Project WATCH (*Water filtration system using Aqua Trash bin and Clam shells as a Heavy metal adsorbent*)

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ABSTRACT

The Philippines has been facing the worsening conditions of its water, polluted with heavy metals such as Lead, Cadmium, Cyanide, etc. that could lead to contamination, shortage, and harm to organisms. The researchers made Project WATCH (Water filtration system using Aqua Trash bin and Clam shells as a Heavy metal adsorbent). A bucket and mesh as the trash collector with aquarium pumps. Cracked clam shells are stored in a plastic cylinder for the heavy metal filter, and attached to another pump. These were connected with pipes and hoses. A frame was added to the device as a strong foundation. They used a plastic storage box as a pool for the device. The device can fit plastic bags, plastic cups, plastic utensils, plastic wrappers, and microplastics. According to the results of the report by Ateneo de Manila PIPAC (Philippine Institute of Pure and Applied Chemistry), there was a trace of less than 1 milligram of Lead per 1 kilogram of pulverized clam shells and less than 0.1 milligrams of Cadmium per 1 kilogram of pulverized clam shells. This proves that clam shells have the capability to adsorb heavy metals such as Lead and Cadmium through Ashing-Acid Digestion and Inductively Coupled Plasma Spectrometry. A residential wastewater sample was taken from Capitol Park Homes II and was run through the device for 5 cycles and through observation, the sample got clearer.

Keywords: project watch; lead; cadmium; clam shells; wastewater

INTRODUCTION

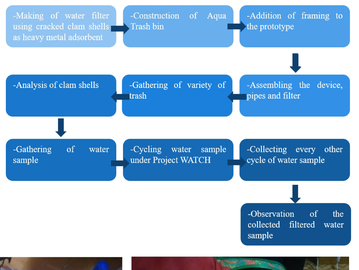
The Philippines has been facing the worsening conditions of solid waste management for many years. It has been 18 years since the signing of RA 9003 or also known as the "Ecological Solid Waste Management Act of 2000". The Philippine waters are highly affected by the arising problem on wastes which causes water pollution, water contamination and water shortage, large number of deaths of sea creatures and cause a spread of diseases.

Greenpeace reports show that the water pollution in the Philippines consists of mostly wastewater from industrial sources such as heavy metals like Lead, Mercury, Chromium, Cadmium and Cyanide (Rhonda M., 2016). Exposure to such metals can harm organisms. Heavy metal poisoning may occur as a result of industrial exposure, air or water pollution, food, medicine, improperly coated food containers, or the ingestion of lead-based paints.

The researchers sought for a solution by creating a device that can filter out both trash and heavy metals from water in one operation. Clam shells were used to filter heavy metals, specifically Lead and Cadmium after researching that it contained chitin (W. Arbia, 2013). Chitin, commonly used in the field of Health can also be applied in wastewater treatment which makes it environmentally and economically significant. In addition, the researchers attached a mesh to a water bucket which will be used as a trash bin that can capture waste in bodies of water. The trash bin was then assembled with the clam shells heavy metal filter with pipes and aquarium pumps in order to work in a single operation. This device is called Project WATCH (Water filtration system using Aqua Trash Bin and Clam Shells as a Heavy metal adsorbent).

This study aims to create a device which can filter both trash and heavy metals from wastewater and is attachable to waste sewage systems such as a creek in Capitol Park Homes II Novaliches, Caloocan City (location where the researchers gathered residential wastewater for testing). The study will be conducted with only limited time framework and financial resources.

METHODOLOGY



FRAMING

FILTER

WATER SETUP

METHODOLOGY

2.1. Water Filter

The researchers crushed the clam shells into pieces. Two short cylinders were cut from the sponge. They cut a small hole in the center of the sponge and did the same for the other sponge. They cut a hole with the diameter of the pipe on both ends of the container and did the same for the larger container. They placed one of the sponges at the end of the small container, then they crushed clam shells and covered it with another sponge. The container was closed and placed inside the larger container.

2.2. Construction of the Device

2.2.1. Bucket/ Aqua Trash Bin

The researchers cut a hole at the bottom of the trash bin with the diameter of the hose. They attached the trash bin covered with mesh to a 10-volt aquarium pump and connected it to the hose. They attached the hose to the large plastic container holding the heavy metal filter then, attached it to another aquarium pump. They attached a series of pipes at the end of the last aquarium pump to serve as the exit way of the water.

2.2.2. Framing

The researchers divided the PVC pipes into eight 1-inch pieces. They attached each piece to eight elbow pipes with Neltex glue. They combined the pieces to tee pipes. They cut a first set of four 8.5-inch long pipes that were connected to four elbow pipes and then tee pipes. Then cut another set of four pipes that is 19 inches long. The first set and second set were connected which formed two rectangular layers. For the pillars that will allow the two layers to connect, they cut four pieces at 11 inches. These 11-inch pipes connected the layers with elbow pipes at each end. They placed a plastic screen underneath the rectangular framing and used a plastic puller tie to secure the screen to the pipes. They secured the filter to the screen using ties.

2.3. Residential Wastewater Sample

2.3.1. Gathering the sample

The researchers went to the nearest residential wastewater area which was Capitol Park Homes II, Novaliches, Quezon City. They collected the wastewater sample coming out of a tube from houses and from under the creek with guidance from a research teacher.

2.4. Filtration

The wastewater will run under Project WATCH by the researchers with the guidance of a research teacher for 5 cycles to show the filtering capability through observation. The mesh will be cleaned after every cycle to see the change in residues. The researchers will collect the 1st, 3rd and 5th residential wastewater sample that ran through Project WATCH to observe and compare if Project WATCH was able to filter the water.

RESULTS

3.1. Determine the quantity of various trash that Project WATCH can hold.

Table 1.1. The quantity of different kinds of trash that can fit Project

Kinds of Trash (average size)	Quantity
Plastic Bags (8 liters)	60
Plastic Cups (8 oz)	19
Plastic Utensils (6 inches)	8
Plastic Wrappers (57 x 35 mm)	89
Plastic Particles (5 mm)	6,911

Sixty plastic bags, nineteen plastic cups, eight plastic utensils, 89 plastic wrappers and six thousand nine hundred eleven plastic particles can fit inside Project WATCH.

3.2. Determine the capability of Clam shells to adsorb heavy metals (Lead and Cadmium) through ICP testing.

Table 2. Test results of Clam shells as a heavy metal adsorbent

	Analyte(s)	Result(s)	Analytical Method(s)
1.	Lead, mg/kg	Less than 1	Ashing-Acid Digestion/Inductively Coupled Plasma Spectrometry
2.	Cadmium, mg/kg	Less than 0.1	

The Clam shells sample was received by the Philippine Institute of Pure and Applied Chemistry in Ateneo de Manila University Campus Loyola Heights, Quezon City on July 29, 2019. The ICP Testing analysis from PIPAC started on August 2, 2019 and finished on August 13, 2019.

3.3. Determine the capability of Project WATCH to filter wastewater through observation.

The 1st, 3rd and 5th (sample A,B and C) collected waste water after running under the Project WATCH compared to the unfiltered wastewater was clearer and residues collected by the mesh were lessened from the 1st to 5th cycle.

CONCLUSION

The aqua trash bin can collect various types of trash and small particles from wastewater. Based on results of the report of analysis by Ateneo de Manila PIPAC, there was a trace of less than 1 milligram of Lead per 1 kilogram of pulverized Clam shells while there was less than 0.1 milligram of Cadmium per 1 kilogram of pulverized Clam shells. Therefore, Clam shells can be an eco-friendly and affordable heavy metal adsorbent, and Project WATCH can clean turbid wastewater.