical regions. Consequently, fungal diseases have emerged as major public health concerns. The escalating incidence underscores the urgent need for novel antifungal medications with improved safety profiles and reduced toxicity compared to existing options. The rapid development of resistance among pathogenic fungi to available antifungals has become a critical global health issue, particularly for HIV-positive patients experiencing drug-resistant conditions like oropharyngeal candidiasis.[2]

Environmental humidity significantly promotes fungal spread, while poor hygiene, overcrowding, unsanitary living conditions, and lack of awareness exacerbate low socioeconomic status challenges. Limited water resources, childhood malnutrition, and environmental fungi collectively increase infection risk. Although human skin typically protects against fungal pathogens, compromised skin integrity due to heat, humidity, moisture, friction, trauma, or use of antibiotics, corticosteroids, and immunosuppressive drugs weakens this defense. Hot, moist environments particularly encourage fungal proliferation. Children in crowded households and institutions face elevated risks due to poor sanitation, limited education, contaminated water, and inadequate nutrition.

The increasing prevalence of cutaneous fungal infections in pediatric populations, especially in tropical areas, causes significant health issues, including disfigurement, pain, itching, and social interaction concerns.[3]

Mycoses result from fungal tissue invasion, ranging from superficial localized infections to severe systemic complications like septicemia, pulmonary infections, or widespread illness. Pathogenic fungi can infect individuals regardless of immune status. Dermatophytosis (ringworm or tinea), a zoonotic skin disease affecting keratinized tissues, is caused by specific fungi called dermatophytes, representing one of the most common superficial mycoses globally. Clinical presentation varies according to the specific species involved. Tinea, the most prevalent fungal infection, demonstrates geographical and anatomical variation, primarily caused by three fungal genera: Trichophyton, Microsporum, and Epidermophyton. Lesions typically appear as single or multiple round patches, often hypopigmented, well-defined, dry, scaly, and mildly erythematous. Foot fungus (athlete's foot) causes burning sensations, skin infections, and moist or flaky pedal skin, affecting 15-25% of the population at any given time.[4]Historically, medicinal herbs have served as traditional treatments for infectious and non-infectious skin conditions, typically applied as pastes or powders. Medicinal plants fulfill basic healthcare needs in traditional medicine, particularly during emergencies, though specific usage data remains limited. Global healthcare systems continue to rely on traditional medicines, with medicinal plants providing essential materials for both traditional and modern therapeutic approaches.[2]Natural formulations consistently attract significant attention due to their potent activity and minimal side effects compared to synthetic medications. Herbal cosmetics contain natural components providing physiological benefits like rehabilitation, appearance enhancement, and conditioning properties. The personal care sector has witnessed remarkable growth in herb-based cosmeceutical production, with increasing demand for herbal cosmetics. These substances aim to modify appearance, promote attractiveness, cleanse, and enhance without compromising bodily structure or functions. However, synthetic materials demonstrate adverse environmental and pediatric effects. Numerous chemicals, dyes, and synthetic substances have been associated with various dermatological conditions and adverse effects, driving efforts toward herbal cosmetic adoption.[5]Skin care cosmetic principles originate from homeopathic, Yajurveda, Ayurvedic, Unani, and Rig Vedic medical systems. These products incorporate crude or extracted plant forms possessing antibacterial, antiseptic, emollient, anti-seborrheic, and antixerotic properties. Cosmetic formulations combat acne, minimize wrinkles, and regulate sebum production. Various herbal and synthetic components create skin protection, sunscreen, anti-acne, anti-wrinkle, and anti-aging formulations for diverse dermatological conditions. Tulsi oil serves as a polyherbal component in creams, selected for systematic purposes and traditional methodologies with contemporary applications. Consistent use of natural creams should provide effective skin protection without toxicity, residual toxins, or irritation while maintaining aesthetic appeal.[3]Topical antifungal creams remain crucial for treating superficial fungal infections through targeted therapy, while systemic antifungals become necessary for severe or systemic conditions despite potential adverse effects. This research examines three primary antifungal cream categories: medicated, herbal, and polyherbal formulations. Medicated antifungal creams typically contain synthetic agents like azoles, allylamines, or polyenes, frequently prescribed in clinical practice due to demonstrated efficacy against fungal proliferation. However, growing concerns regarding antifungal resistance and side effects have stimulated interest in alternative therapeutic approaches.[6]

Herbal antifungal creams provide natural alternatives to pharmaceuticals, incorporating plant-based ingredients with established antibacterial characteristics. These combinations often feature essential oils or extracts from plants with broad-spectrum antifungal properties like garlic, neem, or tea tree. Many patients perceive herbal creams as safer and more sustainable options, though further research is necessary to establish efficacy and safety profiles. Polyherbal antifungal creams utilize multiple natural components to enhance efficacy through synergistic interactions. By combining therapeutic benefits from various plant substances, polyherbal formulations aim to achieve superior treatment outcomes and broader benefits compared to single-component preparations.[7]

This literature review compares efficacy, safety, advantages, and disadvantages of medicated, herbal, and polyherbal antifungal creams, elucidating their mechanisms and potential clinical applications. The introduced skincare innovation represents an antifungal cream revolutionizing treatment through robust effectiveness and gentle application. This exceptional formulation signifies skincare advancement beyond mere treatment, incorporating a unique combination of carefully selected plant extracts with potent antifungal and skin-enhancing properties. Its multimodal approach simultaneously combats fungal infections while nourishing skin, leaving it smooth and refreshed. Menthol extracts provide cooling and soothing effects for sensitive skin, while chamomile and aloe vera offer immediate relief from irritation and pruritus. Each component, from calming lavender to antibacterial tea tree, is meticulously selected for complementary action, creating synergistic combinations outperforming conventional antifungal treatments. The rapidly-absorbing, non-greasy formulation provides targeted relief for ringworm, athlete's foot, or persistent onychomycosis, serving as a reliable ally against fungal pathologies through its unique botanical blend, soothing characteristics, and rapid-absorption formula.[4]

A. Advantages:[5]

1) Prevents gastrointestinal drug absorption issues related to pH, enzymatic activity, and food/drug interactions
2) Provides alternative administration during vomiting, dysphagia, pediatric resistance, or diarrhea
3) Enhances patient acceptance through non-invasive delivery, avoiding parenteral therapy discomfort
4) Circumvents first-pass metabolism, preventing enzymatic inactivation
5) Enables dosage reduction compared to oral forms
6) Accommodates diverse chemical characteristics for combination therapy
7) Improves compliance through prolonged action from a single application
8) Permits rapid therapy cessation by removing the application
9) Demonstrates reduced oiliness and easier skin removal

B. Disadvantages:[5]

1) Unsuitable for medications causing skin irritation or sensitization
2) Higher cost compared to conventional dosage forms
3) Limited by application surface area and required dosage
4) Insufficient research on many topical herbal creams
5) Potential allergic reactions similar to conventional medicines
6) Variable potency depending on ingredient source and quality
7) Possible interactions with other medications
8) Compositional, sourcing, and regulatory differences from marketed antifungal creams

C. Benefits:[2]

1) Reduced adverse reaction risk
2) Universal accessibility
3) Long-term treatment compatibility
4) Enhanced natural detoxification promotion

II. CLASSIFICATION OF ANTI-FUNGAL CREAM

A. Non-Dermatophytes:[7]

Non-dermatophytes have long been recognized as saprophytic organisms prevalent in soil and the environment, known for flourishing in fungal culture media. Recent investigations have identified them as causative pathogens in onychomycosis, tinea pedis, and tinea manuum cases. Specific diagnostic criteria have been established to differentiate these organisms as genuine pathogens rather than contaminants. Non-dermatophytes demonstrate increasing recognition as causative agents in onychomycosis development, with precise prevalence detailed in section three.

B. Dermatophytes:[8]

1) Chytridiomycota
2) Zygomycota
3) Glomeromycotan
4) Ascomycota

C. Causes:

Dermatophytes represent fungal groups thriving on keratin present in hair, nails, and skin's outer layer without infecting living tissue. Candida albicans, a commensal yeast, typically exists harmlessly but under specific conditions can proliferate excessively, causing pruritus and erythema, rarely progressing to severe infections. Environmental fungi inhabiting soil or water include Histoplasma, Coccidioides, Blastomyces, and Aspergillus.

D. Symptoms:[8]

1) Cutaneous changes manifest as erythema, with potential cracking or desquamation
2) Pruritus resulting from bacterial imbalance due to:

- Antibiotic overuse
- Hormonal fluctuations
- Decreased appetite

D. Diagnosis:[8]

1) Visual inspection: Examining affected skin for characteristic signs including erythema, pruritus, and scaling
2) Medical history: Assessing patient history including previous fungal infections, allergies, and medications

E. Treatment:[9]

Standard fungal infection management involves antifungal medications, typically topical applications including creams, gels, lotions, solutions, or shampoos. Oral administration or other pharmacological approaches may be employed. Adjunctive measures include maintaining affected area dryness through powders or open-toed footwear. Corticosteroids may be administered to alleviate inflammation and pruritus for certain infections.

F. Types of Creams:[10]

1) Medicated Anti-fungal creams
2) Natural anti-fungal creams
3) Poly-herbal Anti-fungal creams

- *Medicated Anti-fungal creams*

Medicated antifungal formulations constitute essential dermatological resources against fungal infections. These preparations contain synthetic antifungal agents like azoles, allylamines, or polyenes, serving as primary treatments for various superficial fungal infections from athlete's foot to candidiasis. Their mechanism involves disrupting fungal cell membrane integrity or inhibiting crucial fungal growth and replication enzymes. Azoles like clotrimazole or miconazole provide rapid symptomatic relief from pruritus, erythema, and scaling, enhancing patient comfort and adherence. Their broad-spectrum activity ensures effectiveness against diverse fungal pathogens. However, potential drawbacks include adverse reactions like cutaneous irritation, burning sensations, or allergic dermatitis in susceptible individuals. Extended use may facilitate antifungal resistance development, requiring periodic treatment reassessment.

- *Natural Anti-fungal creams*

Herbal antifungal creams utilize therapeutic potential from natural plant-based substances renowned for their antimicrobial properties. Unlike medicated preparations relying on synthetic agents, herbal formulations derive efficacy from botanical extracts and essential oils. These creams typically incorporate diverse plant extracts like tea tree oil, neem, garlic, lavender, and calendula, each possessing distinct antifungal characteristics. Tea tree oil demonstrates broad-spectrum antimicrobial activity against various fungal species, including Candida albicans and dermatophytes. Neem extract contains compounds like azadirachtin and nimbin with potent antifungal properties. Primary advantages include perceived safety and natural origins, appealing to individuals seeking alternative therapies.

- *Poly-herbal Anti-fungal creams*

Polyherbal antifungal creams combine traditional herbal remedies with modern pharmaceutical principles, offering synergistic multi-plant extract combinations against fungal infections. Unlike single-component herbal creams relying on individual plant therapeutic properties, polyherbal formulations integrate diverse botanicals to enhance efficacy and expand spectrum coverage. These creams typically feature carefully curated plant extracts selected for specific antimicrobial properties and ingredient compatibility, harnessing complementary multi-component actions.

III. FACTORS RESPONSIBLE FOR FUNGAL GROWTH:[11]

1) pH level
2) Temperature
3) Light duration and intensity

4) Atmospheric gas composition
5) Inter-strain variations
6) Initial inoculum concentration
7) Co-existing microorganisms

IV. REVIEW OF LITERATURE:[10][13]

Pram Kumar et al. (2014-2015) developed an ointment containing miconazole nitrate and mupirocin combination with hydrocortisone. Permeation studies utilized cell cultures under controlled conditions, while microbiological examinations and live animal skin tests provided ingredient safety information. The newly created cream, combining miconazole nitrate, mupirocin, and hydrocortisone, demonstrated both effectiveness and safety for dermatological infection treatment.

Behera and Kumar Sahoo (2012) investigated gelatinous-bonded poly(lactic-co-glycolic acid) nanoparticles prepared through solvent evaporation using methanol/chloroform (2:1 ratio). Characterization involved transmission electron microscopy (TEM) and differential scanning calorimetry (DSC). Effects of stringing speeds (250-2500 rpm) and drug:polymer ratios (1:1-2:1) on particle dimensions, frequency distribution, surface charge stability, and pharmaceutical load capacity were examined. Encapsulation efficiency and drug release characteristics were evaluated. Well-structured nanoparticles were successfully created, though TEM and DSC analyses indicated incompatibilities with increasing polymer/drug concentrations and vigorous agitation.

Venugopalan Santosh Kumar et al. (2013) documented Neem (Azadirachta indica), predominantly cultivated in the Indian subcontinent with millennia of traditional medicinal use. WHO reports indicate significant reliance on traditional measures in developing countries. India's 4,500-year neem utilization history addresses numerous health issues. All tree components (fruits, seeds, oils, leaves, roots, bark) demonstrate therapeutic properties. Traditional practices include dental hygiene with neem twigs, dermatological treatment with leaf paste/juice, and general health tonics with neem tea. Leaves also serve as insect repellents for bedding, food storage, and cupboards. Its multifunctional applications earn neem the title "The Village Pharmacy."

Rakesh Kumar Singh (2019) highlighted Neem's (Azadirachta Indica) significance in traditional Indian medical systems (Ayurveda, Homeopathy) for centuries. Beyond extensive Indian cultivation, presence extends to Australia, Africa, Asia, America, and limited European/American farms. As India's most celebrated medicinal plant, Ayurveda documents numerous health benefits. All tree components serve therapeutic purposes: flowers (fresh/dried/powdered) address nausea, intestinal infections, and skin bleaching in South Indian cuisine; fruit pulp functions as natural medicine and methane production substrate.

Balraj Singh Gill et al. (2018) described Vitex negundo (Nirgundi), a medicinal plant with extensive restorative applications across traditional medicine in India, China, Nepal, Pakistan, Sri Lanka, Indonesia, the Philippines, and Indochina. Traditionally, Nirgundi leaves treat arthritis, inflammation, skin infections, and ocular conditions. Dried leaves protect woolen garments through worm and insect-repellent properties.

Nurkhalida Kamal et al. (2022) documented historical Vitex negundo utilization, particularly leaves and fruits, in numerous herbal remedies prepared as powders, pastes, decoctions, and dried extracts for various health issues. Traditional systems (Ayurveda, Unani, Chinese, Malay, European herbal, ancient Greek remedies) recognize Nirgundi's healing capacity for: rheumatism, dermatological diseases, digestive disorders, and sexual health issues, including libido and hormonal imbalances. Cross-cultural therapeutic appreciation demonstrates Vitex negundo's extensive medicinal value.

Vandana Jain et al. (2012) reported Murrayakoenigii (curry leaves) as essential in Indian traditional medicine (Ayurveda, Unani, Siddha) with centuries of culinary and therapeutic use. Various plant components (leaves, stems, bark, oil) demonstrate medicinal benefits, including digestion enhancement and general health improvement. Topical leaf, bark, and root applications address animal bites, skin eruptions, and bodily stimulation. Raw green leaf ingestion alleviates diarrhea and dysentery, occasionally serving as an emetic.

Dr. Sarah Patel et al. examined the economic implications of medicated antifungal creams from healthcare payer perspectives. Synthesizing cost-effectiveness analyses and health economic research, the authors compared antifungal cream cost propositions against alternative treatments, providing resource allocation and healthcare decision-making insights.

Dr. Lily Chang et al. explored herbal antifungal cream therapeutic potential, analyzing clinical evidence supporting botanical ingredient efficacy (tea tree oil, neem, and garlic). Authors investigated mechanisms of action, clinical effectiveness, and safety profiles of herbal treatments, elucidating their role in complementary and alternative medicine.

Prof. Michael Wong et al. focused on cutaneous infections, evaluating herbal antifungal cream efficacy and safety in managing dermatophytosis, candidiasis, and other fungal skin conditions. Preclinical and clinical study synthesis provided insights into therapeutic potential and practical considerations for botanical fungal infection treatments.

V. INGREDIENTS:[14]

1) Tulsi:

- Kingdom: Plantae
- Family: Lamiaceae
- Synonyms: Gauri, Bahumanjari, Pavani, Gramya, Surasa
- Botanical name: Ocimum tenuiflorum
- Common name: holy basil
- Chemical constituents: Eugenol, terpenes, germacrene
- Description: Erect, multi-branched subshrub (30-60 cm) with hairy stems and green/purple leaves; simple, petiolate with ovate blade (≤5 cm) and slightly toothed margin
- Uses: Antipyretic, analgesic, respiratory condition management, stress and hypertension reduction, anticancer properties

2) Neem:

- Botanical name: Azadiracta indica
- Family: Meliaceae
- Color: Green
- Description: Compound change, rachis 15-25cm, leaflets oblique-serrate (7-8.5 × 1-1.7 cm), slightly yellowish-green
- Chemical constituents: Flavonoids, alkaloids, azadirone, nimbin, nimbidin, terpenoids, steroids, tannic acid, saponins
- Uses: Acne reduction, fungal infection treatment, cleansing properties, immunity enhancement, insect repellent, wound healing, pediculosis and skin infection management, anti-allergenic, anti-dermatitic, antipyretic activities, cancerous cell damage facilitation

3) Turmeric:

- Biological name: Curcuma longa
- Common name: Haldi
- Chemical constituents: Protein, fat, minerals, carbohydrates
- Primary component: Root

4) Beeswax:

- Components: Palmitic, oleic, linoleic acids; triacontanol, melissyl alcohol

5) Borax:

- Synonyms: Sodium Borate
- Uses: Pest control, cleaning products, cosmetics, food additive

6) Liquid Paraffin

- Synonyms: Paraffinumliquidum
- Color: Colorless
- Odor: Odorless

7) Methyl Paraben:

- Uses: Cosmetics, pharmaceuticals, food products

8) Distilled Water

9) Rose oil:

- Source roses: Rosa damascena, Rosa centifolia
- Application: Fragrance

VI. EVALUATION PARAMETER:[15]

A. *Physical properties:*

Antifungal cream's physical characteristics significantly influence usability, efficacy, and user experience. Evaluated parameters included color, odor, appearance, and texture.

- Color- Pale Green
- Odor- Characteristic
- Appearance: Semi-solid

B. *Determination of pH:*

Formulation pH was determined using handheld electronic pH measurement devices. Five-gram samples dispersed in 50 mL of distilled water demonstrated a pH of 6.2.

C. *Spreadability Test:*

Spreadability measurement utilized a rectangular wooden apparatus with an attached wheel mechanism. This methodology assessed ointment characteristics based on sliding and rolling properties. Approximately 2 grams of test ointment was applied between glass slides, with identical measurements for anchored landslides. One-kilogram weight application for five minutes followed by compressed air release facilitated enhanced descent experience through friction reduction and velocity increase, creating a consistent inter-slide ointment layer. Boundary scraping removed excess ointment before upper flange tensioning (80 grams) using a cord-connected hook and timing mechanism.

D. *Washability Test:*

Five-gram formulated substance applications on epidermal surfaces underwent tepid liquid rinsing. Preparation removal duration was recorded.

E. *Irritancy test:*

0.01 cm^2 designated areas on the palmar surfaces received cream applications with timed observations. Regular interval monitoring for erythema and edema continued for 24 hours.

F. *Homogeneity:*

Visual appearance and tactile evaluation assessed formulation homogeneity.

G. *Test for microbial growth in formulated creams:*

Streak plate method:inoculate prepared creams into agar medium plates, establishing controls without butter incorporation. Plates remained in 37°C incubators until process completion. Post-incubation microbial growth assessment compared results against controls.

VII. CONCLUSION

Comprehensive analysis addressed various dermatological mycoses and their human epidermal impacts. Detailed examination revealed multiple benefits and applications of antifungal nanoparticles. These carriers undoubtedly signal impending paradigm shifts through potential revolutionary advancements in the pharmaceutical and food industries. Among diverse carriers, nanohydrogels demonstrate an extensive scope in creating effective antifungal hydrogel materials. Nature-derived polymers represent environmentally friendly methodologies offering enhanced safety compared to conventional alternatives. Various plant-derived bioplastics and aromatic compounds permit diverse application integration. Nanohydrogel materials provide effective solutions for functional skincare products addressing multiple fungal-induced dermatological conditions. Both mechanistic processes and successful nanohydrogel therapeutic implementations were documented through fungal skin infection case studies. Future considerations must address significant polysaccharide-derived nanohydrogel system integrity influences from societal factors.

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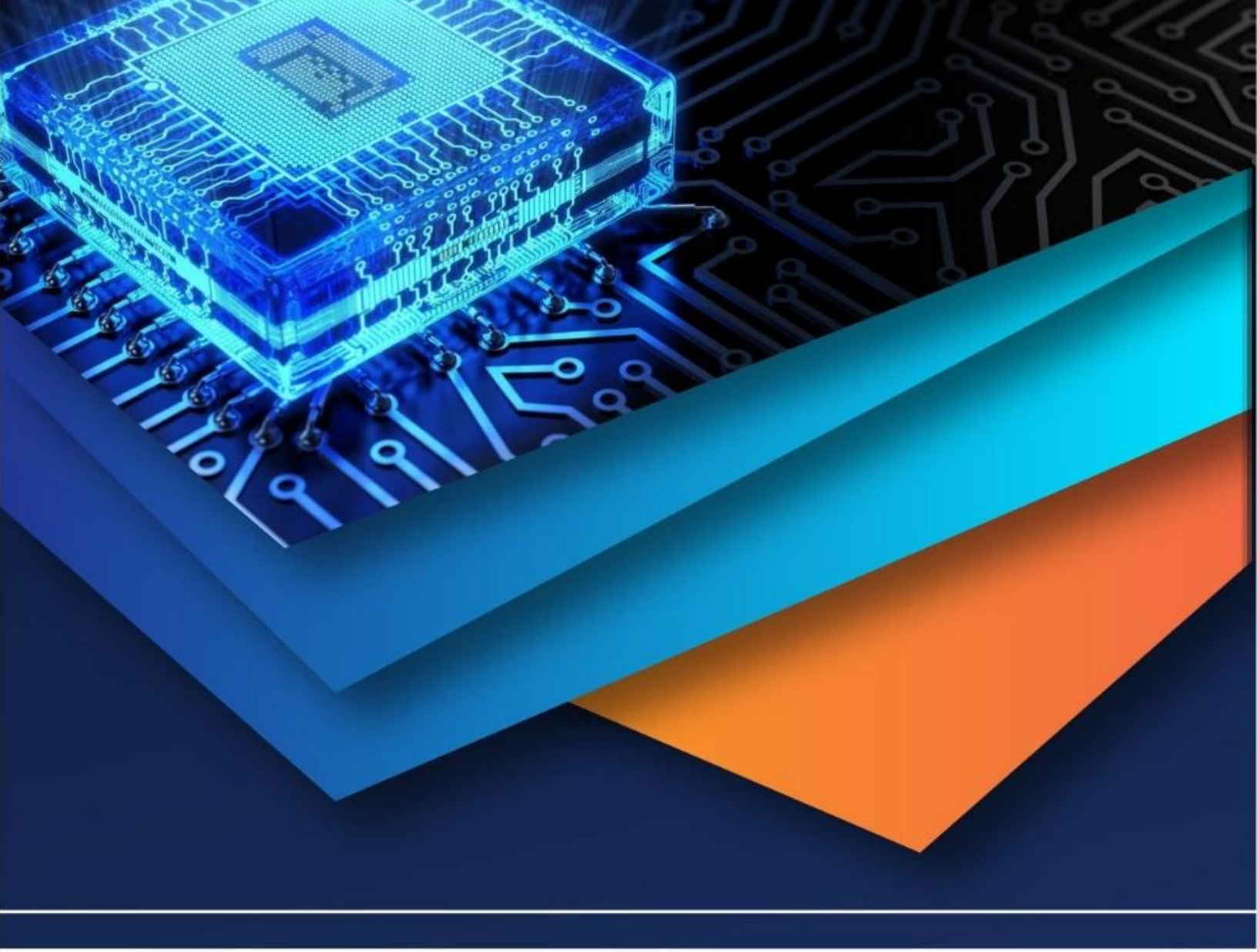

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