

Hong Kong Student Science Project Competition 2022
Template of Extended Abstract (Invention)
(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: JAPE106

Project Title: water absorbing machine

Project Type: Invention

To our best knowledge and after thorough literature research, as at 30 / 6 / 2022 , there are / **are no** similar works. If there are, the reference links are as below:

N/A

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

Our project, the water absorbing machine, is an enhancement and the improvement of the syringe. Syringes, the earliest form of it being invented in the ancient times, dating back to the 9th century, by an Iranian surgeon. By adding Super Absorbent Polymer to it, we are able to stop the water in the syringe from flowing out, effectively making it into a machine where it can absorb and store water.

***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

This project is addressed to the general public. In our daily lives, we might have somehow bumped into our glasses of water, or spilled some drinks. Usually, we would get tissues or a mop to clean it up, but at last, for most of the time, we end up taking more tissue paper as it seems to be never-ending in sopping the water. And for using a mop, not only do you need more water to clean the areas, but it will just make the floor wet, and people will eventually slip and fall. Therefore, we propose using the water vacuum, to solve this common yet annoying problem.

The water vacuum is made of a simple syringe, which at its bottom is a layer of cotton and Super Absorbent Polymer mixed together. The syringe can 'suck' in water by pulling the lever, lowering the gas pressure inside the syringe, which forces the liquid (e.g. water) to be absorbed inside. Then, the cotton and the Super Absorbent Polymer will absorb the liquid inside, preventing it from coming out.

What is Super Absorbent Polymer?

Also known as 'waterlock', we came across this chemical when researching for water-absorbent materials to make this invention. It is a sodium salt of polyacrylic acid, chemical formula $[-CH_2-CH-]_n$ [1][cited from wikipedia] and can absorb up to 1000 times of its own mass of water.

II. Objectives

The aim is to reduce the wastage of water by collecting and reusing the water spilled on the floor for other purposes (e.g. washing the floor and watering plants).

III. Methodology

We used syringes, cotton balls and Super Absorbent Polymer to make the product. We have tested different components and combinations to test the degree of absorbency of the material.

Using the principles of osmosis and gas pressure, we are able to complete this invention.

IV. Design of Invention

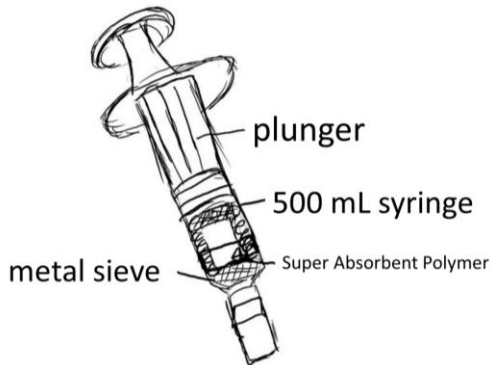
Design

The original idea of the water absorbing machine was to only collect all the water spilled and reuse it to save water by using a syringe. However, this lacks originality and we decided to modify the water absorbing machine. We chose to add water-absorbent materials to speed up the process of water absorbing, likening it into a mop. In the end, through an accident of spilling the water inside the syringe through model testing, we revised our plans by deciding to add the water-absorbent materials inside the syringe to prevent the water collected in the syringe from spilling out when the lever is pushed downwards, ultimately succeeding in 'storing' the water.

Principle of invention

The water absorbing machine has two properties in terms of the scientific rationale - which includes gas pressure and osmosis. The gas pressure is decreased when the lever is pulled upwards and sucking the water up.

Drawing of the invention



V. Application / Market Need

Limitations:

1. It can only be used for a limited number of times before the cotton and sodium polyacrylate is saturated with water. It will decrease the absorbency of the materials, and water as well as saturated gel-like substance (which is the sodium polyacrylate) will come out when the plunger is pushed.
2. Sodium polyacrylate is not good at absorbing non-water based liquids, such as oil.
[citations at <https://www.davincisciencecenter.org/wp-content/uploads/2020/06/Rishab-Yanala-Web.pdf>]

Market need and impact of invention

If large-scale manufacturers manage to make a larger version of it, and turn it into being electricity-powered, it will be able to be mass produced and used in exchange of a mop to absorb water-based materials from the floors without the need to clean them.

VI. 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)

The data for making the water absorbing machine are as follows:

Control set-up: Only syringe, no other modifications

Result: All water is squeezed out when the plunger is pushed.

Set-up A: Syringe with thin cotton layer

Result: Only a small amount of water is absorbed, more than 90% of water is squeezed out when the plunger is pushed.

Set-up B: Syringe with thin menstrual pad layer

Result: A small amount of water is absorbed, with around 80% of the water is squeezed out when the plunger is pushed.

Set-up C: Syringe with a thick layer of cotton

Result: Around half of the water is absorbed, while the other half of water is squeezed out when the plunger is pushed.

Set-up D: Syringe with a thick layer of cotton with Super Absorbent Polymer

Result: All water is absorbed, and the remaining water cannot be squeezed out as well.

Conclusion: Set-up D (Syringe with a thick layer of cotton with Super Absorbent Polymer) is effective in removing water and preventing water collected in the syringe from squeezing out when the plunger is pushed.

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

N/A