ECOBAY

FLUID WITH WATER

ECOBAY
Clean water and sanitation

PHOSPHORUS RECOVERY EXPERIMENT

The phosphorus recovery experiment was the main activity that we carried out throughout the course. We developed a new sustainable material, *PhosR2* (*phosphorus removal and recovery*), based on an natural mineral, magnesite, to adsorb phosphorus (the chemical that causes water eutrophication) from wastewater and reuse it as fertilizer after utilization. This project aims to achieve dual goals of water protection and phosphorus resource recovery.

During this project, we received assistance from professors from SUSTech, including the lab and chemical reagents, guidance on the characterization of the prepared materials via scientific research equipment,s and arrangements for the Humanities Week activities.

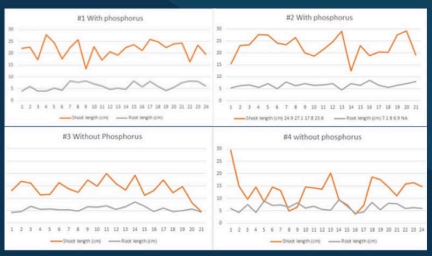

Fig. 1. Shoot and root length for plants growing in each flowerpot

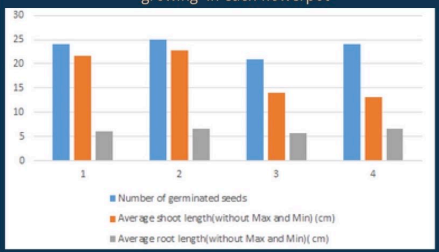

Fig. 2. Average number of germinated seeds/ shoot length/ root

Eutrophication has been a serious water pollution issue for a long time, threatening the ecosystem balance and public health. It is caused by excess phosphorus loading in water, which triggers algal bloom and oxygen exhaustion, gradually destroying the habitat of aquatic animals and creating a rotten smell.
Meanwhile, phosphorus shortage has also been an urgent concern to humanity. Phosphorus rock is estimated to be used up in the next 50-100 years.

Our novel material, PhosR2, can adsorb phosphate pollutants from polluted water and recover phosphate as a fertilizer, providing a promising candidate for these two problems. Herein, we arranged two parallel experiments to test the properties of our novel material.

First, we tested the ability of PhosR2 to decrease phosphorus concentration in water. We designed a series of interlinking filters containing PhosR2(Fig.4), which can capture phosphorus in water that passes through them. We then tested the phosphate concentration change in solutions before and after running through the filter(Fig.5).

Secondly, we tested the performance of PhosR2 as a phosphorus fertilizer in promoting the growth of barley seedlings. The growth rate of these plants is shown in Fig.1 and Fig.2 (the left two plants are treated with PhosR2). As seen, the PhosR2-treated plant groups grow much faster than their counterparts. This result proves the success of our material in phosphorus recovery.

Fig. 3. Plants in flowerpot from left to right #1–#4

(Procedure of testing for the concentration:
1. Phosphate reacts with Molybdate to form Phosphomolybdate amine.
2. The product is reduced by Ascorbic acid, forming Phosphorus-molybdenum-blue solution.
3. Ultraviolet-visible spectrophotometer is used to test for the concentration of phosphate)

Pictures and result inserted in the next page

In December 2021, we held a charity fair in our school during the Christmas events. We sold trinkets and snacks to students and teachers in our school, and raised fund (732 RMB) to support our next event: Humanities Week.

Unfortunately, we were unable to complete the Humanities Week activity due to the Covid—19 pandemic . Our original plan was to conduct a propaganda campaign about clean water shortage around the world. We designed water bottle packages with knowledge about water shortage printing and planned to recreate the way of washing hands for people living in water shortage areas. The Humanities Week postponed to August 2022, and we intend to conduct these activities then.

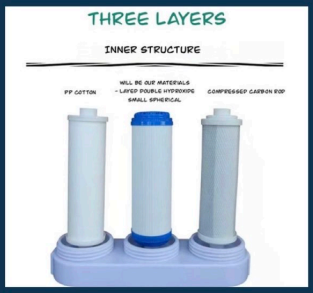

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Fig. 4. Design of filtration apparatus

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Fig.5, Phosphorus level before and after filtration shown in the right column, unit K* Abs . This shows a striking decrease of phosphorus concentration , meaning that our phosphorus removal is successful

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Fig. 6. Color change after adding the reagents, from left to right: after filtration, before filtration

All in all, the journey of attending this competition has been very beneficial. We achieved our aim: to raise public awareness of the issue of clean water shortage and develop a successful and sustainable way of alleviating this problem.

And we also have several outcomes:
1.We made several videos to record our experimental processes and uploaded the edited versions to different social media platforms in China and try to raise people's awareness of water protection.
2.We also have a presentation on our campus in which we displayed how our novel material, PhosR2, works to adsorb phosphorus pollutants from water and illustrate its fertilizer performance to prmote the the growth of the barley plants.

Our group members also gained knowledge and skills:

1.Video editing
2. Groupwork and social skills
3. Critical thinking
4. Compassion and altruism
5. Chemical experimental techniques
6. High-performance material synthesis
6. Logo design
7. Knowledge about water scarcity on our planet
8. Knowledge about experimental techniques
9. Knowledge about how to tackle unsustainable problems in the society

Throughout our journey towards the Clean Water and Sanitation goal, our talented group members made a lot of contributions.

Members	Roles
Sarah	Editorial and logistical staff
Judy	Experimental designer and art designer
Irene	Video editor and exhibition editor
Rachael	captain and group leader
Johnnie	Researcher and information manager

In the end, we edited the photos and videos taken in our project into short videos and posted them on social media website, such as YouTube and Bilibili (a Chinese app similar to YouTube) , so that our experiences and be shared to more people, and raise public awareness in the ideology of protecting clean water and sanitation on our planet.