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Formulation and Evaluation of Anti-Inflammatory Herbal Oil for Treatment of Varicose Veins

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Abstract: ***This research paper presents the formulation and characterization of herbal oil utilizing anti-inflammatory herbal extracts to alleviate symptoms associated with varicose veins.***
The formulation integrates ginger oil, garlic, turmeric, olive oil, mustard oil, peppermint oil, castor oil, eucalyptus oil and guggul powder to create synergistic blend targeting varicose veins .
The selection of ingredients was based on their individual properties, including anti inflammatory, improving blood circulation, cooling effects.
The oil was developed through a series of experiments to optimize ingredients concentrations and ensure stability and efficacy. Characterization studies include pH measurement, viscosity analysis, stability testing , acid value, saponification value, were conducted to evaluate the quality and performance of the formulation.
Additionally, the safety profile of herbal oil was assessed through skin irritation tests. The results demonstrate that the formulated herbal oil exhibits desirable characteristics , including a balanced pH , suitable viscosity for application and good stability over a time.
Furthermore ,it indicate promising anti-inflammatory effects of herbal oil, suggesting its potential as a natural therapeutic option for managing varicose veins.
Overall, this research contributes to development of natural and effective herbal oil , highlighting the potential of herbal formulation for treating varicose veins.
Keywords: Herbal oil, varicose veins, pH, anti inflammatory, eucalyptus oil, guggul powder

I. INTRODUCTION

A. Definition

In the subcutaneous tissues of the legs and ankles, varicose veins are twisted, swollen, palpable, and frequently readily noticeable. They are typically blue or dark purple in color. All of these veins have one-way valves to guarantee that blood goes to the heart. However, because these valves are typically ineffective, blood reflux occurs, which can lead to venous hypertension and its associated symptoms.[1]

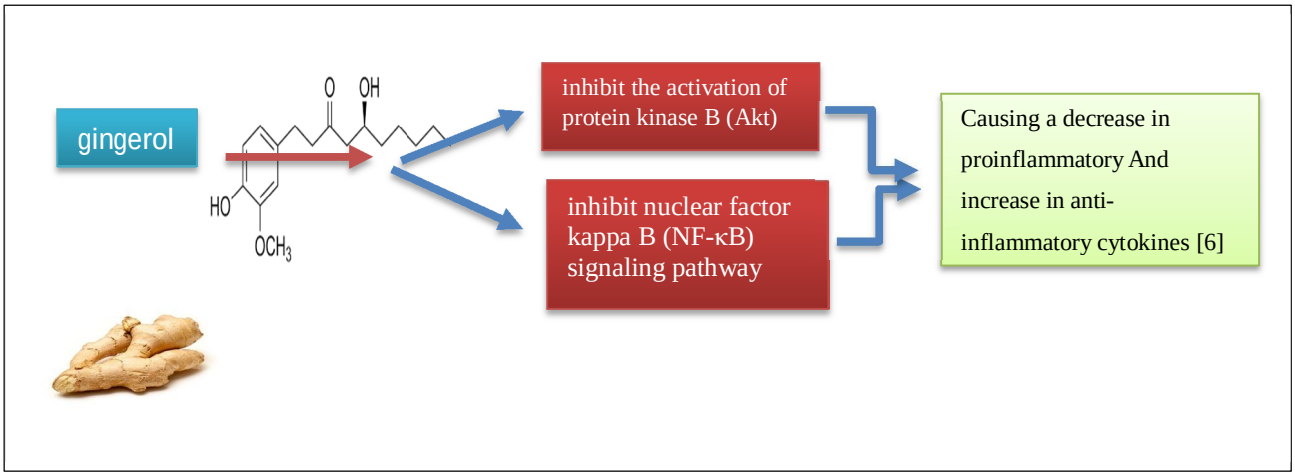
Varicose veins afflict millions worldwide, causing discomfort and impacting quality of life. To address this pervasive issue, we present Varico-Ease Oil, a meticulously crafted blend of ginger oil, olive oil, turmeric, garlic, peppermint oil, castor oil, mustard oil, eucalyptus oil and guggul powder.[2]

This innovative formulation harnesses the therapeutic properties of each ingredient to provide comprehensive relief for varicose vein symptoms. Ginger and olive oil offer anti-inflammatory benefits, reducing swelling and discomfort, while turmeric's curcumin improves circulation and alleviates pain.[3]

Garlic strengthens vein walls, while peppermint oil provides a cooling sensation for relief. Castor oil promotes healing, while mustard oil enhances blood flow with its warming effect. Guggul powder supports vein health and reduces inflammation.[4] Through synergistic action, Varico-Ease Oil offers a holistic approach to managing varicose veins, addressing both symptoms and underlying issues.

This research project aims to explore the efficacy and mechanisms of Varico-Ease Oil, offering insights into its potential as a natural solution for varicose vein management.[5]

B. Mechanism of Action



II. MATERIALS AND METHODS

A. Herbal Ingredients used for Formulation

1) Ginger

a) Biological Source: Ginger are extracted from Rhizome (under ground stem) of Zingiber officinale belongs to family Zingiberaceae.

b) Chemical Constituents: 6-gingerol, 6-shogaol, and 6-paradol, zingiberene and bisabolene. Ginger, one of the pungent herbal medicines, has the super ability to dissolve fibrin and reinstate blood circulation in vessels. Remember it is not an easy task to breakdown fibrins and it requires powerful food such as ginger to accomplish. It should be noted that ginger delivers the most desirable effect when it is consumed in its fresh form. It reduce inflammation in the body, relieve muscle and joint pain.


[7]

2) Turmeric

a) Biological Source: Turmeric is a product of Curcuma longa, a rhizomatous herbaceous perennial plant belonging to the ginger family Zingiberaceae

b) Chemical Constituent: polyphenol, curcumin Increases the production of nitric oxide, which in turn facilitates better blood flow and circulation. The mechanism of action by which curcumin shows anti-inflammatory effect is by attenuating inflammatory response of TNF-α stimulated human endothelial cells by interfering with NF-κB.


[8]

3) *Garlic*

a) *Biological Source:* Garlic consists of ripe bulbs of Allium Sativum, belonging to family Liliaceae .

b) *Chemical Constituents:* Garlic contains carbohydrates, proteins, fats, mucilage and essential oil (volatilesir). The volatile oil is the main active constituent. It contains allicin.

Garlic is an excellent herb for reducing inflammation and the symptoms of varicose veins. It also helps break up harmful toxins in the blood vessels and improve circulation.

[9]

4) *Guggul*

a) *Biological Source:* Guggul is an aromatic or fragrant oleo gum resin that exudes out from the bark of Commiphora mukul, belonging to family Burseraceae.

b) *Chemical Constituents:* oleo-gum resin are Z-guggulsterone, E-guggulsterone, Z-guggulsterol and guggulsterol I-V Guggul sap, also referred to as guggul, gum guggul, guggula, or gugulipid, is tapped from the plants similarly to how maple syrup is extracted from maple trees .Guggul has been used for centuries in Ayurvedic medicine, a holistic, plant-derived medical system, to treat various health conditions, such as obesity, arthritis, and inflammation (1Trusted Source).Guggul contains a mixture of plant compounds, including steroids, essential oils, lignans, flavonoids, carbohydrates, and amino acids — all of which may be responsible for its various health effects Purported to have anti-inflammatory and antioxidant properties, it has been used in ancient medicine to protect against a variety of diseases.

[10]

5) *Mustard Oil*

1) *Biological Source:* The seeds of the mustard plant, which belongs to the Brassicaceae family, are used to make mustard oil.

2) *Chemical Constituents:* The main ingredient, allyl isothiocyanate, is what gives the oil its strong scent and irritating acid and other also present.

The nutritional profile of mustard oil is fabulous. Mustard oil is rich in vitamins A, B, Vitamin E, calcium, and protein. It also has significant amounts of omega-3 fatty acids, besides monounsaturated and polyunsaturated fatty acids. Moreover, the anti-inflammatory property of mustard oil helps to treat joint-related pain. Mustard oil contains a compound that could be useful for reducing inflammation: allyl isothiocyanate.

 [11]

6) *Olive Oil*

a) *Biological Source*

b) *Chemical Constituents:* Mixed triglyceride esters of oleic acid, linoleic acid, palmitic acid and of other fatty acids, along with traces of squalene and sterols.

Olive oil is a rich source of Vitamin E which plays a crucial role in maintaining proper vascular health. Vitamin E present in olive oil widens the blood vessels. Since an erection requires the penis chambers to be dilated, olive oil can prove to be quite successful in increasing the blood supply to the penis so that proper erection can be achieved.

 [12]

7) *Eucalyptus Oil*

a) *Biological Source:* Originated from eucalyptus tree leaves, belonging to family Myrtle

b) *Chemical Constituents:* One of the main ingredients, 1,8-cineole (eucalyptol), makes up 70–90% of the oil's composition.

Eucalyptus oil helps to reduce pain and inflammation associated with many conditions. It may also be helpful to people experiencing back pain or those recovering from a joint or muscle injury.

 [13]

8) Castor Oil

a) Biological Source: Derived from castor bean plant seeds, belonging to family Euphorbiaceae .

b) Chemical Constituents: Approximately 90% of the fatty acid content in castor oil is made up of ricinoleic acid.

Castor oil is a vegetable oil pressed from castor beans. It is a colourless or pale yellow liquid with a distinct taste and odour. Castor oil's anti-inflammatory properties make it an excellent massage oil for arthritic joints, sore muscles, and inflammation of your nerves. The ricinoleic acid that castor oil contains possess the ability to boost anti-inflammatory properties within the body and is considered a safe remedy for arthritis pain.

 [14]

9) Peppermint Oil

a) Biological Source: Peppermint oil is the essential oil taken from the flowering parts and leaves of the peppermint plant, belonging to family Lamiaceae.

b) Chemical constituents: Menthol and menthone, menthyl acetate, 1,8-cineole, limonene, beta-pinene and beta-caryophyllene.

Peppermint oil is known for its potential anti-inflammatory properties, which can be beneficial in managing varicose veins. Varicose veins are enlarged, twisted veins that often cause discomfort and pain. Peppermint oil contains menthol, which has a cooling effect and may help reduce inflammation and pain associated with varicose veins. The massage can help improve circulation and reduce inflammation.

 [15]

Table: Formula

Sr. no.	Name of Ingredients	Quantity (30ml)			
		F1	F2	F3	F4
1	Ginger oil	2	1	-	3
2	Turmeric	2	2	1	3
3	Garlic	2	2	1	2
4	Guggul powder	1	1	1	2
5	Mustard oil	5	10	15	5
6	Olive oil	6	2	1	2
7	Eucalyptus oil	5	1	-	1
8	Castor oil	5	10	10	10
9	Peppermint oil	2	1	1	2

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III. PROCEDURE

A. Preparation of Extract

The dried ginger was grinded to powder using a grinder and stored in a closed receptacle. 10 g of the powdered ginger sample was placed inside a thimble and inserted into the Soxhlet extractor. 250 mL of methanol was added to 10 g ginger sample and extraction of the oil was carried out for 3 hours The refluxing temperature was 65 °C. After extraction, the methanol was removed using cleavenger apparatus leaving the essential oil only. [16]

Fig : Extraction

B. Procedure

1) Accurately weigh all the ingredients and dried powder.
2) Mix mustard oil, castor oil, olive oil uniformly.
3) After that mixing add crushed turmeric and garlic with guggul powder. Then heat until the colour changes.
4) To the oil mixture, add eucalyptus oil and ginger oil , stir well.
5) Heat the oil and herbs over low heat for 10-15 min. Avoid boiling of oil;gentle heat will help the herbs infuse without breaking down too much.
6) Stir occasionally and ensure that the herbs do not burn.
7) In the last stages, after heating leave it for cooling and then add peppermint oil in the oil mixture
8) After mixing ,whole preparation filter the oil to get rid of all the solid particles using filter paper.
9) To maintain its qualities,pour the squeezed oil into a dark glass bottle.Store the oil somewhere at cold and darkh place.[17]

Fig : Heat and Stir

Fig : Filteration

Fig : F1, F2, F3, F4 batches

IV. EVALUATION TEST

A. *Organoleptic Property*

The organoleptic characterization of herbal oil such as colour, odour and texture were investigated.

B. *pH Evaluation*

The pH of herbal oil is measured to determine their acidity or alkalinity. This data is essential because it ensures that the oil is in the ideal pH range for optimal skin health and effectiveness.

1) Before use, rinse the electrode with distilled water.
2) Calibrate the pH meter by using buffer solutions of 4.01, 7, and 10.01.
3) The electrode was transferred to the test solution.
4) The pH was recorded for 5 samples respectively. [18]

Fig. : pH of Oil

C. Viscosity

Viscosity is measured using an Ostwald viscometer. The amount of time needed for the liquid to flow by gravity between marks A and B inside the capillary tube is found. The test liquid's flow time is compared to the amount of time needed for a known-viscosity liquid and an unknown-viscosity liquid.

1) The viscometer was placed on an appropriate pedestal and fixed vertically.
2) The viscometer was filled with water up to mark A.
3) Water flowed from mark A to mark B in a timed manner.
4) The same process was carried out with the test liquid, and its viscosity can be calculated using the formula below.

η_1 can be determine using following equation.

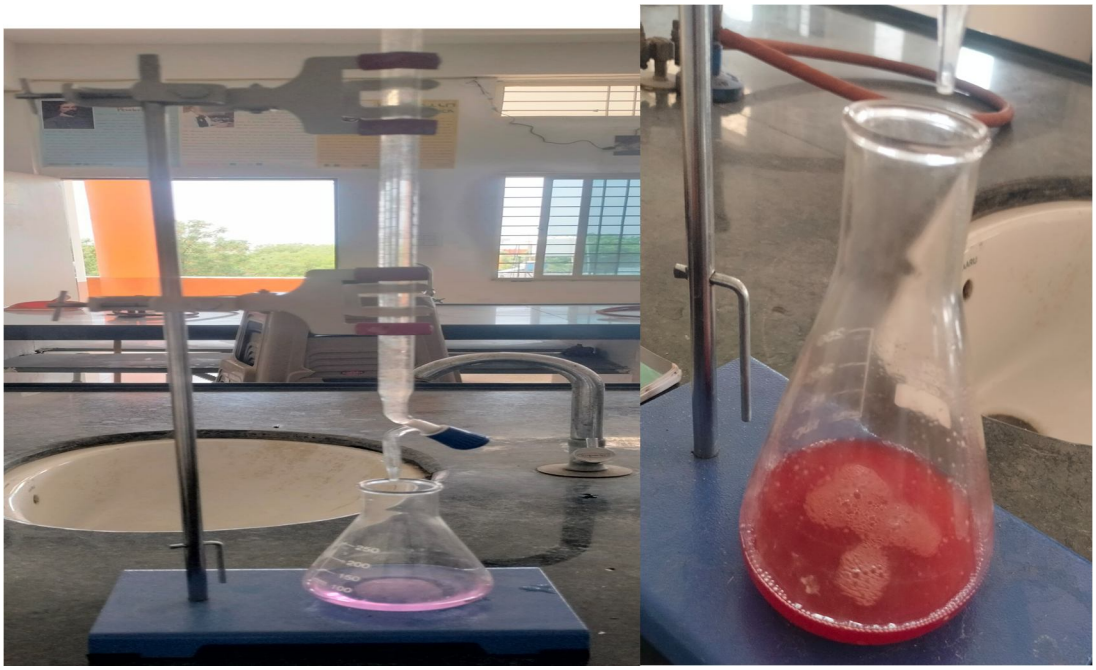
$$\eta_1 = \int_1 t_1 / \int_2 t_2 \text{ X } \eta_2$$

$\int_1$=Density of unknown liquid
t_1 =Time of flow of unknown liquid
$\int_2$ =Density of standard liquid
t_2 =Time of flow of standard liquid
η_2=Viscosity of standard liquid. [19]

D. Acid Value

10 ml of oil was added with 50 ml of ethanol. Phenolphthalein was added as indicator and titrated with 0.1N sodium hydroxide solution,

Acid value = 5.61n/w Where,
n= Number of ml of 0.1N NaOH
w= Weight of oil [20]



E. Saponification Value

2g of oil was accurately weighed and transferred into a 250ml of iodine flask. 25ml of 0.5M alcoholic potassium hydroxide was added and boiled under reflux on a water bath for 30mins. Phenolphthalein was added as indicator and titrated against 0.5M HCl ('a' ml). Similarly blank was performed ('b' ml) without the sample.

Saponification Value: 28.05(b-a)/w Where, w= weight in grams of the solution.[21]

F. Specific Gravity

Specific gravity of the prepared oil was determined using or specific gravity bottle.

1) Start by weighing an empty specific gravity bottle.
2) Fill the bottle with a known volume of oil and weigh it again.
3) Calculate the weight of the oil by subtracting the weight of the empty bottle.
4) Now, fill the bottle with water and weigh it once more.
5) Again, calculate the weight of the water by subtracting the weight of the empty bottle.
6) Finally, divide the weight of the oil by the weight of the water to get the specific gravity of the oil.

Calculation

Specific gravity at 30°C/30°C =(A-B) / (C−B)

where,

A = weight, in g, of the specific gravity bottle with oil at 30°C,

B = weight, in g, of the specific gravity bottle, and

C = weight, in g, of the specific gravity bottle with water at 30°C.[22]

G. Skin Irritation

Skin irritation was determined manually. Oil was applied on hand and exposed to sunlight for 5mins to check for any irritation over skin.[23]

H. Skin Penetration Test

1) *Cleanse the Area:* Start by cleansing the area of the skin where you will be conducting the test. Make sure it's free from any dirt, oils, or other substances.
2) *Apply a Small Amount of Oil:* Take a small amount of the herbal oil and apply it to the test area. It's best to choose a small, discreet area of skin for the test.
3) *Massage the Oil:* Gently massage the oil into the skin using circular motions. This helps the oil penetrate the skin and allows for better absorption.
4) *Wait and Observe:* Allow the oil to fully absorb into the skin. This can take a few minutes to an hour, depending on the oil and the individual's skin type. During this time, observe any changes or reactions on the skin.
5) *Assess the Results:* After the absorption period, examine the test area for any signs of irritation, redness, or other adverse reactions. If there are no negative reactions, it suggests that the oil has penetrated the skin without causing any harm.[24]

V. RESULT AND DISCUSSION

A. Organoleptic Properties

An organoleptic test was performed by examining the colour, smell and texture of the product. It is clear from the organoleptic test findings that the preparation of the herbal oil is translucent yellow . All herbal oil products have an aromatic scent to them. Every herbal oil recipe is easy to absorb, non-sticky, and smooth.

Table-: Organoleptic test results

Batches	Colour	Odour
F1	Faint yellow	Pungent
F2	Yellow	Pungent
F3	Yellow	Pungent
F4	Pale yellow	Tolerable

B. pH Measurement

The herbal oil's pH was regularly found to be between 5.01 and 6.05, which is the safe range for topical application. The ideal pH range for preserving the integrity of the skin barrier without irritating the skin is between slightly acidic and neutral.
pH of the product is determined by using digital pH meter ; pH of this product is 5.34.

C. Viscosity

The oil had a moderate viscosity, which guarantees adequate spreadability while staying substantial enough to stay on the skin without dripping, according to a Ostwald's viscometer reading. Because of this, it can be applied to the legs, which are prone to varicose veins. Viscosity of the oil determined by Ostwald's Viscometer and result is 0.93 cP.

D. Acid Value

In the acid value test of anti-inflammatory oil, the result would indicate the amount of acidic substances present in the oil. This measurement helps determine the oil's quality and freshness.
The acid value of product is 1.34 mg KOH/g.

E. Saponification Test

The saponification test result for a product can provide valuable information about the amount of alkali needed to saponify the oils. This test helps determine the quality and purity of the oils for various applications.
The saponification value of product is 187 mg KOH/g.

F. Specific Gravity

The specific gravity of the herbal oil is a measure of its density compared to water.
After calibration and careful measurement using a specific gravity bottle, the specific gravity of the substance was determined to be 0.957 at temperature of 25°C.

G. Skin Irritation

After applying a small amount of the oil on hand and letting it sit for a while, it was found that the skin was not irritated.

H. Skin Penetration Test

The result of the skin penetration test of oil would provide insights into how effectively the oil is absorbed by the skin and its potential impact on skin health based on the depth of penetration observed during the test.

VI. DISCUSSION

The formulation of the anti-inflammatory herbal oil for varicose veins has yielded positive results, based on the evaluation tests. Anti inflammatory herbal oil aims to address specific concerns, such as reducing inflammation associated with varicose veins. The conclusion drawn from the evaluation test indicates that formulation F4 performed better than the other formulations (F1, F2 and F3), showcasing desirable properties such as stability and efficacy. The organoleptic qualities of the designed oil showed no signs of immiscibility or uneven color distribution, which is promising for its application. Additionally, formulation F4 exhibited values within the standard range, particularly in pH and skin irritation tests, suggesting its suitability for use. The absence of discoloration after exposure to direct sunlight indicates good physical stability, further enhancing its appeal.
Moreover, the stability test results revealed that formulation F4 was more stable when subjected to varying temperatures compared to the other formulations. This stability is crucial for ensuring consistent performance and efficacy over time.In summary, formulation F4 of the anti-inflammatory herbal oil for varicose veins appears to be the most promising option among the tested formulations, demonstrating favorable characteristics and delivering the desired results.

VII. CONCLUSION

In summary, the herbal oil that was created to treat varicose veins shows promise in terms of its physical and chemical stability. The mixture of substances worked well to improve the look of varicose veins and relieve associated symptoms. Because of the oil's user-friendly, safe, and effective formulation, it presents a good alternative to more intrusive varicose vein treatments.

To properly evaluate the oil's long-term effects and any adverse effects, more research with bigger sample numbers and longer duration is needed. Furthermore, research that draw comparisons with currently available treatments can shed additional light on the herbal oil's effectiveness and affordability. Sustained quality and efficacy in practical applications will be ensured by routine formulation monitoring and improvement.

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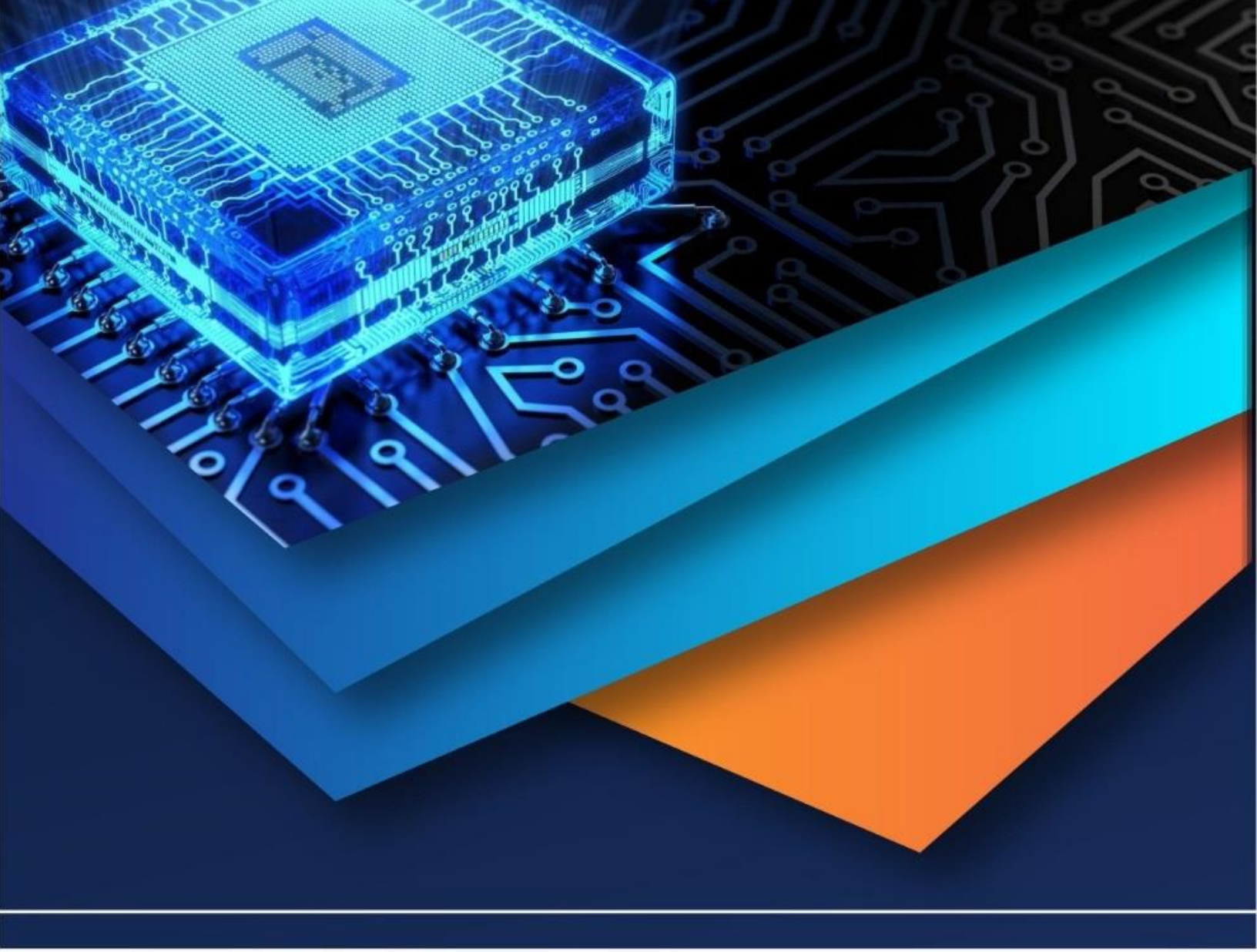

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