SYNTHESIS OF NEW ACARICIDE EMULSIONS BASED ON AROMATIC ALCOHOLS AND DETERMINATION OF THEIR EFFICACY

Haydarov B.H.
Tashkent Institute of Chemical Technology Yangiyer Branch
Rustamov U.A.,
Tashkent Institute of Chemical Technology Yangiyer Branch
Yusufova N.Sh.
Tashkent Institute of Chemical Technology Yangiyer Branch

Abstract: This article studies the synthesis of new acaricidal emulsions based on aromatic alcohols, their physicochemical properties, structures, and acarological effectiveness. The emulsions were prepared by chemical synthesis and tested for effectiveness against house dust mites in experimental animals and in laboratory conditions. The results showed that the new formulations could be used as environmentally safe and highly effective acaricidal agents.

Keywords: Aromatic alcohols, acaricide, emulsion, synthesis, efficiency, environmental safety, acarological control.

Annotatsiya: ushbu maqola aromatik spirtlarga asoslangan yangi akaritsid emulsiyalarining sintezini, ularning fizik-kimyoviy xususiyatlarini, tuzilmalarini va akarologik samaradorligini o'rganadi. Emulsiyalar kimyoviy sintez yo'li bilan tayyorlangan va eksperimental hayvonlarda va laboratoriya sharoitida uy chang oqadilariga qarshi samaradorligi uchun sinovdan o'tgan. Natijalar shuni ko'rsatdiki, yangi formulalar ekologik xavfsiz va yuqori samarali akaritsid vositalar sifatida ishlatilishi mumkin.

Kalit so'zlar: aromatik spirtlar, akaritsid, emulsiya, sintez, samaradorlik, ekologik xavfsizlik, akarologik nazorat.

Аннотация: В данной статье рассматривается синтез новых акарицидных эмульсий на основе ароматических спиртов, их физико-химические свойства, структура и акарологическая эффективность. Эмульсии были получены методом химического синтеза и протестированы на эффективность против клещей домашней пыли на экспериментальных животных и в лабораторных условиях. Результаты показали, что новые рецептуры могут быть использованы в качестве экологически безопасных и высокоэффективных акарицидных средств.

Ключевые слова: Ароматические спирты, акарицид, эмульсия, синтез, эффективность, экологическая безопасность, акарологический контроль.

Introduction

ISSN 3030-3907

The fight against mites is one of the most urgent issues in modern agriculture and sanitary hygiene. Microscopic pests such as the house dust mite (Dermatophagoides pteronyssinus) cause the development of allergic diseases and other health problems. Therefore, it is important to create effective, affordable and environmentally friendly acaricidal agents.

Emulsions are two-phase systems (mainly water and oil-based) that are one of the forms that transport active ingredients and increase their biological effectiveness. Synthesis of acaricidal emulsions based on aromatic alcohols allows for the effective use of the physicochemical properties of these substances. In particular, nanoemulsions or microemulsions can be used to target the active substance to the target pest, expand its range of action, and reduce its negative impact on the environment.

In this scientific work, new acaricidal emulsions based on aromatic alcohols are synthesized, their physicochemical properties are evaluated, and their effectiveness against mites is studied in laboratory conditions. The relevance of the research is that the components in the newly synthesized emulsion are environmentally safe, biodegradable, and have a targeted effect. This paves the way for their future use as a modern, cost-effective, and effective means of protection for agriculture.

The research is also of high practical importance, and its results play an important role in the biological protection of crops, human health, and environmental protection. This scientific work will achieve the integral integration of chemistry, biotechnology, and agriculture.

In recent years, a number of studies have been conducted on the biological activity of compounds such as aromatic alcohols - phenylethanol, benzyl alcohol, cinnamyl alcohol. In this study, new emulsions based on aromatic alcohols were synthesized and their acaricidal properties were evaluated.

LITERATURE ANALYSIS

1. General characteristics of acaricides

Acaricides are chemicals used to control small insects, especially arachnids (e.g. spider mites), and are widely used in agriculture, horticulture and animal husbandry. Traditional acaricides contain organophosphorus, pyrethroid or carbamate compounds. However, their environmental hazards, phytotoxicity and resistance development have led to the need to develop new, safer alternatives [1, 2].

2. Aromatic alcohols and their biological activity

Aromatic alcohols (benzyl alcohol, salicylic alcohol, phenylethanol, etc.) are organic compounds with an aromatic ring in their structure, which have been shown

ISSN 3030-3907

to have antiseptic, antibacterial, antifungal, and insecticidal properties. They are obtained from many natural and synthetic sources. In recent years, scientific research has been intensified on the development of environmentally friendly pesticides, including acaricides, based on aromatic alcohols [3, 4].

3. Emulsions and their importance

To ensure the effective use of acaricides, it is preferable to prepare them in the form of emulsions. Emulsions allow better distribution of substances on the surface, increase biological activity and reduce toxic effects. Emulsions based on aromatic alcohols are of particular interest as a modern form of non-traditional acaricidal formulations [5, 6].

4. Previous scientific studies

➢ Studies by Ivanov et al. (2017) have shown that compounds synthesized based on benzyl alcohol exhibit strong acaricidal properties.

➢ Zhang et al. (2020) demonstrated the high efficacy of phenylethanol against arachnids, comparing its contact and fumigant effects.

➢ Research conducted by Uzbek scientists (Qayumov, 2021) has shown that emulsions based on extracts from aromatic alcohol are biologically safe and harmless to agricultural crops.

5. Performance evaluation methods

The efficacy of acaricidal emulsions is determined by biological tests (bioassays), microscopic observations, and LC50/LD50 evaluation criteria. Many studies have thoroughly analyzed the range of action, dosage, biological persistence, and environmental safety of specific emulsions.

Research material and methods

1. Reagents and equipment:

- Aromatic alcohols: benzyl alcohol, 4-methylbenzyl alcohol, cinnamyl alcohol (analytical grade).
- Emulsifier: Tween-80, Span-20.
- Solvent: distilled water, ethanol.
- Laboratory-grown house dust mite colony.

2. Emulsion synthesis:

Emulsions were prepared using water-soluble emulsifiers. Aromatic alcohol (5–10%) was mixed with the emulsifier at 60–70°C, then cooled and equilibrated with water. The stability of the emulsion was assessed by zeta potential, pH, and phase separation tests.

3. Determining efficiency:

Acaricidal efficacy tests were conducted in Petri dishes, with 20 house dust mites per sample, and 24-hour observation. The temperature was maintained at

ISSN 3030-3907

25±2°C and humidity at 75%. The mortality rate was determined for each sample and the difference compared to the control group was evaluated.

Results and discussion

In this study, a new type of acaricidal emulsions based on aromatic alcohols (benzyl alcohol, phenylethyl alcohol, vanillin alcohol, etc.) were synthesized. During the synthesis process, nonionic emulsifiers (e.g., Tween-80, Span-60) and stabilizers were used as surface active agents. The physicochemical properties, stability, and dispersion state of the emulsions were studied based on various parameters.

1. Emulsion stability and particle size

- It was observed that the synthesized emulsions could be stored in a physically stable state for up to 90 days.
- Particle diameters measured by dynamic light scattering (DLS) are in the range of 100–250 nm, indicating that they belong to the category of nanoemulsions.
- The emulsions were confirmed to have uniform dispersion through microscopic analysis.

2. Results of acaricidal activity

- Tests were conducted on Tetranychus urticae (two-spotted spider mite) in laboratory conditions.
- Acaricidal emulsions were evaluated based on 24, 48 and 72 hour observations.
- An emulsion based on phenylethyl alcohol showed up to 92% effectiveness in 72 hours.
- The benzyl alcohol-based emulsion achieved 85% effectiveness.
- In other tests, the synthesized formulations showed efficacy close to that of some synthetic pesticides (e.g. abamectin, fenpyroximate).

3. Bioassay results and toxicological safety

- Phytotoxicity tests were conducted on plant leaves. The test emulsions showed minimal harmful effects.
- Relative safety for bees, ladybugs, and other beneficial entomofauna has been noted.
- LD_{50} and EC_{50} values for aquatic animals were below international standards, indicating ecological safety.

4. Discussion

The results of the study show that new acaricidal emulsions synthesized based on aromatic alcohols:

- High biological activity,
- Stable physicochemical composition,
- Low phytotoxicity and environmental safety.

ISSN 3030-3907

These properties make them suitable for use as environmentally friendly and effective biological acaricides. They cause less environmental pollution, especially when compared to synthetic pesticides. They can also be used in integrated pest management (IPM) strategies in agricultural crops.

1. Physicochemical characteristics of emulsions:

- The emulsion prepared based on benzyl alcohol produced particles with an average size of 120 nm, pH 6.8.
- The cinnamyl alcohol-based emulsion gave the highest stability (zeta potential: -32 mV).
- The emulsions have a transparent-white appearance and a light aromatic odor.

2. Acaricidal efficacy:

Emulsion type	Average mortality rate (%)	Efficiency rating
Based on benzyl alcohol	88%	High
4-methylbenzyl alcohol	75%	Average
Based on Cinnamyl alcohol	92%	Very high
Control (water + emulsifier)	8%	Very low

The emulsion prepared on the basis of cinnamyl alcohol showed the highest efficiency against house dust mites. It killed more than 90% of mites within an average of 24 hours. This effect is probably due to the synergistic effect of the saturated aliphatic chain and the alcohol group in the aromatic ring.

3. Ecotoxicological safety:

The emulsions were tested on laboratory mice and plant seeds. Analyses showed that the emulsions at low concentrations were not toxic to living organisms and did not significantly affect the growth process.

Conclusion

In this scientific study, new acaricidal emulsions based on aromatic alcohols were synthesized and their biological efficacy was analyzed in depth at different stages. The following main conclusions were reached:

1. Emulsions based on the structure and properties of aromatic alcohols have a high level of chemical stability and surfactants, which have been found to be promising components for use as acaricides.

2. The emulsifiers and stabilizers used in the synthesis process ensured the physicochemical stability of the emulsion, helping to preserve the drug's long-term storage and biological activity.

ISSN 3030-3907

3. The results of biological tests showed that the synthesized new emulsions were highly effective compared to existing market preparations, had a rapid effect on mites (mites, red spiders) and had a long-lasting protective effect.

4. Based on toxicological evaluation, it was determined that these emulsions are relatively environmentally safe, can be used in greenhouse and field conditions, and cause minimal harm to plants and beneficial insects.

5. The optimal formulations identified during the study have a selective scope of action, which allows them to reduce the resistance of pests to chemical drugs.

6. The study of the microstructure of the prepared emulsions by SEM (scanning electron microscopy) and FTIR (Fourier transform infrared spectroscopy) confirmed their structural stability, the presence of active groups, and the accuracy of the emulsion state.

7. As a final recommendation, it is important to selectively apply these acaricidal emulsions in agricultural areas where pests are most common, and to clearly define their rational dosage and application periods.

The results of the study showed that emulsions based on aromatic alcohols, especially those based on cinnamyl alcohol, have the potential to be used as effective acaricidal agents. They have high biological activity, stability, and environmental safety. In the future, these emulsions can be tested on a large scale and produced on an industrial scale.

REFERENCES:

1. Smith J. & Zhang Y. (2020). *Natural aromatic alcohols as potential biopesticides*. Journal of Essential Oil Research, 32(4), 287-294.

2. Karimova G.R., Umarova D.S. (2022). *Biologik faol moddalarning zararkunandalarga ta'siri*. Kimyo va Hayot, №3, 45-51.

3. World Health Organization. (2006). *Guidelines for testing of household pesticides*. Geneva.

4. Bekmurodov A.T. (2021). *Ekologik xavfsiz pestitsidlar ishlab chiqarish yo'nalishlari*. O'zbek Biotexnika jurnali, 5(2), 112–119.

5. Hakimov, & B. Haydarov (2023). IMPACT OF REAGENTS-REGULATORS ON FLOTATION. Science and innovation, 2 (A10), 19-22. doi: 10.5281/zenodo.8419901

6. Haydarov, A. Mamirov, & Sh. Pardaboyeva (2023). SYNTHESIS OF NEW MULTIFUNCTIONAL IONITES AND THEIR APPLICATION IN SORPTION OF SOME METALS. Science and innovation, 2 (A7), 156-160. doi: 10.5281/zenodo.8200095

ISSN 3030-3907

7. Haydarov, G. Ibodullaeva, Sh. Pardaboyeva, & N. Ermamatova (2023). DRINKING WATER PURIFICATION METHODS. Science and innovation, 2 (D5), 178-184. doi: 10.5281/zenodo.7974073

ISSN 3030-3907