

# Innovative Product Design of an Eco-Friendly and Energy-Saving Mosquito Trapping Can

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**Abstract**—When sleeping at night, mosquitoes may buzz in your ears. When you get up to catch them, you probably won't be able to. Being disturbed in the middle of the night is truly annoying. Mosquitoes circle over people's head because they are attracted by the high temperature and strong infrared wavelength produced by it. Based on this theory, an anti-mosquito device that emits high-concentration carbon dioxide from a refillable source to lure mosquitoes into the trap was designed. This device doesn't need to be plugged in and can be used anywhere. It is energy saving and eco-friendly. Moreover, it is compact and portable.

**Keywords**—mosquito trapping can, innovative design, product design.

## I. INTRODUCTION

Mosquitoes often fly around people's mouth and nose at night while they are sleeping. The reason is that the head is the part of the human body that has the highest temperature and strongest wavelength of infrared rays which attract mosquitoes to fly around people's ears and disturb them. This study placed replaceable CO<sub>2</sub> agent inside the mosquito trap, making the CO<sub>2</sub> concentration inside the can higher than that of the CO<sub>2</sub> breathed out by humans. This attracts mosquitoes to fly inside and be trapped. This innovatively designed invention can emit high concentrations of CO<sub>2</sub> so as to efficiently catch mosquitoes. It does not require AC/DC power and is eco-friendly. It causes no pollution and wastes no resources. In addition, it is compact and portable.

This eco-friendly and energy-saving mosquito trap can be used in daily household care. It can prevent mosquitoes from biting or disturbing people at night or in dark places, thus affecting their quality of life or sleep. This design is valuable in that it is eco-friendly and produces zero-pollution. The carbon dioxide agent attracts mosquitoes to fly into the can. Its protective design, which allows mosquitoes to go inside but not out, enables people to sleep without worry. Consequently, this innovative idea that improves sleep quality is extremely beneficial and has very high market potential.

## II. LITERATURE REVIEW

Mosquito coils contain pyrethroid. After lighting one side of the coil, incomplete combustion causes smoke to kill mosquitoes. In the past, mosquito repelling

incense was in the form of powder or a stick. Nowadays, it is usually in the form of a 75 cm-long coil. This design can extend the life of the incense and reduce the space required. Mosquito coils are usually green, black, or brown and can burn for 6 to 7 hours. However, the smoke caused by the incomplete combustion is harmful to humans. The harm equals to that of smoking 130 cigarettes and is similar to second hand smoking. In the aspect of pollution concentration, burning mosquito coils indoor should be prohibited [4].

Electric mosquito mats are made by adding insecticide on special papers. An electric mat should be placed in the center of an electric mosquito repellent heater. When the mat is heated to 120 to 140 degrees (°C), the insecticide will be released through evaporation. The color of the mat gets lighter with usage time. On average, each mat can remain effective for 6 to 8 hours. Electric mosquito mats are often used indoors; thus, the insecticide used is usually pyrethroid which is not so harmful to human bodies. Electric mosquito mats are rather clean and produce no sparks or ashes. They are fairly effective during the first few hours of use. However, after 4 to 5 hours, the insecticide is almost used up, and they become less effective. Electric mosquito repellent heaters should be kept away from inflammable goods to prevent fire. Anti-mosquito liquid vaporizers combine the features of mosquito coils and electric mats and give a stable evaporation of the insecticide. They can be used continuously for a long time, for example, 6 hours a day for 60 days in a 15 m<sup>2</sup> room and feature the advantages of both traditional incense and electric mats [4].

The function of a mosquito repellent is to keep mosquitoes away and reduce chances of being bitten by them. A study which extracted natural plant essential oil to repel mosquitoes found that extracted essential oils and developed composite products can be used to replace toxic chemical insecticides to repel insects [5]. Moreover, alternative solutions using synthetic compositions are being developed, such as mosquito repellent patch, which is an effective, eco-friendly, and safe way to repel mosquitoes [1]. In addition, a study on the effective use of environmental biological organic waste found that after being processed, recycled coffee bean husk can be a good material for killing mosquitoes [6].

Some scholars studied the main vectors for Japanese B encephalitis transmission in South-East Asia and the West Pacific Area and found that temperature and rainfall were highly related to mosquito density. Therefore, they gave a thorough discussion

about mosquito retention and the related maximum and minimum temperatures [3]. Another study analyzed different types of mosquito repellents and materials, as well as human body temperature and environmental temperature and humidity, in hopes of finding the type of mosquito repelling device most suitable for human bodies [7]. Moreover, another study adopted the purposive sampling method to select volunteers who participated in a mosquito repelling experiment and found that the most effective device was an electric trap which lures mosquitoes within a short distance [2].

### III. INNOVATIVE PRODUCT DESIGN

Mosquitoes often fly around people's mouth and nose because the head is the part of the human body that has the highest temperature and strongest wavelength of infrared rays which attract mosquitoes. The device designed by this study can efficiently lure mosquitoes to fly into it due to the high-concentration soapy CO<sub>2</sub>. This device does not require any power source or battery. It is compact and portable. Compared with other mosquito repelling devices which are large and power-consuming, this device is unique for it is rather eco-friendly and energy-saving.

The innovative product design in this study combined replaceable CO<sub>2</sub> with a mosquito repelling device. Because the concentration of the CO<sub>2</sub> agent inside the device is higher than that of the CO<sub>2</sub> breathed out by humans, mosquitoes may be lured into the device and trapped inside, achieving the efficacy of having a way in but no way out. The user just needs to regularly replace the CO<sub>2</sub> agent and change the adhesive board to attain the function of trapping mosquitoes at home.

The exterior of this eco-friendly mosquito trap is similar to a common aluminum can. However, it is different on the inside. Inside the can, there are two parts. The upper part is a device which allows CO<sub>2</sub> to be released, thereby attracting mosquitoes to fly in and be trapped inside. The lower part is a space for the replaceable CO<sub>2</sub> agent. Generally, this product can be used continuously for 6 to 8 hours. It can be placed next to users' bed at night to make sure that they will not be disturbed by mosquitoes while sleeping.

### IV. DESIGN RESULTS

The creative concept for the innovative product design in this study is to create an eco-friendly and energy-saving mosquito trapping device that can lure, with high-concentration CO<sub>2</sub>, mosquitoes to fly in and trap them inside. This device can be used at night while people are sleeping so as to trap mosquitoes and reduce the chances of being disturbed by them and to maintain quality sleep.

This study presents the appearance (figure 1), internal structure (figure 2), and usage scenario (figure 3) of this product as diagrams. The application for R.O.C. utility model patent for this product was submitted and approved (figure 4). Moreover, the product was presented at: the 4th International Innovation and Invention Conference (figure 5) where it won a silver medal (figure 6); the 2013 Korea International Youth Invention Contest (figure 7) where it

was awarded a silver medal (figure 8); the EYReC where it was given a special award (figure 9); the 4th Korea Cyber International Genius Inventor Fair (CIGIF) 2013 where it won a gold medal (figure 10); the 2015 New Media Art Creation Design Tour where it was exhibited in 12 senior (vocational) strategic alliance high schools; the 2014 Macau International Innovation & Invention Expo (figure 11) where it won a gold medal (figure 12) and a special award (Indonesia) (figure 13) as well as mentioned in a report by the school magazine; the 2014 Technology Commodification Creativity Contest held by Far East University where it was one of the 15 works selected in the preliminary contest and won the honorable mention award in the semi-finals (figure 14); and the 2014 Seoul KSBDA where it was exhibited with designs from over 20 countries (figure 15); and participate in the international design competition (figure 16).

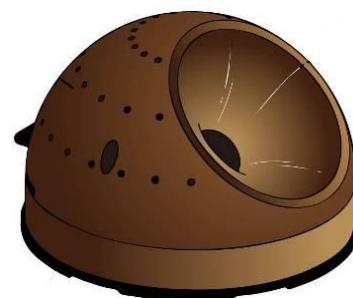


Fig. 1. Appearance of the product

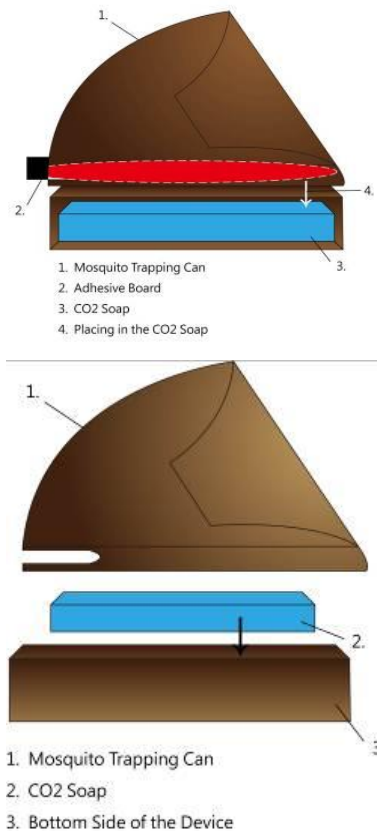


Fig. 2. Internal structure

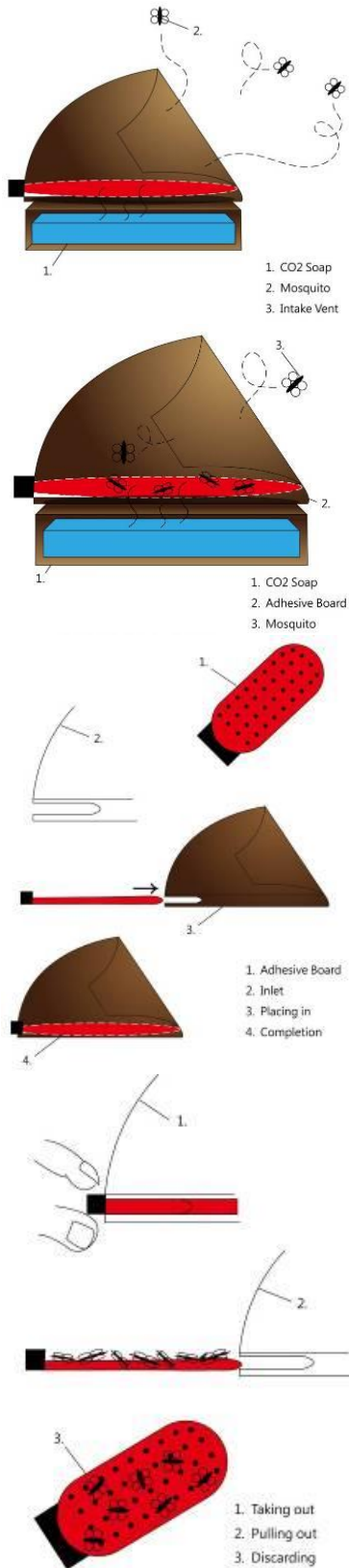


Fig. 3. Usage scenario diagram



Fig. 4. Utility patent



Fig. 5. Poster design



Fig. 6. Silver medal



Fig. 7. Poster design



Fig. 11. Poster design



Fig. 8. Silver prize



Fig. 9. Special award



Fig. 12. Gold medal



Fig. 10. Gold medal



Fig. 13. Special award



Fig. 14. Excellent award



Fig. 15. Poster design



Fig. 16. Poster design

## V. CONCLUSIONS

In general, the results for the innovative research and development of this study are summarized and illustrated below:

(1) Traditionally, people use mosquito repelling incense to ward off mosquitoes. However, the smell of such repellent may make people uncomfortable; furthermore, inhaling the incense into the lungs is unhealthy. Anti-mosquito liquid vaporizers are limited by the need to be plugged in. Mosquito swatters require users to stand up to use them, however users may find it difficult to catch mosquitoes. Mosquito lamps can kill mosquitoes automatically, yet they must be plugged in

all night long. The fore-mentioned mosquito repellents are not eco-friendly in some ways, accordingly, they accentuate the eco-friendly and energy-saving features of the mosquito trapping can's innovative product design.

(2) The innovative product design of the mosquito trapping can emits CO<sub>2</sub> from the soap through aeration holes to lure mosquitoes to fly in. Mosquitoes will then be stuck on the adhesive paper and thus trapped inside the can. Consumers must only replace the CO<sub>2</sub> agent regularly, and they would be able to have good sleeping quality and be freed from disturbances caused by mosquitoes.

(3) This innovative product design is small in size and useful for daily care. It can meet consumers' demands for household care and bring up potential customers' desire to make a purchase; therefore, it has a very high market potential.

(4) The utility model patent application for the results of this study was approved. In addition, this design was presented in various international and domestic exhibitions and competitions and has won many awards. All these facts show the general public's affirmation of this product; therefore, it is worth the attention of related manufacturers. It is hoped that in the future, there will be prospects for the development and mass production of this design.

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