

Advances on Mosquito Repellent Research

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Abstract

Mosquito-borne diseases such as malaria, yellow fever, dengue fever and Zika virus disease have been a serious threat to the lives and health of people around the world. The use of mosquito repellents can reduce mosquito bites and prevent and control the occurrence and prevalence of mosquito-borne diseases. Plant - derived repellents are safe and environmentally friendly. In this paper, the research progress of plant repellent against mosquitoes and its dosage forms were reviewed, and the research and application prospects of plant repellent against mosquitoes were also prospected.

Keywords

Plant mosquito repellent; Compound synergism; Research progress.

1. Introduction

Mosquitoes belong to the order Diptera, family insectidae. There are about 3300 species and subspecies in the world, and about 33 species and subspecies in China. Common mosquitoes bite people and cause itching, itching and other symptoms, but some of the disease-carrying mosquitoes bite people and spread a variety of diseases, including dengue fever, malaria, yellow fever, filariasis, Japanese encephalitis and other diseases. For a long time, people mainly used chemical drugs to control mosquito invasion, and achieved good results. However, in addition to the problem of drug resistance, chemical synthetic pesticides also have the problem of high toxicity and environmental pollution. Therefore, seeking natural plant essential oil from nature for mosquito control has become a hot research topic. Plant essential oil is taken from herb flowers, leaves, roots, bark, fruit, seeds, resin, etc., with distillation, press extracted with aromatic and certain volatile oil liquid, is a kind of plant source secondary metabolites. The composition of essential oil is very complex, generally an essential oil contains dozens or even hundreds of chemical components. At present, studies on the application of essential oils in mosquito control generally focus on three aspects: 1) repellent effect of essential oils on adult mosquitoes. 2) Toxicity of essential oil to larvae. 3) Synergistic effects of essential oils and synthetic pesticides [1].

2. Plant Essential Oil Mosquito Repellent

The repellents themselves are not toxic to mosquitoes, but their odor can drive away or make them repellent. The most successful repellent developed so far is DEET, which is not only a broad-spectrum repellent, but also the most effective and long-lasting repellent on the skin, and is considered the gold standard of repellents. However, it is not advisable for children and pregnant women to use mosquito repellent products containing DEET, in order to avoid excessive skin irritation, neurotoxicity, hand and foot tremors, convulsions, coma and other symptoms [2]. Therefore, the development of a more natural and safe repellent has become a market demand.

3. Blend with Essential Oil Repellent

A number of studies have shown that essential oil blending has synergistic effect, which can significantly reduce drug dosage and increase efficacy. Essential oils can be used as synergists and become one of the important ways to treat and delay the current widespread drug resistance. Yang Zhonglin et al. studied the repellent activity of two essential oils, namely, pepper oil and peppermint oil, when used alone or mixed with each other. The results showed that the repellent effect of the combined essential oil was better than that of the single essential oil, and the effective protective time of the combined essential oil was about 2 h. Wang Li et al. studied that the effective protection time of 23 pure plant essential oils was 0.13-0.75 h, and the effective protection time of 14 compound plant essential oils was 0.8-2.4 h. Among them, the effective protection time of compound essential oils combined with pure *Linhora* leaf oil, geranium leaf oil, geranium oil and soybean oil was 2.0-2.4 h, indicating that the combination of essential oils had excellent synergistic effect [3].

Yu Kai et al. studied the synergistic effect of steam distillation essential oils from *Cinnamomum camphora* leaves, *Cinnamomum camphora* fruits and *Cinnamomum cinnamomum* leaves on adult *Culex pipiens quinquefasciatus*. The results showed that the co-toxicity coefficients of the three plant essential oils were all above 120 after mixing in an appropriate proportion, showing significant synergistic effect.

4. Study on the Dosage Form of Mosquito Repellent

In terms of preparation development, because essential oils are highly volatile, how to ensure the effective protection time of essential oils through preparation processing is a key problem to be solved in the research of essential oils for mosquito repellent. In general, the original repellent agent cannot be directly applied to the human body, but must be transformed into different application forms through certain processing processes, so that it can be used for different prevention and treatment objects, different environments and different methods [4]. Of course, for the same repellent product, its dosage form is different, the repellent effect is not the same.

Through the study of dosage form, the following objectives can be achieved: ① By improving the physical properties of repellent, the screening probability can be increased. ② The repellent effect and safety can be improved through modification of dosage form. ③ Through the development of new dosage forms, the application scope of existing repellents can be expanded, the life of existing repellents can be extended, the sales of existing repellents can be expanded, and the market competitiveness can be enhanced [5]. Foreign countries attach great importance to the development of repellent dosage forms, the main direction of the research is water-based, controlled release and functional.

5. Prospects of Mosquito Repellent Research

Microcapsule technology is a technology that uses film forming materials to cover solid or liquid to form tiny particles. It was developed by The National Cash Register company in the 1950s for the manufacture of colorless pressure-sensitive carbon paper. This technology can improve the physical properties (color, appearance, apparent density, solubility) of the encapsulated material. Improve the stability of the core material, make the material free from the influence of the environment, improve the reactivity, durability, thermal sensitivity and photosensitivity of the encapsulated material; Reduce substance toxicity; Odor shielding; Make drugs have targeted function; Slow release function and other features. So far, microcapsule technology has been widely used in medicine, daily chemicals, textiles, pesticides, food, coatings and other fields [6]. Plant essential oil microcapsules have been widely used in food, textile, plant protection, daily

chemical and leather fields due to their advantages of high efficiency, environmental protection and control. However, the standardization of technical standards, the study of release mechanism, the reduction of cost and the simplification of preparation process need further research and exploration. With the further development of microencapsulation technology and the deepening of people's attention to plant essential oil, microencapsulation of plant essential oil will have a broader application space. In this project, the mosquito repellent activity of plant essential oils widely reported in the literature was measured in order to find the essential oils with strong repellent activity against mosquitoes, and on this basis, natural microcapsule mosquito repellent preparation was studied.

Plants and extracts have been used for nearly a thousand years to repel harmful insects and are still used today because of their natural safe sources. Citronella oil was recommended as an insect repellent as early as 1908. Citronella is a common botanical ingredient in insect repellent preparations in the United States and is found in candles and incense products marketed as insect repellent. At present, the effective components of plant-derived repellents are plant essential oils, which are composed of terpenes, aldehydes, esters, alcohols and other chemical molecules, with small molecular weight, volatile and short effective duration. With the development of material science and technology, the development of microcapsules (Microcapsule) formulations can solve this problem well, Microcapsule is built in polymer materials and size in micron hollow vesicle, possesses the advantages of lower volatility, using this feature, preparation plant essential oil into the micro capsule, slow release make essential oils, drive midge longer hours.

As people's health and ecological environment is becoming more and more attention, especially people use mosquito drive suspension agent, more for the sake of their safety to human body, plant essential oil with low toxicity, low residue, good compatibility with the environment etc, therefore, its application in the field of health pest control, at the same time, combined with the micro capsule, to develop it into a natural source drive avoid agent, has huge development potential and market value.

6. Conclusion

At present, the concept of health and environmental protection is more and more popular, and natural plant essential oil to avoid mosquitoes will be the first choice in the future. In Addition, a number of studies have shown that many plant essential oils have good toxicity against mosquito larvae. Based on these two points, we should expand the screening range of mosquito repellent plants and find more efficient plant essential oils. At the same time, essential oils can play a synergistic role, but the mechanism of action between these components and the olfactory system of mosquitoes still needs more research, and ultimately develop efficient and safe repellents for mosquitoes.

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