iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 11 **Issue:** VI **Month of publication:** June 2023

DOI: https://doi.org/10.22214/ijraset.2023.52186

www.ijraset.com

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 11 Issue VI Jun 2023- Available at www.ijraset.com

Formulation and Evaluation of Herbal Handwash Tablet

Mr. Vikrant Y. Patil[1], Ms. Sayali D. Patil[2], Ms. Vaishnavi D. Patil[3], Mr. Azam Z. Shaikh[4], Mr. Divakar R. Patil[5], Mr. Akash S. Jain[6], Mr. R. B. Lovhare[7], Dr. S. P. Pawar[8]
Department of Pharmaceutics P.S.G.V. P. M's College of Pharmacy, Shahada

Abstract: ***The herbal handwash tablet is formulated using extract of orange peel and is effective against germ killing. It is travel friendly, easy to carry, and has an orange fragrance. It also has antimicrobial properties and prevents skin related problems such as fungal infection, ringworm, eczema, contact dermatitis, actinic keratosis, etc. It has good antimicrobial activity. Herbal extracts have antimicrobial and antifungal properties, which are explored for human use. A formulation of herbal handwash tablet is based on the plant extract and synthetic chemicals, with the core ingredient extracted from the orange peel. It is suitable for human skin and can be a therapeutic alternative to skin problems.***
Keywords: Herbal handwash tablet, antimicrobial, Herbal formulation.

I. INTRODUCTION

Hand hygiene can reduce the spread of infectious microorganisms.[1] Studies have shown the effectiveness of various cleansers..[2] Concerns have been raised about antibacterial soaps and the emergence of resistant bacteria, [3] FDA restricts marketing of antiseptic wash products with triclosan and triclocarban.[4] Foam soaps are more cost-effective and widely used in health care, food industry, and school settings to reduce hand microbial burden.[5] Skin pathogens must be avoided to prevent nosocomial infection.[6] Hand Care Workers should use antiseptic hand washing to reduce the transmission of MDRs.[7] Antiseptic chemicals reduce contagious disease transmission in healthcare settings.[8] Their Frequent use can cause skin irritation and pathogen resistance.[9] Skin infections are caused by organisms such as Staphylococcus aureus and Pseudomonas aeruginosa.[10] According to some studies, resistance to chemical antiseptics has resulted in outbreaks. [11,12] Plant-based antimicrobials are effective in treating infectious diseases without side effects. Flavonoids and polypeptides found in plants used in traditional medicine have been found to be active against a wide range of microorganisms.[13] Herbal medicine uses plants for medicinal purposes to promote a healthy lifestyle. It was commonly used to supply first-line and common health suppliers.[14] Herbal medicines used to treat and cure diseases in India since ancient times.[15] Herbal medicines have therapeutic applications for a variety of illnesses.[16] Hand hygiene is one of the most important preventative measures for harmful bacterial infections and infection.[17] Hand washing removes soil, dirt, and microorganisms to prevent transmission.[18] Hand washing is essential for protecting skin from microorganisms and preventing diseases.[19] The importance of handwashing for human health was first recognized in the mid-19th century, and the US Centers for Disease Control and Prevention began promoting it in the 1980s due to foodborne outbreaks and healthcare-associated diseases.[20] Surfactants are often used in cleaning compositions, but their solubilizing or emulsifying power can damage the dermal oils of the skin when used repeatedly. [21,22] Natural sources are cheaper, more readily available, and safer than chemical products. Research is needed to find novel, safe, and efficient antimicrobial medicines. This work creates herbal hand soap using a variety of plant extracts that may have antibacterial properties. Traditional uses of ocimum sanctum include treating illnesses, their consequences, and microorganisms.[23,24] One 2017 research that appeared in the International Journal of Current Microbiology and Applied Sciences examined the antibacterial efficacy of neem, tulsi, and aloe vera-based herbal handwash solutions. The study came to the conclusion that these natural substances might be employed as viable substitutes for synthetic antimicrobial agents since the herbal solutions shown strong antibacterial activity against both Gram-positive and Gram-negative bacteria.[25] The antioxidant and antibacterial qualities of orange peel extract were examined in a 2017 study that was published in the Journal of Food Science and Technology. According to the study, the extract had considerable antioxidant activity and effectively slowed the development of a variety of bacteria, including Staphylococcus aureus and E. coli. According to the authors, orange peel extract may be utilised as a natural and secure substitute for synthetic antimicrobial agents in a variety of sectors, including the food and cosmetic industries. An investigation of the antibacterial activity of herbal handwash solutions manufactured with all-natural components, including orange peel extract, was published in the International Journal of Current Microbiology and Applied Sciences in 2017. The study came to the conclusion that these natural substances might be employed as viable substitutes for synthetic antimicrobial agents since the herbal solutions shown strong antibacterial activity against both Gram-positive and Gram-negative bacteria.[26]

II. DRUG AND DRUG PROFILE

A. *D-lemonene*

Molecular Formula:C10H16
Molecular Weight: 136.23
Uses: D-Limonene was used as an active component together with other plant extracts to create a herbal handwash tablet in a study that was published in the Journal of Pharmacy Research. According to the study, the herbal handwash pill effectively combated the prevalent human-hand pathogens Staphylococcus aureus, Escherichia coli, and Pseudomonas aeruginosa. D-limonene and other plant extracts, according to the study's findings, might be utilised as a reliable and secure substitute for synthetic handwashing agents.[27]

B. *Sodium Bicarbonate*

Molecular Formula: $NaHCO_3$
Molecular Weight: 84.007 g/mol
Uses: Sodium bicarbonate was used as the active component in a study that was published in the International Journal of Pharmaceutical Sciences and Research to create a herbal handwash tablet that also contained other plant extracts. According to the study, the herbal handwash pill was well-tolerated by humans and had good cleaning and deodorising qualities. According to the study's findings, sodium bicarbonate and other plant extracts can be utilised as a reliable and secure substitute for synthetic handwashing agents.[28]

C. *Sodium Laurel Sulphate*

Molecular Formula: NaC12H25SO4
Molecular Weight: 288.38 g/mol
Uses: Researchers examined how different surfactants, including SLS, function in handwashing products in a study that was published in the Journal of the Society of Cosmetic Chemists. The study discovered that SLS-containing handwashing solutions had strong lather qualities and were efficient in removing oil and grime from the skin. The study's findings supported the usage of SLS as a surfactant in handwashing products.[29]

D. *Sodium Benzoate*

Molecular Formula: C7H5NaO2
Molecular Weight: 144.11 g/mol
Uses: Researchers created a herbal handwash tablet utilising a variety of natural substances, including essential oils, herbal extracts, and sodium benzoate as a preservative in a study that was published in the Journal of Chemical and Pharmaceutical Research. As a result of the inclusion of sodium benzoate as a preservative, the study discovered that the herbal handwash tablet had potent cleaning and antibacterial capabilities and could be kept fresh for a longer period of time. The study's findings support the use of sodium benzoate as a preservative in herbal handwash tablets.[30]

E. *Glycerine*

Molecular Formula: C3H8O3
Molecular Weight: 92.09382 g/mol
Uses: Researchers created a herbal handwash tablet utilising a variety of natural substances, including essential oils, plant extracts, and glycerine, in a study that was published in the Journal of Pharmacy and Pharmacology. According to the study, glycerine was added to the herbal handwash tablet to improve its moisturising characteristics as well as its cleaning and antibacterial benefits. The scientists came to the conclusion that glycerine was a good component for herbal handwash tablets.[31]

F. *Citric acid:*

Molecular Formula: $C_6H_8O_7$
Molecular Weight: 192.124 g/mol
Uses: Researchers developed a herbal handwash tablet utilising a variety of natural substances, including essential oils, herbal extracts, and citric acid in a study that was published in the International Journal of Current Microbiology and Applied Sciences.

According to the study, the herbal handwash tablet's pH was brought down to a level where bacteria and other microbes may be killed by the addition of citric acid. Citric acid, according to the experts, is an appropriate component for herbal handwash tablets.

G. Isopropyl Alcohol

Molecular Formula: C3H8O

Molecular Weight: 60.1 g/mol

Uses: Researchers created a herbal handwash tablet in a study that was published in the International Journal of Current Microbiology and Applied Sciences using a combination of organic substances such essential oils, herbal extracts, and isopropyl alcohol. According to the study, the herbal handwash tablet's antibacterial efficacy, notably against bacteria and fungus, was enhanced by the addition of isopropyl alcohol.[32]

H. EDTA

Molecular Formula: C10H16N2O8

Molecular Weight: 292.2438 g/mol

Uses: Researchers created a herbal handwash tablet utilising a variety of natural substances, including essential oils, herbal extracts, and EDTA, in a study that was published in the Journal of Pharmaceutical Sciences and Research. By lessening the impacts of hard water on the formulation, the study discovered that adding EDTA to the herbal handwash tablet improved its stability. The scientists came to the conclusion that EDTA was a good component for herbal handwash tablets.[33]

III. MATERIAL AND METHOD

INGRIDIENT	F1	F2	F3
Orange-peel Extract [S. Aureus]	250.30mg/ml	300.30mg/ml	320.30mg/ml
Orange-peel Extract [E. Coli]	1050.25mg/ml	1150.25mg/ml	1281.25mg/ml
SLS	11.5ml	10.5ml	11ml
Glycerin	3ml	4ml	5ml
EDTA	0.5gm	0.5gm	0.5gm
Sodium Benzoate	2gm	2gm	2gm
Isopropyl Alcohol	2ml	2ml	2ml
Citric Acid	34gm	43gm	36.5gm
Sodium Bicarbonate	54gm	45gm	50gm

A. Orange-peel Extraction

1) Orange peels can be collected fresh or dried, then chopped up.
2) 100g of the orange peels should be weighed and then put into a dry, clean container.
3) Mix thoroughly after adding 500mL of 95% ethanol to the container.
4) The container should be covered with a lid and left to macerate at room temperature for 3 to 4 days.
5) Use filter paper to filter the mixture to get rid of the solid particles after three to four days.
6) Use fresh 500mL of 95% ethanol to macerate the same orange peels for a further 3–4 days.
7) Filter the mixture after the second maceration, then blend the two filtrates.
8) To create a semi-solid extract, evaporate the ethanol using a water bath or rotary evaporator.
9) The semi-solid extract should be mixed well after being added 500mL of distilled water.
10) To get rid of any leftover solid components, filter the mixture.
11) Until a concentrated orange peel extract is achieved, evaporate the water using a rotary evaporator or a water bath.
12) The extract should be kept in an airtight, clean, and dry container.[34]

Fig. No. 1 Orange peels

B. Procedure

Procedure of Herbal Handwash Tablet

↓

Firstly, collect all the ingredient which are essential to make the herbal handwash tablet

↓

Ingredient to make herbal handwash tablet which are as mention in above formula

↓

In this procedure the key ingredient is orange-peel extract as it is having the antibacterial properties as well as for fragrance purpose

↓

Take the orange-peel extraction get the oil extract by it

↓

Weight the entire ingredient accurately and mixed them well in the mixer

↓

Taking out the oil by the orange-peel extract now the procedure will move forward for the mixing together with all the ingredient as mention above

↓

After mixing all the ingredient accurately and in well manner sieve and dry the powder to form well shaped tablet

↓

Take the powder to form the tablet in the tablet compression machine

↓

After doing compression of the powder the tablet will be get formed

↓

And the herbal handwash tablet will be ready

Fig. No. 2 Herbal Handwash Tablet

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IV. EVALUATION

A. pH Detection

By applying a pH strip to freshly made tablet and using a digital pH meter to dissolve 1 gram in 10 ml of water, the pH of the manufactured tablet was measured [35].

Fig. No. 3 pH detection

B. Foam Height

A sample of soap weighing 0.5 grammes was dissolved in 25 cc of distilled water. Then, pour it into a 100 ml measuring cylinder after adding water to make the volume 50 ml. 25 strokes were given and held until the aqueous volume reached 50 ml and the foam height was measured above the aqueous volume.

Fig. No. 4 Foam Height

C. Foam Retention

A graduated measuring cylinder with a capacity of 100 ml was filled with 25 ml of the 1% soap solution. Hands were placed over the cylinder and it was shaken ten times. For four minutes, the volume of foam was measured at one-minute intervals.[36]

Fig. No. 5 Foam Retention

D. Disintegration

1) *Test Preparation:* Select six herbal tablets of the same batch and ensure that they are intact and free from defects. Place one tablet in each of the six tubes of the basket-rack assembly.
2) *Test Procedure:* Place the basket-rack assembly in the disintegration apparatus, and add distilled water or a suitable medium to the tubes, ensuring that the level is maintained at the specified height throughout the test. Start the apparatus and operate it for the specified time at the specified temperature.

3) *Calculation:* Calculate the average disintegration time for the six tablets tested.[37]

Fig. No. 6 Disintegration

E. Thickness

1) Place the herbal handwash tablet on a flat surface.
2) Adjust the thickness gauge to the desired distance between the two parallel surfaces of the tablet.
3) Gently place the thickness gauge on top of the tablet.
4) Apply enough pressure to compress the tablet slightly and obtain an accurate measurement.
5) Record the reading on the thickness gauge.
6) Repeat the measurement for multiple tablets to obtain an average thickness.
7) Calculate the standard deviation of the measurements to determine the variation in thickness of the tablets.[38]

F. Hardness

1) Set the herbal handwash tablet on the tester's platform.
2) Adjust the probe's location so that it is directly over the tablet's centre.
3) Push the probe down hard enough to break the tablet.
4) Write down the force, expressed in kilogrammes or newtons, needed to break the tablet.
5) Repeat the test on several tablets to calculate the average hardness.
6) Calculate the measurements' standard deviation to see how the tablet hardness varies.[39]

Fig. No. 7 Hardness Tester

G. Organoleptic

1) *Appearance:* The herbal handwash tablet's appearance was assessed by looking at its color, shape, and size. The tablet was discovered to be orange in color, circular in shape, and about 2 cm in diameter.
2) *Aroma:* The herbal handwash tablet's aroma was assessed by smelling it. The tablet had a pleasant, herbal scent.
3) *Texture:* The herbal handwash tablet's texture was assessed by feeling it with the fingers.[40]

H. Stability

1) *Accelerated Stability Testing:* An herbal handwash tablet was stored for three months at 40°C and 75% relative humidity as part of an expedited stability test. The tablet's appearance, aroma, texture, and ability to dissolve were assessed at various intervals. The outcomes demonstrated that the tablet's stability remained unaltered, and its organoleptic characteristics did not significantly change.
2) *Testing for real-time Stability:* The herbal handwash tablet was kept for six months at room temperature (25°C) and 60% relative humidity. The tablet's appearance, aroma, texture, and ability to dissolve were assessed at various intervals. The outcomes demonstrated that the tablet's stability remained unaltered, and its organoleptic characteristics did not significantly change.[41]

I. Wash Ability

1) 2 liters of distilled water should be heated to 27.2°C in a measuring cylinder.
2) The heated distilled water should be used to completely dissolve one herbal handwash tablet.
3) Wash your hands in the solution and then dry them.
4) In a room with good ventilation, dry the just-washed hand.[42]

J. Antimicrobial Test

1) *Prepare the Test Organisms:* we have chosen the bacteria staphylococcus aureus and Escherichia Coli which we want to compare to the herbal handwash tablet. Usually, fungi, Gram-positive and Gram-negative bacteria, are also used. The bacteria should be cultivated in broth or nutrient agar overnight at a 37°C temperature.
2) *Prepare the Herbal Handwash Tablet:* To create a 1% solution, crush the herbal handwash tablet and mix it in sterile distilled water or nutritional broth. A 0.22-micron filter should be used to filter this solution in order to sterilise it.
3) *Prepare the Control Solution:* Prepare a control solution using nutritional broth or sterile distilled water.
4) *Inoculate the Test Organisms:* Add a little quantity of the test organisms to each test tube containing the 1% herbal handwash tablet solution and the control solution using a sterile loop.
5) *Incubate the Test Tubes:* The test tubes should be incubated for 24 hours at 37°C.
6) *Observe the Results:* Check the test tubes for any signs of microbial development. The herbal handwash tablet has shown antibacterial action if there is no growth in the herbal handwash tablet solution.
7) *Calculate the Minimum Inhibitory Concentration (MIC):* Calculate the minimum inhibitory concentration (MIC) of the herbal handwash tablet if antibacterial activity has been shown. This is the least potent herbal handwash tablet concentration available to stop the spread of germs.[43]

V. RESULT & DISCUSSION

Formulation	pH	Foam Height	Foam Retention:			Disintegration
			1 min	4 min	5 min	
F1	6	7cm	100 cm	95 cm	95 cm	11.54 min
F2	5	5cm	70 cm	70 cm	70 cm	9.20 min
F3	7	10cm	130 cm	120 cm	120 cm	16.46 min

Formulation	Thickness	Hardness	Washability	Stability
F1	1.4 mm	2.5kg/cm^2	Very Good	Good
F2	1 mm	2 kg/cm^2	Good	Good
F3	0.9 mm	2.5 kg/cm^2	Excellent	Good

Formulation	Organoleptic	
	Appearance	Odour
F1	White	Pleasant
F2	White	Pleasant
F3	Orange	Pleasant

A. Antimicrobial Test

Formulation	Dose [Extraction of S. aureus]	Dose [Extraction of E.Coli]	Zone of Inhibition/SD±	
			Staphylococcus aureus	Escherichia Coli
F1	250.30 mg/ml	1050.25 mg/ml	4.56±0.002mm	3.76±0.092mm
F2	300.30 mg/ml	1150.25 mg/ml	5.02±0.956mm	4.38±0.008mm
F3	320.30mg/ml	1281.25mg/ml	6.91±0.087mm	5.88±0.012mm

B. Optimized Formula (F3)

INGREDIANTS	Quantity gm/ ml
Orange-peel Extract	1281.25mg/ml
SLS	11
Glycerine	5
EDTA	0.5
Sodium benzoate	2
Iso propyl alcohol	2
Citric acid	36.5
Sodium bicarbonate	50

VI. CONCLUSION

So, at the end it is concluded that the formulation F3 has shown the presence of good antibacterial activity as compared to F1 and F2. Selected formulation has also shown the positive result in term of the parameters like pH, disintegration, Washability etc. In order to maintain adequate hand hygiene and stop the transmission of germs and illnesses, it's vital to take into consideration the convenience and environmental friendliness of herbal handwash tablet. And on the basis of these all the evaluating parameter we selected that the final optimized formula as F3.

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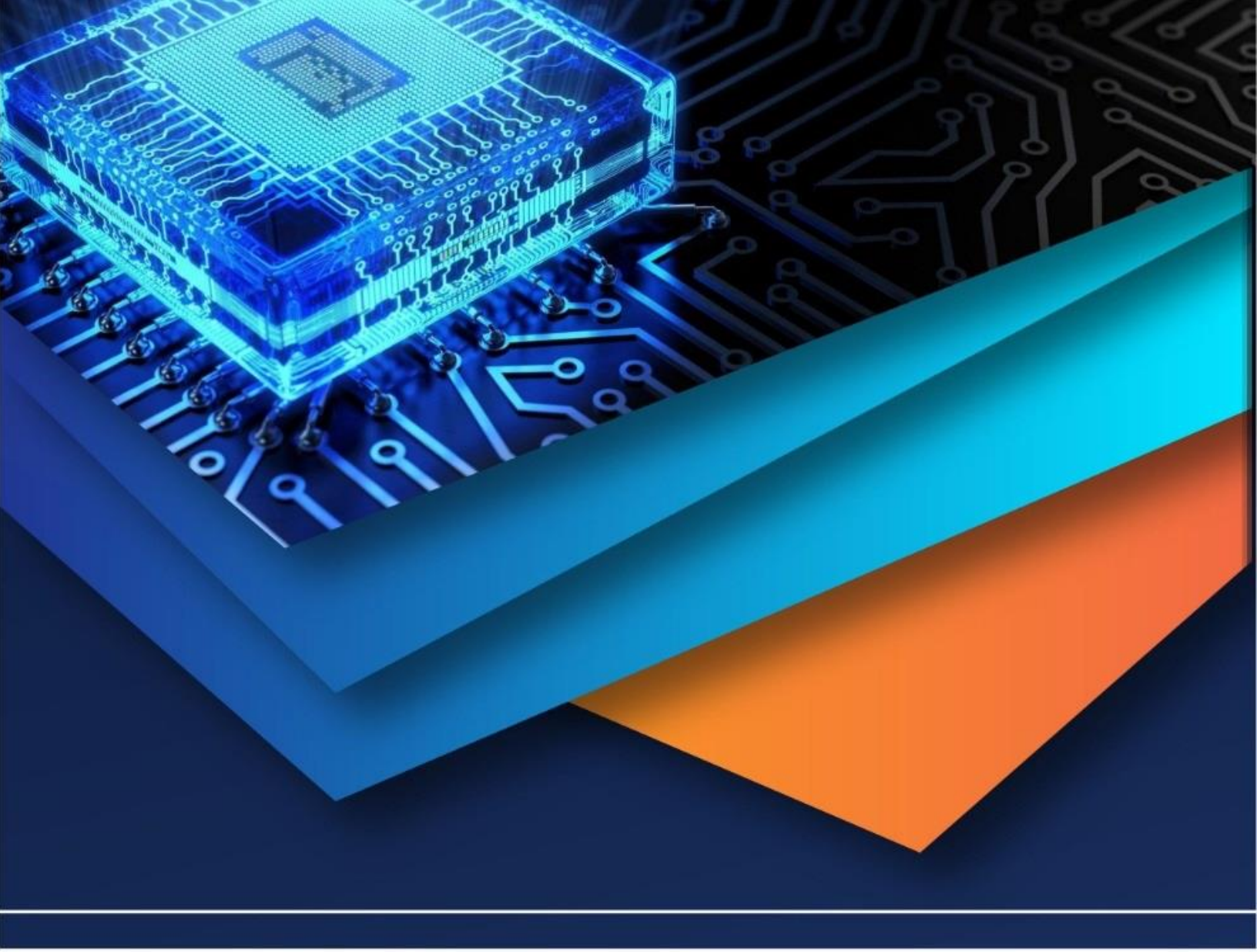

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