

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation)

(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: JBBC156

Project Title: Outdoor Protector – Coffee Grounds Insect Repellent Candle The investigative study of converting coffee grounds i

Project Type: Investigation

To our best knowledge and after thorough literature research, as at 5/7/2022 , there are no similar works. If there are, the reference links are as below:

--

The enhancement our project has made for the existing related products or research is summarized as below:

--

*Please delete if not applicable. HKSSPC values the originality of works. Students must conduct literature research thoroughly to ensure that their works are unique, and to list relevant reference materials to complement the research or invention.

I. Background

- Provide background information of project and/or state the problem to tackle
- Provide highlights of the **literature review** with the support of pertinent and reliable references
- Provide an overview of work and mention the **research gap that the project is trying to fill**

In our daily life, we often troubled by insect, like ant, cockroach, mosquito, silverfish, termite. Some insects are harmful to our health and they can cause severe illness, including Japanese encephalitis and Zika fever. Applying mosquitos' repellent is the most common and practical option for us to reducing bug bites. However, most of the mosquito repellent products on the market contain various chemical ingredients such as DEET, which all cause certain harm to the human body. Thus, it is better to select natural insect repellent instead of the commercial one.

According to the United States Environmental Protection Agency, coffee grounds are most potent when they are burned. Thus, after we have prepared the coffee grounds, we will integrate it into a form that is ready to be burnt.

II. Objectives

- State the **aim(s)** of project

To create an organic and environmentally friendly insect repellent by using the extraction from remaining coffee grounds.

Objectives

1. To prepare the coffee grounds
2. To prepare the candle with the coffee ground in different ratio

3. To study the effectiveness of the repellent toward ants, cockroaches, and mosquitoes.

III. Hypothesis

- Propose an explanation for a phenomenon and stating how the **hypothesis** can be tested by experiments

According to the EPA, coffee grounds are most potent when they are burned . Therefore, we choose coffee grounds for insect repellent. Most bugs have a very strong sense of smell. Since coffee grounds are very potent, it's a perfect repellent to fight off those pests.

IV. Methodology

- List out the materials used
- Describe the **experimental protocol** including the set-up of **control experiment** (if any), **repeated experiment** (if any), and its scientific theory
- Indicate with the support of reasons, the **analysis** used in the investigation

Preparation of coffee grounds - The coffee grounds is obtained from a chained coffee shop. The coffee grounds were dried in oven overnight to remove the moisture.

Integrating the coffee grounds with soy wax in different ratio –

1. Fill the mug with soy wax. Place the mug on the Bunsen Burner.
2. Stir the wax around to ensure even melting.
3. Place the Candle Wicks middle of the mug
4. Let it cool down
5. The soy bean candle(control) is finished.









Prepare other 3 candle with coffee grounds with the following steps:

1. Prepare 20 g of dried coffee grounds and 20 g of soybean wax granules.
2. Heat the wax until melting. Add coffee grounds into the melting wax.
3. Pour the melting wax into the cup with the candle wicks.
4. Repeat step 1 - 3 with 10 g soybean 30 g coffee grounds, 10 g coffee grounds and 30 g soybean.

V. Results

- Present the **data** with figures, tables or photos
- **Data analysis** (if any, with emphasis on data reliability and the reproducibility based on statistics)
- Interpret the results and its implication
- Discuss **limitation** and compare with existing related works (if any)
- Discuss the importance or impact of the research and how it is applicable to real problems

Appearance, texture, scent and sootiness of different candles

Name	A	B	C	D
Photo	 	 	 	 
Ratio	40 g soybean wax	10 g coffee ground + 30 g soybean wax	15 g coffee ground + 25 g soybean wax	20 g coffee ground + 20 g soybean wax
Appearance	White, smooth	Two layer 1st: coffee ground(brown) 2nd: soybean wax(white)	All brown, collapse	Rough surface, Coffee grounds loosely attached
Hardness	Soft	1st layer: hard 2nd layer: soft	1st layer: soft 2nd layer: hard	Very hard

Lighting of candle				
Size of flame	Normal	Normal	Small	Large
Characteristic of scent	No characteristic	Burnt coffee	Coffee with sweet scent	Burnt
Sootiness	++	++	++	+++++

After burning, sample B had brown liquid brought to the surface; the wick in example C is too short to be relighted; The fire in example D burnt the coffee ground so it produced a burnt smell.

The candle with the ratio, 15 g coffee grounds : 25 g soybean wax, will be used in following steps, as it produced a pleasant smell.

After optimizing the ratio between soybean wax and the coffee grounds, 2 approaches were proposed for the following up experiment:

Approach A – Placing a treated cloth in an enclosed transparent box containing insects:



In this proposed method, a 5 x 5 cm cloth (which act as the clothes) is first kept with the burning candle at a fixed distance for X minutes (e.g. 15 mins, 30 mins, 60 mins) in a closed room.

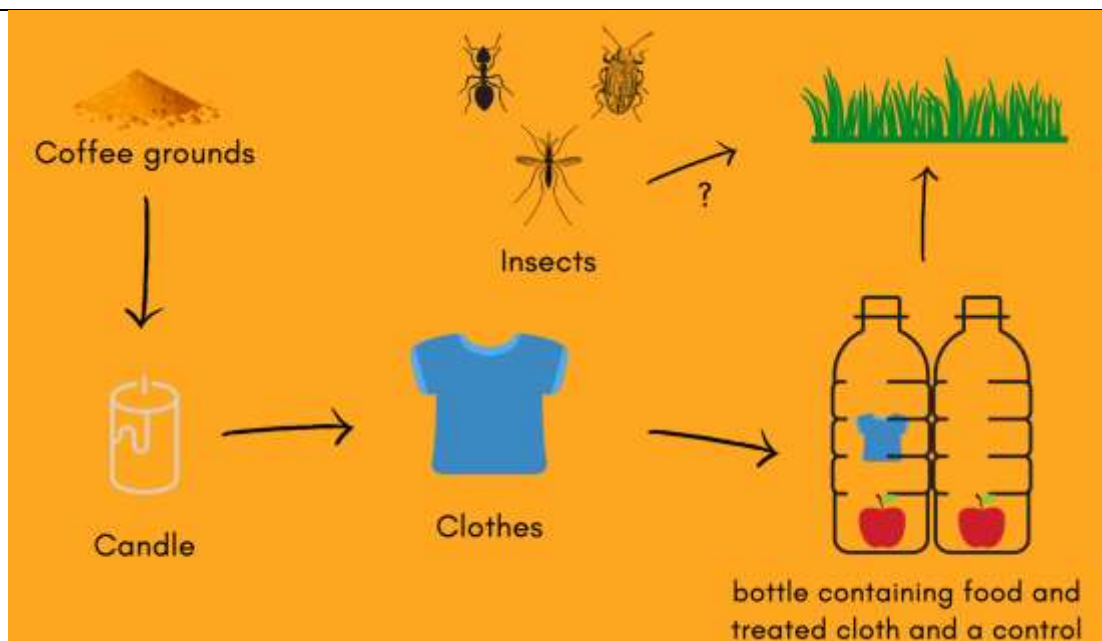
Then the treated cloth is transferred immediately to the transparent glass box containing insects under studied. The cloth is placed at the center of a marked paper with a dart board.



Top view of the box

By recording the staying duration of the insect at different rings, the effectiveness of repelling effect can be studied. It is expected that if the treated cloth can repel insect, insect tends to stay away from the cloth, i.e. spend more time at the outer ring than the inner one.

Approach B – Placing a treated cloth in a plastic bottle which containing food in the wild:



In this proposed method, a 5 x 5 cm cloth(which act as the clothes) is first kept with the burning candle at a fixed distance for X minutes(e.g. 15 mins, 30 mins, 60 mins) in a closed room.

Then the treated cloth is transferred to the bottle containing food(e.g. a piece of apple) and then placed in the garden. Another control set-up is placed next to it.

By comparing the remaining food, i.e. the apple, the effectiveness of repelling effect can be studied. It is expected that if the treated cloth can repel insect, insect tends to stay away from the cloth, i.e. feed on the apple in the control while leaving the another one alone.

VI. Conclusion

- Make a **data-driven** conclusion of the project and the way forward of the research
- Justify if the proposed project meets the objective(s)

After the burning test, it is found that the candle with the ratio, 15 g coffee grounds : 25 g soybean wax, is the most suitable one as it does not produce burnt smell and it is burnt with a small flame.

In the future study, the effectiveness of the candles will be studied in 2 approaches, including placing a cloth treated with the scent of the burning candle with insect in an enclosed area and placing a treated cloth in a plastic bottle which contains food in the wild.

- Our project is developed based on our school's previous project and the enhancement is as below: