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Hemidesmus Indicus Used as Potential Antifungal

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Abstract: ***Hemidesmus indicus, a plant widely used in traditional medicine, has demonstrated potential as a natural antifungal agent. This study explores its efficacy against pathogenic fungi by evaluating various extracts ethanolic, methanolic, and aqueous through in vitro antifungal assays. The results indicated significant inhibitory effects, particularly from the ethanolic extract, against*** **Candida albicans**, ***Aspergillus*** **Niger**, ***and Trichophyton rubrum. Phytochemical analysis revealed the presence of secondary metabolites like flavonoids, alkaloids, and tannins, which are likely responsible for the antifungal activity. These findings support the potential of*** **Hemidesmus indicus** ***as a source of bioactive compounds for the development of plant-based antifungal treatments.***

Keywords: Hemidesmus Indicus, Antifungal Agent, Ethanolic Extract.

I. INTRODUCTION

Hemidesmus indicus (Apocynaceae) is widely used in traditional medicine in the different parts of the Indian subcontinent due to the various biological activities attributed to its different parts, especially the roots [1]. It has traditionally been used for treating snakebites, scorpion stings, diabetes, urinary diseases, dyspnoea, anorexia, fever, abdominal colic and pain, dysentery, diarrhoea, cough, rheumatism, headache, inflammation, pyrosis, skin diseases, leprosy, sexually transmitted diseases and cancer[2].



Fig.1: Hemidesmus Indicus

Compound Isolated From Plant includes 2-hydroxy 4- methoxy benzaldehyde, saponins, flavonoids, tannins, and alkaloids. Among these, 2-hydroxy-4-methoxybenzaldehyde is particularly significant for its antifungal, antimicrobial, and antioxidant properties[3]. This aromatic aldehyde is mainly responsible for the plant's characteristic fragrance and therapeutic efficacy. Other compounds such as hemidesmin-1 and hemidesmin-2 have also shown cytotoxic and immunomodulatory effects[4]. The synergistic action of these phytochemicals is believed to be responsible for the plant's wide-ranging medicinal effects, including anti-inflammatory, hepatoprotective, and antimicrobial activities[5]. Due to its rich phytochemical profile, *Hemidesmus indicus* is considered a promising source for the development of natural drugs and therapeutic agents[6].

2-Hydroxy-4-methoxybenzaldehyde (HMBA) is a major bioactive compound isolated from the roots of *Hemidesmus indicus*, a medicinal plant commonly known as Indian sarsaparilla [7]. This phenolic aldehyde contributes to the plant's distinctive aroma and therapeutic properties. HMBA exhibits strong antioxidant activity due to its hydroxyl and methoxy groups, which help scavenge free radicals [8]. It also shows notable anti-inflammatory effects by inhibiting inflammatory enzymes and mediators. Research has demonstrated its antimicrobial potential against various bacterial and fungal strains [9].

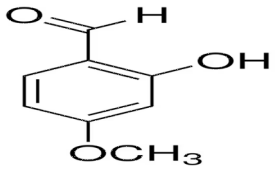


Fig.2: 2-Hydroxy 4-Methoxy Benzaldehyde

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2-Hydroxy-4-methoxybenzaldehyde (HMBA) has shown significant potential as a natural antifungal agent. Its phenolic and aldehydic functional groups contribute to its ability to disrupt fungal cell membranes and inhibit essential enzymatic pathways [10]. Studies have demonstrated its effectiveness against various pathogenic fungi, including *Candida albicans* and *Aspergillus* species. HMBA is believed to induce oxidative stress in fungal cells, leading to cellular damage and growth inhibition [11]. This oxidative damage results in lipid peroxidation and damage to cellular components, ultimately inhibiting fungal growth. HMBA also inhibits key enzymatic functions necessary for fungal survival. Through these mechanisms, HMBA effectively reduces the viability of various pathogenic fungi, including *Candida albicans* [12].

II. EVOLUTION PARAMETER FOR ROOT POWDER

Sr. No.	Parameter	Inferences
1.	Color	Brown or Dark Brown
2.	Odour	Smells Like Vanillin
3.	pH	5.4-7.8
4.	Bulk Density	17
5.	Tapped Density	12
6.	Angle of Repose	14.93

[13,14,15]

III. METHOD OF EXTRACTION

2-Hydroxy-4-methoxybenzaldehyde (HMBA) can be effectively extracted from *Hemidesmus indicus* using the maceration technique.

1) Preparation of plant material:

- Plant material: Dried roots of Hemidesmus indicus
- Solvent: Ethanol
- Apparatus: Conical flask, stirrer, etc.

2) Extraction Process:

Maceration of the root powder of *Hemidesmus indicus* is a commonly used method to extract 2-hydroxy-4-methoxybenzaldehyde. In this process, 50 gm dried and finely powdered roots of the plant are soaked in 100 ml ethanol. The mixture is left to stand for 24 to 72 hours at room temperature, allowing the solvent to dissolve the soluble compounds from the plant material.

3) Collection of extract:

After 72 hours extraction is complete, extract is collected in beaker at room temperature.

[16,17,18,19]



Fig.: Extract after filtration

FORMULATION TABLE:

SR. NO.	INGREDIENT	QUANTITY	USES
1.	2-hydroxy 4-methoxy benzaldehyde	1ml	Antifungal agent
2.	Carbapol	1gm	Gelling agent
3.	Glycerin	5ml	Co-solvent
4.	Propylene glycol	10ml	Humectant
5.	Methyl paraben	0.2gm	preservative
6.	Propyl paraben	0.2gm	preservative
7.	Triethanolamine	q.s.	pH adjuster
8.	Distilled water	q.s.	vehicle

[20,21,22]

PROCEDURE:

1) *Preparation of gel base:*
- Dispersed 0.5-1% Carbapol 940 in distilled water.
- Stir slowly and allow it to hydrate for 30-60 minutes.

2) *Dissolve the active compound:*
- Dissolve 2-hydroxy 4-methoxy benzaldehyde in a small amount of ethanol or propylene glycol
- Concentration: 0.1-1% of total formulation depending on tis antifungal potency

3) *Combine the solution:*
- Add HMBA solution to hydrated Carbapol gel under constant stirring

4) *Add humectant and preservative:*
- Add glycerin (2-5%) and a preservative if desired

5) *Adjust pH:*
- Slowly add triethanolamine dropwise to neutralize the Carbapol and form the gel

6) *pH: 5.5-6.5*

7) Final volume and packaging:
- Make up volume with distilled water if needed
- Mix thoroughly, avoid air entrapment
- Transfer into clean, sterilizes container

[23,24,25,26]



Fig.: Formulation of antifungal gel

IV. EVOLUTION PARAMETER OF GEL

Sr.no.	Parameter	Inferences
1.	Color	Light brownish
2.	Odour	Vanillin like
3.	pH	5.0-6.5
4.	Spreadability test	Easily spreadable
5.	Consistency	Smooth and uniform

[27,28,29]

V. DISCUSSION

1) Studies have shown that 2-hydroxy-4-methoxybenzaldehyde exhibits antifungal properties against various fungal pathogens, including Candida albicans, Aspergillus species, and Fusarium[30].

2) 2-Hydroxy-4-methoxybenzaldehyde is a derivative of salicylaldehyde and has both hydroxyl and methoxy functional groups attached to a benzene ring, which may contribute to its biological activity[30].

3) The compound's structure allows it to interact with biological systems, potentially leading to antifungal /antimicrobial effects[31].

4) In this review paper we discuss that 2-hydroxy 4-methoxy Benzaldehyde are the potential antifungal agent which is obtained from natural sources of plant Hemidesmus indicus.

5) While 2-hydroxy-4-methoxybenzaldehyde has shown potential as an antifungal agent, further studies are required to understand its full spectrum of activity, optimal dosage, and safety profile for clinical use[32].

VI. CONCLUSION

1) The available research conclude that Hemidesmus indicus has contain different types of phytochemicals like alkaloid , flavonoids, tannins, glycosides , resins which is shows different types of pharmacological activity such as antimicrobial, antibacterial, anticancer, anti-oxidant, anti-diabetes, diuretics, wound healing etc[33].

2) In this research we are conclude that 2-hydroxy 4- methoxy benzaldehyde as potential antifungal agent from H.indicus against various species such as Candida species, Aspergillus nigher, Dermatophytes[34].

3) In this research we are preparing a herbal antifungal gel of 2-hydroxy 4- methoxy benzaldehyde Along with additives like Humectant , preservative, co-solvent etc.

4) In this studies proved that the herbal antifungal gel are effective against various fungi by performing antifungal activity[35].

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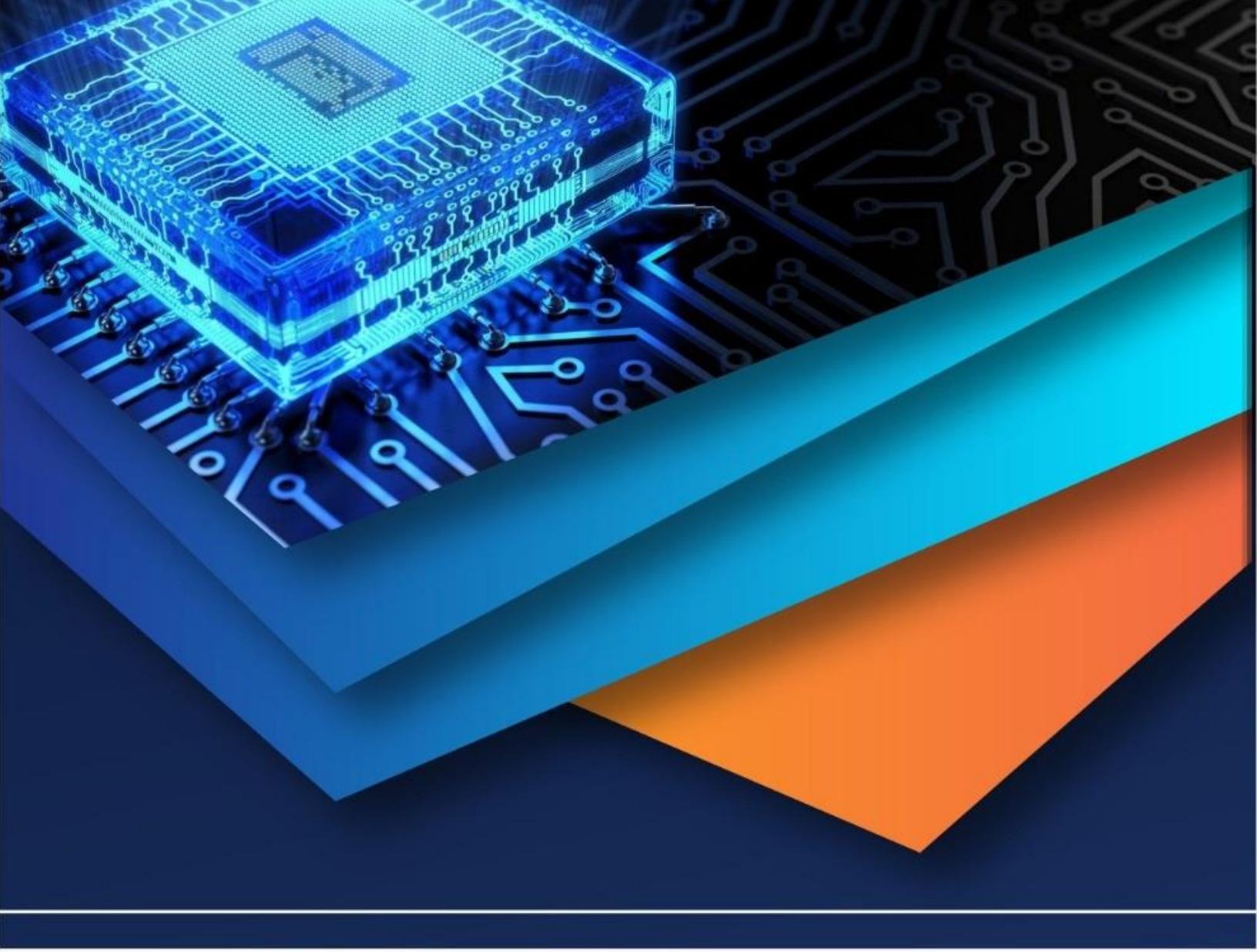
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