

Hong Kong Student Science Project Competition 2023

Extended Abstract (Invention)

(Word Limit: 1,600 words, Pages: 3 pages only)

Team Number: JAPE023
Project Title: Water Filter
Project Type: Invention
To our best knowledge, there <u>are</u> / are not * similar works in the market; (if there are,) related product links are as below:
https://www.fortress.com.hk/en/shop/kitchen-appliances/water-purifiers/c/65
The enhancement our project made / the difference with related products are:
The water filter can be made by ourselves using simple materials at home.
<i>*Please delete if not applicable. The competition values the originality of works. Students must do enough literature research to ensure that their works are unique and list relevant reference materials before starting research or invention.</i>
I. Background
<ul style="list-style-type: none">• Provide background information as to learn about the audience for whom the project is addressing• Provide highlights of <u>literature review</u> and/or related technologies or devices, with the support of pertinent and reliable references• Provide an overview of work, create a point of view as to define the needs and insights of the audience and mention the <u>research or technology gap the project is trying to fill</u>
<p>It is easy to get clean water supply in Hong Kong and other developed urban cities. However, in other underdeveloped countries, people do not have access to a clean water source.</p> <p>The water purifying products in the market are commonly too expensive for the poor. Our invention can help people, who do not have as much resources as us by providing them with a simple and affordable device, made with materials found at home, that purify water. Ultimately, we hope our invention can be made by people at home so that more people can be benefitted from it.</p>

II. Objectives

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

The design aims to provide clean drinking water for people living in under-developed countries. With simple materials and a straightforward design, we hope that people there can obtain drinking water for themselves and their families by using our water filter. This can alleviate the problem of the lack of water in poorer countries and thus, lowering the percentage of people dying of thirst.

III. Methodology

- Briefly describe the **approaches** used e.g. use of equipment, materials, tests and experiments
- Explain the selected implementation strategies with the **scientific theory**

In the design, water is first added to a plastic bottle.

Large insoluble substances, like leaves, are filtered through the first filter (a plastic sheet with big holes). Small insoluble substances are then filtered through a layer of tea bag.

We used aluminium foil to reflect the sunlight to warm up the water.

Water evaporates and water vapour condenses upon cooling when it is on a cooler surface, other soluble substances with a high boiling point left behind.

Purified water is then collected at the other side of the plastic bottle.

IV. Design of Invention

- Describe the **design** and the **principle** of invention (e.g. The ideation of the projects, the prototypes or creative solution as far as applicable)
- Provide sketches / drawings / photos of the invention

Large and small insoluble substances are first separated in the filter and teabag respectively.

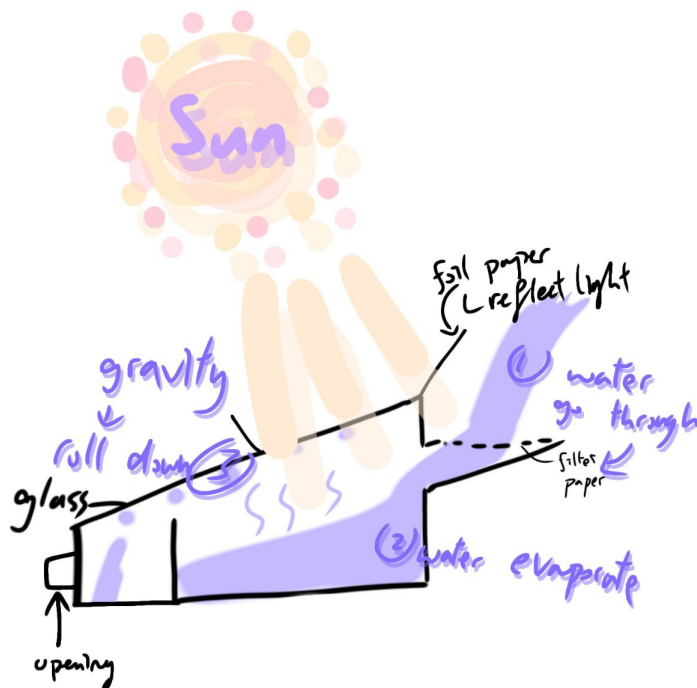
We then separate water from other soluble substance using the principle of evaporation and condensation.

Different substances have different boiling points.

In this device, when the pond water is heated, water evaporates and water vapour condenses upon cooling on a cooler surface. Other soluble substances with a high boiling point left behind.

Some microorganisms are killed under ultraviolet light from the sun. However, as boiling is not involved, not all microorganisms are killed in the contaminated water.

The following is the design of our invention.



V. Application / Market Need

- Explain the area of **application** and function of invention
- Indicate the market need and impact of invention
- Discuss **limitation** and compare with existing related works (if any)

The area we are aiming is the under-developed area which do not have clean water supply and this invention helps alleviate the problems concerning the lack of fresh water in the world, allowing people to have a water filter of their own using a few simple materials that is affordable for them.

According to the World Health Organization, 1 in 3 people in the world do not have access to safe drinking water. Spreading the design to them can alleviate the problem of the lack of water in poorer countries and thus, lowering the percentage of people dying of thirst and contaminated water every day.

However, the limitation of the design is that it takes a long period of time to finish the process, a small volume of water can be collected. Secondly, only some microorganisms are killed under ultraviolet light of the sun. As boiling is not involved, it cannot fully remove all the microorganisms in the water as much as ones from manufacturers.

Comparing to the distilled water in the market now, our invention takes much more time for the purification of water as the heat provided for evaporation is not high enough. The cost and the mobility of our design makes it unique. The evaporation and condensation processes can be done at one's home as long as sunlight is provided.

VI. If your team will compete the Sustainable Development Award, please indicate the specific sustainable development goal the project is related to, and provide justification for competing for this award. (Word limit: 300 words)

Our design belongs to the 'Clean Water and Sanitation' category. It is a water filter, in which we hope to provide drinkable water to the poor in under-developed countries using simple material. Our design fits the **sustainable development goals number 6 - clean water and sanitation**. We have limited the materials to the simplest such that one can purify water at home as long as sunlight is provided.

VII. If your team will compete the Social Innovation Award, please list the target group or social issue the project focuses on, and provide justification for competing for this award.

(Word limit: 300 words)

-

VIII. Conclusion

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

To test whether the quality of the water has improved after filtered through our invention, the water filter, we are going to conduct experiments to compare **(1) the amount of bacteria and (2) turbidity of the water** before and after purification using our device.

(1) Amount of bacteria

We will first wash our fingers with (a) pond water, (b) pond water purified using our device and (c) bottled distilled water (control set-up). We will then press these fingers on to agar plates A, B and C respectively. These agar plates will be placed in the incubator for 48 – 72 hours.

At the end of the experiment, the number of bacterial colonies will be compared. The more the bacterial colonies on the plate, the more bacteria the sample has.

Set-up c, washing our hand with distilled water, acts as a control set-up to show the amount of bacteria in purified bottled water.

We expect more bacterial colonies in sample (a) pond water than (b) pond water purified using our device.

(2) Turbidity

We will use a turbidity meter to compare the turbidity of (a) pond water, (b) pond water purified using our device and (c) bottled distilled water (control set-up).

We expect the turbidity of the sample decreases after purified using our device.

In the future, we are going to perform other tests (e.g. pH) to compare the changes between the water before and after purifying using our device. We will also get feedback from our classmates in order to improve this invention.

*** Our project is developed based on previous project and the enhancement is below:**

-