IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

FORMULATION AND EVALUATION OF NOVEL MOTH BALLS.

Submitted by

Dhanashri Gadekar, Sayali Ghadge, Sakshi Gurav

B PHARM SEMESTER –VIII UNDER THE GUIDANCE OF PROF: N. B. BHOSALE

SETH GOVIND RAGHUNATH SABLE COLLEGE OF PHARMACY,SASWAD.

ABSTRACT

Wool is one of the most ancient and incredibly desired fibers to mankind and is extremely prone to insect infestation that's a prime challenge to the woolens and is an age-old issue. Woolens, saved in a poorly ventilated, dark, and humid atmosphere are at risk of the moth attack. Mothballs are used globally to prevent moth-larvae from negative stored apparel and precious furs. Mothballs can be made of various pesticides, however the essential one used is naphthalene. While naphthalene is powerful in stopping the moth attack, its toxicity is likewise a major issue.

KEYWORDS :- Moth ball, Naphthalene, *Azadirachta indica*, Cedar wood, Moths, Repellent.

RESEARCH AIM

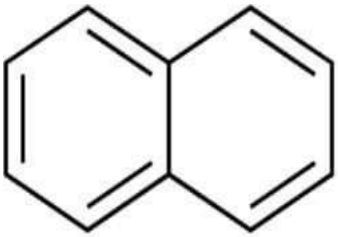
Formulation and Evaluation of Novel Mothballs

This study aims to develop and assess the efficacy of mothballs containing a synergistic blend of three active ingredients: neem oil (*Azadirachta indica*), cedarwood oil (*Cedrus spp*.), and naphthalene. By reducing the concentration of naphthalene and supplementing it with neem oil, we can maintain the desired moth-repellent effect while mitigating the toxicity concerns associated with naphthalene.

INTRODUCTION

Mothballs are categorized as a pesticide and used to control moths, silverfish and other fiber pests in wool and other natural fiber clothing and substances. Mothballs need to simplest be used as exact on the label, and their use is regulated by way of the U.S. Environmental protection organisation (EPA). Mothballs are commonly product of naphthalene or para- dichlorobenzene, each of which can be poisonous to humans. Those chemical compounds are solids at room temperature and are made into spherical balls, flakes or cakes that slowly change to a gas and come to be fumes inside the air.However the toxicity of chemicals in moth balls posses a challenge.The researcher and manufacturers are exploring alternater,nontoxic method for pest control and moth repellents. The primary objective of this article is to present innovative strategies for addressing the toxicological implications of naphthalene exposure. The proposed strategy involves reducing the reliance on chemical-based solutions by leveraging natural compounds that exhibit comparable bioactivity and efficacy. The natural compounds employed for this purpose include Azadirachta indica-derived neem oil and Cedrus spp.derived cedarwood oil.

BACKGROUND NAPTHALENE:-



Naphthalene is a polycyclic aromatic hydrocarbon that is usually encountered in indoor and outside environments. This bicyclic compound exists in most cases as a vapor at ambient stress due to its high vapor stress. Naphthalene has a strong, function odor with a low smell threshold of about 0.44 mg/m3(0.084 ppm) in air. There are numerous assets of naphthalene within the surroundings. It is a part of crude oil, and it is also amade of herbal combustion. A giant source of non-occupational exposures in residential settings is idea to be from the usage of naphthalenebased products, specially mothballs.

PROPERTIES:-

Naphthalene is a polycyclic fragrant hydrocarbon that exists at roomtemperature as a white crystalline strong with an aromatic odor. it's far insoluble in water but soluble in methanol, ethanol, benzene, toluene,olive oil, turpentine, chloroform, carbon tetrachloride, ether, hydro-naphthalenes, fixed and risky oils, and ethylene dichloride. it's miles stable in closed containers under regular temperatures and pressures(Akron 2009). bodily and chemical properties of naphthalene are indexed in the following desk·

Molecular weight	128.2gm/mol
Density	1.162 g/cm3
Melting Point	80.2°C
Boiling Point	217.9°C
Log K_{ow}	3.3
Water solubility	0.031 g/L at 25°C
Vapour pressure	0.085 mm Hg at 25°C
Vapour density relative to air	4.42

PRODUCTION:-

Naphthalene is produced commercially from either coal tar or petroleum.Naphthalene has long been produced by the damaging distillation of excessive-temperature coal tars, called carbonization or coking . Coal tar turned into the traditional source of naphthalene until the past due Fifties while it was in brief supply, and the era of naphthalene from petroleum with the aid of dealkylation of aromatics-wealthy fractions from reforming and catalytic cracking have become commercially possible . In 1960, the first petroleum–naphthalene plant was added on move in the usa and, via the overdue1960s, petroleum-derived naphthalene accounted for over 40% of overall US naphthalene production. the provision of huge portions of ortho-xylene in the course of the Nineteen Seventies undercut the placement of naphthalene because the top uncooked material for phthalic anhydride. In 1971, forty five% of phthalic anhydride ability inside the u.s.a. became primarily based on naphthalene, as compared with only 29% in 1979 and 17% in 1990. The closing dehydroalkylation plant for petroleum naphthalene was close down past due in 1991.

NAPHTHALENE'S MECHANISM OF ACTION IN MOTHS INVOLVES:

- Disruption of Moth Physiology

1. Nervous system disruption: Naphthalene affects the moth's nervous system, leading to impaired coordination and eventually death.
2. Interference with sensory organs: Naphthalene's vapor interferes with the moth's sensory organs, disrupting its ability to navigate and find food.

- Repellent Effects

1. Vapor phase: Naphthalene's vapor phase is responsible for its repellent effects, making it unappealing to moths.
2. Concentration-dependent: The repellent effect is concentration-dependent, with higher concentrations being more effective.

- Toxicity 1. Toxic effects: Prolonged exposure to naphthalene can be toxic to moths, leading to mortality.
2. Dose-dependent: The toxic effects are dose-dependent, with higher doses being more toxic.

USES

The essential use of naphthalene in the u.s. is as an intermediate inside the production of phthalic anhydride, which in turn is an intermediate in the production of phthalate plasticizers, pharmaceuticals, insect repellents, and other substances. Naphthalene has additionally been used as an intermediate inside the manufacturing of one-naphthylNmethyl-carbamate insecticides, β-naphthol, artificial leather-based-tanning chemicals, surfactants (e.g., naphthalene sulfonates), moth repellents, and toilet-bowl deodorizers. In 1999, 59% of naphthalene was used for manufacturing of phthalic anhydride, 21% for production of surfactant and dispersant chemical compounds, 11% for production of insecticides, and nine% in moth repellents and for different purposes. The Naphthalene Panel of the American Chemistry Council pronounced in 2002 that naphthalene become now not used directly in tanneries, inside the textile industry, or in the production of bathroom-bowl deodorizers and that β-naphthol changed into not manufactured within the US.

NAPHTHALENE'S TOXICITY:

Toxicity is related to haemolytic anemia, liver abnormalities, acute kidney injury, neurological symptoms like confusion and convulsions,and ocular results like cataracts and retinal hemorrhage. also categorised as a carcinogen, naphthalene increases the risk of growing head, neck, and gastrointestinal cancers.

Naphthalene enhances the production of loose radicals, which cause oxidative strain and ultimately damage to cells because of lipid peroxidation . individuals who are vulnerable to oxidative stress can gift with hemolysis, including humans with G6PD deficiency . G6PD has a essential role in red cellular metabolism as it prevents oxidative stress on the mobile and, as a result, reduces the severity of naphthalene toxicity.

- Cancer Risk

a. Workers occupationally exposed to vapors of naphthalene and coal tar developed laryngeal carcinomas or neoplasms of the pylorus and cecum. However, this study is inadequate because there were no controls, exposure levels were not determined, and subjects were exposed to complex mixtures containing other demonstrated carcinogens.

b. Di- tri- and tetramethyl naphthalene contaminants of coal tar were found to be carcinogenic when applied to the skin of mice, but naphthalene alone was not.

c. An increased number of alveolar/bronchiolar adenomas and carcinomas were reported in female mice exposed by inhalation.

d. No carcinogenic responses were reported in rats exposed to naphthalene in their diet and by injection.

e. EPA has classified naphthalene as a Group C, possible human carcinogen.

NEEM OIL

The neem tree (Azadirachta indica) is a tropical evergreen tree local to India and is likewise determined in different South East nations. Neem is also known as 'Arista in Sanskrit this means that 'ideal', whole and imperishable'. The seed, bark and leaves comprise compounds with tested antiseptic, antiviral, antipyretic, anti-ulcer and antifungal and pesticidal homes. The Sanskrit call 'nimba' comes from the time period 'nimbati syasthyamdadati which means that to offer right health. The numerous elements of this tree live neem oil, neem seed cake, neem leaves, neem extracts, neem bark and roots also are used in insect-pests control.

MECHANISM OF NEEM OIL AS MOTH REPELLENT

1) Neem acts as a repellent at extraordinary tiers and in numerous methods. Often it acts as antifeedant ie., while an insect larva is hungry and it wants to feed on the leaf but if the leaf is dealt with neem product, due to the presence of azadirachtin, salaninand melandriol there's an antiperistalitic wave within the alimentary canal and this produces something similar to vomiting sensation in the insect. Because of this sensation the insect does not feed on the object dealt with neem oi and ability to swallow is also blocked.

2) The utilization of neem kernel powder and/or neem oil as a seed coating inhibits oviposition in female insects, thus offering a valuable strategy for controlling pest populations in stored seeds.

USES

- Traditional remedy:

Neem oil has been used for hundreds of years in conventional Ayurvedic remedy for treating numerous skin situations, such as zits, eczema, and infections.

- Pest manipulate:

Neem oil is a natural insecticide and can be used to govern pests in agricultural settings.

- Meals maintenance:

studies have shown that neem oil can help keep food by inhibiting the growth of micro organism that spoil meals.

- Dental Hygiene:

Neem oil and extracts were used in oral hygiene products to combat gum disease and decrease dental plaque.

- Pores and skin Care:

Neem oil can be used topically to deal with pores and skin infections and different pores and skin situations, however it should be diluted before use

CEDARWOOD

Cedars are very famous decorative bushes used ordinarily utilized in horticulture. proper cedar bushes are native to the northern and western mountains of the center East nations. In historic times, the proper cedars were derived

from the cedars of Lebanon. The cedarwood oil is derived from cedar timber by means of distillation of their timber. Cedars from the own family Pinaceae (Cedrus sp.) produce most of the vital oils in comparison to the proper cedars of Cupressaceae circle of relatives (Juniperus and Cupressus species). Thuja occidentalis (white cedar) belongs to the circle of relatives Cupressaceae. In nineteenth century, white cedar became used to deal with ringworms, thrush and warts. The activity of cedar timber oil relies upon upon the presence of many of its active components. one of the common factors said in numerous cedar timber oils is cedrol, and this is implicated for its insecticidal property. In historic instances, the Egyptians used the oil of cedar bushes to shield themselves from the insects (repellent impact). Cryptomeria japonica has been utilized in Asian conventional medicines for exclusive remedies.

PROPERTIES

- Light yellow to golden color with a mild reddish blue.
- Straight grain with a best texture.
- Herbal resistance to moisture.
- Insect infestation.
- Excessive electricity-to-weight ratio.
- Dimensionally strong.

MECHANISM OF ACTION

The natural oils found in red cedarwood are the important thing to its effectiveness at deterring moths. Those oils diffuse into the encircling air, creating an aroma that moths hate however we find pleasant. This aroma overpowers the pheromone indicators moths use to talk with every other. The utilization of cedarwood interferes with the mating behavior of moths, effectively disrupting the reproductive cycle by preventing female moths from attracting males and ovipositing..Any current moths can also be stressed and repelled, so that they leave your apparel and home.

USES

Cedar balls provide a multitude of blessings, making them a popular preference for preserving clothing and textiles

- Natural Moth Repellent : Cedar balls are incredibly effective at repelling moths and bugs due to the herbal oils found in cedarwood, which emit a fragrance that moths locate ugly. This shielding barrier allows save you moth infestations and harm for your clothing.
- The soil that cedar wood is grown on is insect and moth repellent. Therefore the wood also makes for a good item of durable closet furniture to store clothes and keep them safe from insects.
- Insecticidal activity :Mortalities of second instar larvae of P.xylostella that were exposed to higher concentrations of essential oil and fractions (A2-A6) of C. deodara.

TOXICITY OF CEDAR WOOD

Cedar timber mothballs are taken into consideration secure to apply because they are made from herbal cedar timber and do no longer incorporate the damaging chemical substances discovered in traditional mothballs. The herbal oils in cedar act as a deterrent to moths and different pests with out posing good sized dangers to humans or pets while used efficiently. but, it is important to use cedar wood mothballs sparsely and in well-ventilated regions, because the robust heady scent may be overpowering in enclosed areas and might purpose slight respiratory infection for some people. at the same time as cedar timber isn't always poisonous inside the manner chemical mothballs are, it’s excellent to preserve cedar mothballs out of attain of kids and pets to save you unintentional ingestion, because the focused oils ought to reason moderate gastrointestinal pain if ingested in huge portions.

NOVEL MOTHBALLS

Our product features a unique blend of naphthalene and neem oil, carefully infused into a cedarwood matrix. As the naphthalene sublimates, the neem oil is released and subsequently absorbed by the cedarwood, thereby augmenting its efficacy. The combination of neem oil, naphthalene, and cedarwood creates a triple-effect repellent, leveraging the unique properties of each ingredient to achieve enhanced efficacy. By minimizing the concentration of naphthalene, the product reduces potential toxicity while maintaining its effectiveness, thereby overcoming the drawbacks of traditional repellents and establishing itself as a superior solution.

PROCEDURE

The manufacturing process involves the following steps:

1. Naphthalene flakes are fed into a jacketed vessel and heated to 88°C, with continuous agitation to facilitate melting.
2. Once the naphthalene is fully melted, additional ingredients such as paraffin wax and camphor are added and thoroughly mixed.
3. The required quantity of neem oil is then incorporated into the solution.
4. A cedarwood ball with a hollowed-out cavity is prepared to serve as a mould and matrix.
5. The molten solution is poured into the cedarwood cavity, allowing it to solidify for a few minutes.

This process enables the creation of a unique product that combines the properties of naphthalene, neem oil, and cedarwood.

FORMULATION TABLE

INGREDIENT	**QUANTITY**	**PROPERTY**
NAPTHALENE	48%	Repellent
NEEM OIL	50%	Repellent
CEDARWOOD BALL	1 ball	Repellent
PARAFFIN WAX	1%	Binder and filler
CAMPHOR	1%	Perfume

METHODOLOGY

DESIGN: Our proprietary formulation combines naphthalene and neem oil, precision-crafted within a cedarwood structure.

WORKING: Upon sublimation of the naphthalene, the neem oil is liberated and absorbed by the cedarwood, resulting in enhanced activity.

MECHANISM: The effectiveness of red cedarwood, naphthalene, and neem oil in deterring moths lies in their unique modes of action. Cedarwood's natural oils create an aroma that overpowers moth pheromones, disrupting their mating behavior and reproductive cycle. Naphthalene, on the other hand, affects the moth's nervous system and interferes with its sensory organs, leading to impaired coordination and death. Additionally, neem oil inhibits oviposition in female insects, offering a valuable strategy for controlling pest populations.

EFFECTIVE USE OF NOVEL MOTHBALLS

- A common mistake when using mothballs is storing them in non-airtight containers, which can lead to prolonged exposure to toxic vapors and potential health issues. To minimize risks, it's essential to keep moth balls in tightly sealed containers, preventing pesticide fumes from spreading into living spaces and reducing the risk of inhalation by humans and animals.
- A common mistake when using mothballs is storing them in non-airtight containers, which can lead to prolonged exposure to toxic vapors and potential health issues. To minimize risks, it's essential to keep mothballs in tightly sealed containers, preventing pesticide fumes from spreading into living spaces and reducing the risk of inhalation by humans and animals.
- Naphthalene balls are best used for long-term clothing storage, not for regularly worn items. For other clothing, linens, and bedding, a simple laundry cycle can effectively remove moth eggs and maintain fabric quality.
- To effectively use naphthalene balls, consider the container size and number of items: # Recommended Usage Rates

1. Gallon-sized bag: One naphthalene ball per shirt.
2. Large storage bag: Two or three-inch diameter balls for multiple clothing items.
3. Huge trunk: Up to four one-inch diameter balls.

- This ensures optimal moth protection without overusing naphthalene.

HOW IS OUR PRODUCT BETTER THAN THE MARKETED PRODUCT?

- Conventional naphthalene balls, which comprise 99.9% of the market, pose significant health risks to humans, necessitating a solution. Our reformulated product reduces naphthalene content by half while maintaining efficacy and introducing enhanced benefits through the incorporation of neem oil and cedarwood coating.
- By reducing the quantity of naphthalene, you've successfully minimized potential health risks to humans while maintaining the product's effectiveness as a moth repellent. This achievement strikes a balance between safety and efficacy.
- The combination of neem oil and cedarwood not only repels moths but also provides a pleasant aroma, effectively acting as a deodorant and leaving a refreshing scent.

EVALUATION

Appearence:- Brown ,woody from outside and lime, yellow from inside. Shape:-Round /circular

Weight:- 4.90g

Chemical test :-

1) Float test :- Napthalene balls being less dense than water will float.While paradichlorobenzene balls being denser will sink.
2) Melting point:-At hight temperature 79-80ºC

BENEFITS

This unique formulation offers several benefits, including:

1. Improved efficacy: Enhanced protection against moths and insects.

2. Natural and sustainable: Cedar wood matrix reduces environmental impact.

3. Pleasant aroma: Cedar wood's distinct scent may provide a more pleasant alternative to traditional mothballs.

FUTURE DIRECTIONS

Further research could focus on optimizing the proportion of naphthalene and neem oil, exploring other natural matrices, or evaluating the formulation's effectiveness in various applications.

CONCLUSION

The innovative combination of naphthalene and neem oil in a cedar wood matrix has resulted in a novel mothball formulation that offers enhanced protection against moths and insects. The equal proportion blend leverages the repellent properties of neem oil and the moth-repelling capabilities of naphthalene, while the cedar wood matrix provides a natural and sustainable base.

REFERENCES

1) Kumari Medha, Salim Rajna, Laimayum Jogeeta Devi, Lata Samant, Seiko Jose,A comprehensive review on moth repellent finishing of woolen textiles,Journal of Cultural Heritage,Volume 49,2021,Pages 260271,ISSN 1296-2074,

https://doi.org/10.1016/j.culher.2021.02.006. containing a synergistic blend of three active ingredients: neem oil (*Azadirachta indica*), cedarwood oil (*Cedrus spp*.), and naphthalene.

(https://www.sciencedirect.com/science/article/pii/S1296207421000352)

2) TOUYZ L.Z.G. (2014) Naphthalene Mothballs: A Silent Killer. Chapter in: Food Poisoning. Nova Publishers. NY11788 USA. ID 22559. Nova publishers.com

3) Fred Fishel's The "Facts about moth balls" one of a series of the Agronomy Department, UF/IFAS Extension. Original publication date December 2014. Visit the EDIS website at http://edis.ifas.

4) Daniel L. Sudakin, MD, MPH, David L. Stone, Ph.D, and Laura Power, MS Oregon State University, Department of Environmental and Molecular Toxicology "Naphthalene Mothballs: Emerging and Recurring Issues and their Relevance to Environmental Health". Published in final edited form as:Curr Top Toxicol. 2011
; 7: 13–19.

5) Report on Carcinogens, Fifteenth Edition. "Naphthalene" CAS No. 91-20-3 Reasonably anticipated to be a human carcinogen First listed in the Eleventh Report on Carcinogens (2004).

6) Naphthalene production data mono 82.8

7) Open Access Case Report Naphthalene or Mothball Poisoning Manifesting as Acute Intravascular Hemolysis and Acquired Methemoglobinemia Salman Habib Roghani , Mohammad Ali Arif , Rauf Niazi , Sadia Mansoor, Internal Medicine, Pakistan Institute of Medical Sciences, Islamabad, PAK.

8) National Center for Biotechnology Information (2024). PubChem Compound Summary for CID 931,Naphthalene. (2024). https://pubchem.ncbi.nlm.nih.gov/compound/Naphthalene.

9) Bagchi M, Bagchi D, Balmoori J, Stohs SJ: Naphthalene induced oxidative stress and DNA damage in macrophage J744A.1 cells. Free Radic Biol Med. 1998, 25:137-43. 10.1016/s0891-5849(98)00063-x 6.

10) Chugh KS, Singhal PC, Sharma BK, Mahakur AC, Pal Y, Datta BN, Das KC: Acute renal failure due to intravascular hemolysis in the North Indian patients. Am J Med Sci. 1977, 274:139-46. 10.1097/00000441197709000-00004.

11) Naphthalene Zargul Mangal Shaikh Zayed University, Faculty of Education. Department of Chemistry. Khost Afghanistan.

12) Dr. Sunita Arya1, Dr. Rajesh Kr Dubey Associate Prof. Department of Zoology, DG P.G. College, Kanpur (U.P.) India Director, UGC-HRDC, JNVU, Jodhpur, Rajasthan, India "Studies on application, importance and effect of Neem tree (Azadirachta indica) oil on effect and intensity of guava insects" vol 6 ,April 2017.

13) "Neem products and their agricultural applications" by Subbalakshmi Lokanadhan, P. Muthukrishnan and S.Jeyaraman*

14) Manjula Ramadass, Padma Thiagarajan. Importance and Applications of Cedar oil. Research J. Pharm. and Tech. 8(12): Dec., 2015; Page 1714-1718. doi: 10.5958/0974-360X.2015.00308.X.

15) Hammer KA, Carson CF and Riley TV et al. Antimicrobial activity of essential oils and other plant extracts. Journal of Applied Microbiology. 86; 1999: 985-990.

16) Guleria S, Kumar A and Tiku AK et al. Chemical composition and fungitoxic activity of essential oil of Thuja orientalis L. grown in the north-western Himalaya. Zeitschrift fur Naturforschung C: A Journal of Biosciences. 63; 2008:211-214.

17) Brijesh K, Ruchi R and Sanjita D et al. Phytoconstituents and Therapeutic potential of Thuja occidentalis . Research Journal of Pharmaceutical, Biological and Chemical Sciences. 3; 2012:354-362.

18) Singh LP, Tripathi K and Yadav RB et al. Devadaru (Cedrus deodara (roxb.) Loud): a critical review on the medicinal plant. International Journal of Ayurveda and Pharma Research. 2; 2014:1-10.

19) Cheng SS, Lin HY and Chang ST et al. Chemical composition and antifungal activity of essential oils from different tissues of Japanese Cedar (Cryptomeria japonica). Journal of Agricultural and Food Chemistry. 53; 2005:614-619.

20) Eller FJ and King WJ. Supercritical carbon dioxide extraction of cedarwood oil: a study of extraction parameters and oil characteristics. Phytochemical Analysis. 11; 2000: 226-231.

21) Cedar wood :characteristics and how it is used

22) Cedar Wood Moth Balls:Everything You Need to Know NATURAL SOLUTIONS

23) How Cedar Balls Work ;Exploring the Science of Cedar Balls

24) https://housing.com/news/cedar-wood-origin-type-and-uses/

25) Chaudhary A, Sharma P, Nadda G, Tewary DK, Singh B. 2011. Chemical composition and larvicidal activities of the Himalayan cedar, Cedrus deodara essential oil and its fractions against the diamondback moth, Plutella xylostella. Journal of Insect Science 11:157 available online: insectscience.org/11.157

26) Frequently asked questions Find answers to all your questions about cedar wood mothballs—how they work, how to use them, and why they're a safe, natural alternative to chemical repellents.

27) Napthalene balls

28) Naphthalene Balls to Protect Clothes from Moths:Complete Guide;August 31, 2022