

Citrus Shield: Developing an Insect Repellent from Orange Peel Using Glycerine Extraction Using Dip-and-Dry Method and Applying It to Mulch Mat

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Abstract -This study looks into the development of a Eco friendly insect repellent get from orange peel using glycerol extraction, applied to coir mulch for pest control. The extraction process involves mixing orange dry peel power with glycerol, harmless solvent, to efficiently obtain required oils containing insect repellent compounds such as D-limonene and terpenes. The extract is applied to coir mulch mat through a dip and dry method. The efficacy of treated coir mulch pest repellent is evaluated in controlled trials, comparing pest activity on treated against untreated mulch. The results indicate that coir mulch treated with the orange peel extract importantly reduces insect activity. This method presents a encouraging alternative to chemical insecticides, making use of biodegradable materials and natural citrus oils for ecofriendly pest control. The findings contribute to sustainable pest management solutions, contributing applications in organic farming and environmentally aware agricultural practices.

Keywords: insect repellent, orange peel, glycerine extraction, coir mulch, pest management, sustainable agriculture.

1 INTRODUCTION

Textiles are essential materials used in a wide range of applications, including clothing, shelter, and artistic expression. They can made from both natural fibres (wool, silk, cotton, and jute) and synthetic fibers (polyester and nylon). Textiles are woven, knitted, or nonwoven to produce fabrics used in various industries.

Technical textiles, designed for specialized functions, have found applications in sectors such as agriculture, healthcare, and construction. The use of agrotextiles, including shade nets and mulch mats, plays a significant role in improving agricultural productivity, conserving resources, and protecting the environment. Mulch mats are particularly useful in reducing pesticide use, conserving soil moisture, and preventing weed growth.

Coir fiber, derived from coconut husks, is an eco-friendly material used in producing biodegradable agrotextiles. The need for sustainable pest control methods has led to the use of plant-based insect repellents, such as those derived from citrus peels. D-limonene, a bioactive compound found in orange peels, is an effective natural insect repellent. Glycerine, a non-toxic solvent, is used for extracting essential oils from plant materials.

This study explores the use of glycerine-extracted orange peel oil as a natural insect repellent applied to coir mulch for eco-friendly pest control.



2. Materials and Methods

2.1 Material Collection

We gathered orange peels from nearby vendors. The supplier of coir mulch mats, which are frequently utilized in agriculture, specializes in environmentally beneficial agricultural products.

2.2 Extraction Process

In Sec. 2.2, We explain how to use glycerine to extract bioactive components from orange peel. Orange peels were first cleaned, dried, and ground into a powder. As a non-toxic solvent, glycerine was utilized to extract the essential oils. To make the extraction process easier, the peels were boiled and submerged in glycerine. After that, any solid residue was filtered out of the liquid extract.

2.3 Application to Coir Mulch

In Sec. 2.3, We describe how the coir mulch was treated using the dip-and-dry technique. After being submerged in the orange peel solution made with glycerine, the mulch mats were allowed to dry. This ensured that the extract was dispersed uniformly throughout the coir mats' surface.

2.4 Eco-Friendly Testing

Testing for the effectiveness of the insect repellent was conducted in a controlled home environment, as described in Sec. 2.4. Coir mulch mats, both treated and untreated, were placed in garden beds, and the insect activity was monitored over a period of several weeks. The number of insects around each type of mulch was recorded and compared.

3. Results

3.1 Insect Repellency Effectiveness

The results of the physical examinations are presented. Insect activity was significantly lower in the orange peel extracttreated coir mulch than in the untreated mulch. There were much fewer insects around the treated mulch, demonstrating how well the orange peel extract worked as an insect repellent.



Fig 1: insect repellent mulch mat

3.2 Sustainability Impact

Section 3.2 determines the treatment's environmental impact. Agricultural waste is decreased by the use of orange peel, a food industry byproduct. Also, this method is a sustainable substitute for synthetic pesticides because coir mulch is biodegradable and the orange peel extract is non-toxic.





Fig 2: eco friendly mulch mat

3.3 Antibacterial activity of fabric sample (disc diffusion method)

The antibacterial activity of the fabric sample was assessed using the disc diffusion method. Muller Hinton Agar plates (60 mm diameter) were inoculated with test organisms. Sterile fabric discs (50x50 mm, 6 mm width) were impregnated with 50 and 100 µl of the sample and placed on the agar. After 30 minutes at room temperature for diffusion, the plates were incubated at 37° C for 24 hours. The zone of inhibition was measured in millimeters, and the experiment was repeated twice.

3.4 Antifungal activity of fabric sample (disc diffusion method)

The antifungal activity of the fabric sample was tested using the disc diffusion method. Sabouraud's dextrose agar (SDA) plates (60 mm diameter) were inoculated with test organisms. Sterile fabric discs (50x50 mm, 6 mm width) were soaked with 50 and 100 μ l of the sample and placed on the agar. After 30 minutes at room temperature for diffusion, the plates were incubated at 37°C for 24 hours. The zone of inhibition was measured in millimeters, and the experiment was repeated twice.

Result:

The antimicrobial activity of coir samples treated with extracts were analysis against pathogens are revealed in table 2. Figures 2 indicate that coir samples showed a maximum inhibition was observed against *Candida albicans* (8 mm) at a concentration 100 μ g/ml.

TABLE 1

Sample Concentration		Concentration	Organisms/Zone of inhibition (mm)	
		(µg/ml)	Candida albicans	Pseudomonas aeruginosa
Control			0	0
Fabric	sample	50 µl	6	4
coated	with	100 µl	8	5
extracts				



Discussion

4.1 Effectiveness of Orange Peel Extract

Section 4.1 describes how the extract's ability to repel insects is attributed to limonene, the main bioactive component of orange peel. Limonene functions as an efficient natural insecticide by interfering with insects' breathing systems. One important discovery is that glycerine extraction was successful in transferring these qualities to coir mulch.

4.2 Commercial Potential

Section 4.2 explores the potential for scaling up the formulation for commercial use. While the results are promising, further research and field testing are necessary to refine the process and improve its cost-effectiveness. The formulation could be beneficial for organic farming, offering an environmentally safe alternative to synthetic pesticides.

5.CONCLUSION

This study investigates the use of orange peel, rich in limonene, as a natural insect repellent. The peel's repellent properties were extracted using glycerine and applied to coir mulch mats through the dip-and-dry method. The results showed that the orange peel extract effectively enhanced the insect-repellent qualities of the coir mulch, offering an eco-friendly alternative to synthetic pesticides. This approach not only utilizes agricultural waste but also supports sustainable pest control in agriculture. Further research and field testing could improve its commercial viability, benefiting organic farming and sustainable agricultural practices.

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