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I. SAMPLE COLLECTION

The wastewater samples from Quezon City were collected in Brgy. UP Campus. The unfiltered sample (QC unfiltered) was collected without the use of the Kinetic Reactor filter. The filtered samples (QC Filtered and Batangas Filtered) were collected after installing the Kinetic Reactor filter on the faucets. Furthermore, the filtered samples were collected 5 seconds after the faucet has been turned on. The samples were stored in a refrigerator with maintained temperature of $5^{O}C$ before use in the specific analyses.

II. METHODOLOGIES

Total Dissolved Solids (TDS) Test

The TDS content of the water samples were determined using the evaporation (gravimetric) technique. Three beakers, one for each water sample (QC unfiltered, QC Filtered, and Batangas Filtered), were cleaned properly and dried in an oven for 1 hour. The beakers were cooled to room temperature before weighing using an analytical balance. The weights of the beakers were then recorded. The beakers were then placed in a desiccator prior to use. Each water sample (200 ml) was filtered using a Whatman 42 filter paper, using the cleaned and dried beaker as the catching glassware. Afterwards, the beakers with the filtered water sample were placed in an oven for overnight drying at $110^{O}C$.

The next day, the beakers were taken out from the oven using tongs and cooled inside a desiccator. The beakers were then weighed using an analytical balance and the weights were recorded. Using the weights of the dried beaker from the previous day and the weights of the beaker from day 2, the TDS content of each water sample was calculated.

Atomic Absorption Spectrometry

The instrument used for the analysis was the Shimadzu Atomic Absorption Spectrometer. All standards and samples were analyzed using the same instrument and conditions.

Prior to sample analysis, a calibration curve was constructed for each metal tested (Pb, Zn, Co, Ni, Cd, Fe, Cu, Cr, Mg, & Ca). Five standard solutions of varying concentrations were prepared for each metal. Subsequently, the water samples were analyzed in triplicates for presence of each metal ion. Note that the samples were analyzed multiple times since the analysis only allows detection of one metal per run. Also, the samples need no further digestion in acid because the samples are already in liquid form. The concentration of each metal tested were automatically calculated by the instrument.

ANTIMICROBIAL ASSAY

Three potato dextrose agar (PDA) plates (Figure 1) were prepared for this assay. All plates were divided into two hemispheres, the lower hemisphere for the control (no water sample) and the upper hemisphere for the sample (with water sample). Cotton bud swabs from doorknobs were rubbed against potato dextrose agar plates. After swabbing, an antibiotic (chloramphenicol) was added to the lower hemispheres of all plates. The plates were left on a laboratory tabletop for the cultivation of microbes. Photographs of the plates were taken at 0 hour, and after 24 hours, and 120 hours.

III. RESULTS AND DISCUSSION

CLAIM 1: LIME SCALE PREVENTION

Water hardness is an indicator of dissolved calcium and magnesium content of a water sample. It is important to determine the water hardness because water with high calcium and magnesium content could cause problems such as clogging of sinks and waterways. This is because hard water facilitates the buildup of calcium carbonate (lime scale) and magnesium stearate (soap scum). For this claim, the Mg and Ca content of the QC filtered and QC unfiltered water samples were investigated using Flame-AAS.

Results show that there was a 58% and 3% reduction of the Mg and Ca content, respectively. Calculation of water samples show that the samples fall within the soft water category, 4.52 for QC Unfiltered and 3.32 for QC filtered. Although both samples are soft water, it is important to take note that the filtering power of the Kinetic Reactor filter was demonstrated by the significant reduction of Mg and Ca content. **The Kinetic Reactor filter significantly reduces the formation of lime scale and soap scum which means easier cleaning of your sink and dishes and better water efficiency of water heaters**.

Lime Scale and Soap Scum Reduction Summary

QC Unfiltered		QC filtered	
Ca	Mg	Ca	Mg
0%	0%	3%	58%

CLAIM 2: REDUCTION OF CHEMICAL CONTAMINATION

Heavy metal ions such as iron (Fe), lead (Pb), cadmium (Cd), and copper (Cu) can cause serious health problems if left unchecked in water. Therefore, removal of these metal ions is necessary to ensure the safety of drinking water. For this claim, the metal ion content (Pb, Zn, Co, Ni, Cd, Cr, Fe, and Cu) of the QC filtered, QC unfiltered, and Batangas filtered water samples were investigated using Flame-AAS.

Table 1 shows the summarized results of the Flame AAS analysis. The analysis showed that our water supply contains metal ions in very trace amounts (less than 50 ppb). For Pb, Co, Ni, and Cd, no comparisons can be made across all samples as the concentrations are almost zero and way below the limit of detection of AAS (TRACE). However, a comparison can be made for Zn, Fe, Cu, and Cr. The use of the Kinetic Reactor filter caused a reduction of 15%, 17%, 68%, and 79% of the Zn, Fe, Cu, and Cr content, respectively. **The results suggest that the Kinetic Reactor filter significantly reduces the concentration of health-hazardous inorganic elements in water like heavy metal ions.**

Table 1. AAS Results Summary

Metal	Sample		
	QC Unfiltered	QC Filtered	Batangas Filtered
Lead (Pb)	TRACE	TRACE	TRACE
Zinc (Zn)	**0.356 ppm**	**0.300 ppm**	TRACE
Cobalt (Co)	TRACE	TRACE	TRACE
Nickel (Ni)	TRACE	TRACE	TRACE
Cadmium (Cd)	TRACE	TRACE	TRACE
Iron (Fe)	**0.0584 ppm**	**0.0486 ppm**	TRACE
Copper (Cu)	**0.0106 ppm**	**0.0034 ppm**	TRACE
Chromium (Cr)	**0.015 ppm**	**0.0031 ppm**	TRACE
Magnesium (Mg)	**0.474 ppm**	**0.200 ppm**	0.838 ppm
Calcium (Ca)	**1.031 ppm**	**1.002 ppm**	2.412 ppm

CLAIM 3: REDUCTION OF MICRO-BIOLOGICAL CONTAMINATION

After 24 hours, colonies of fungi already have formed in the unfiltered sample whereas there are no formations in the filtered samples. However, 120 hours after the start of the assay, there is significant formation in both the QC unfiltered and Batangas filtered sample. The formation of colonies in the Batangas filtered sample can be attributed to the higher hardness (9.42) relative to the QC samples. This growth after 120 hours is somewhat expected since moisture encourages bacterial growth. Despite that, it is worth noting that the water filtered using the Kinetic Reactor filter can inhibit microbial growth for 24 hours. **In summary, the antimicrobial assays show that the Kinetic Reactor filter is very capable in microbiological disinfection of the water.**

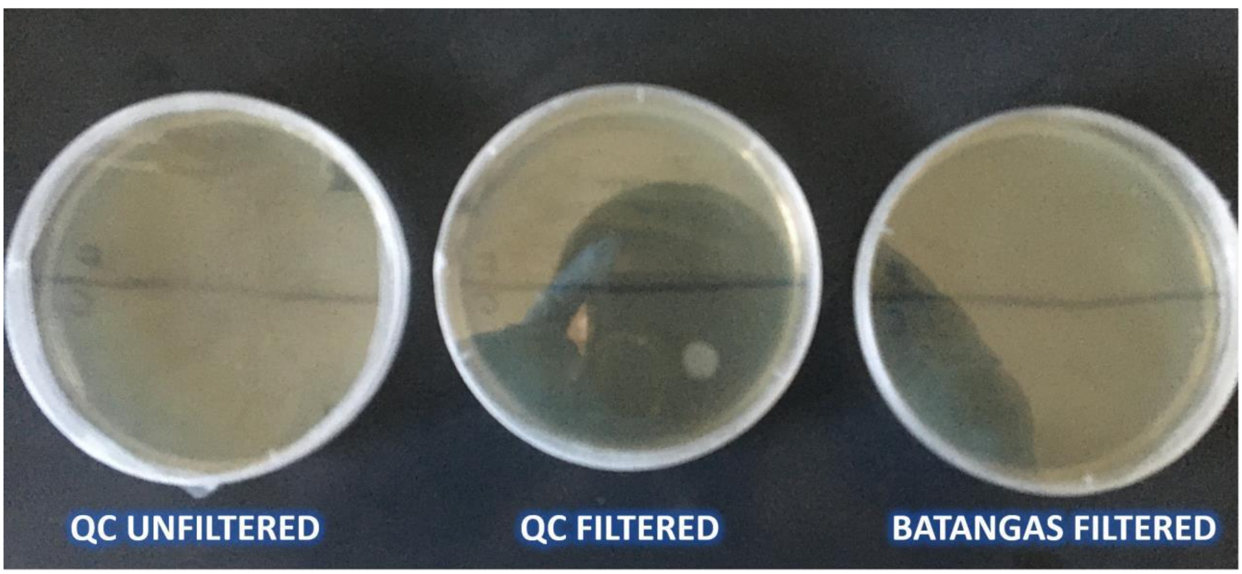

Figure 1. Day Zero plates

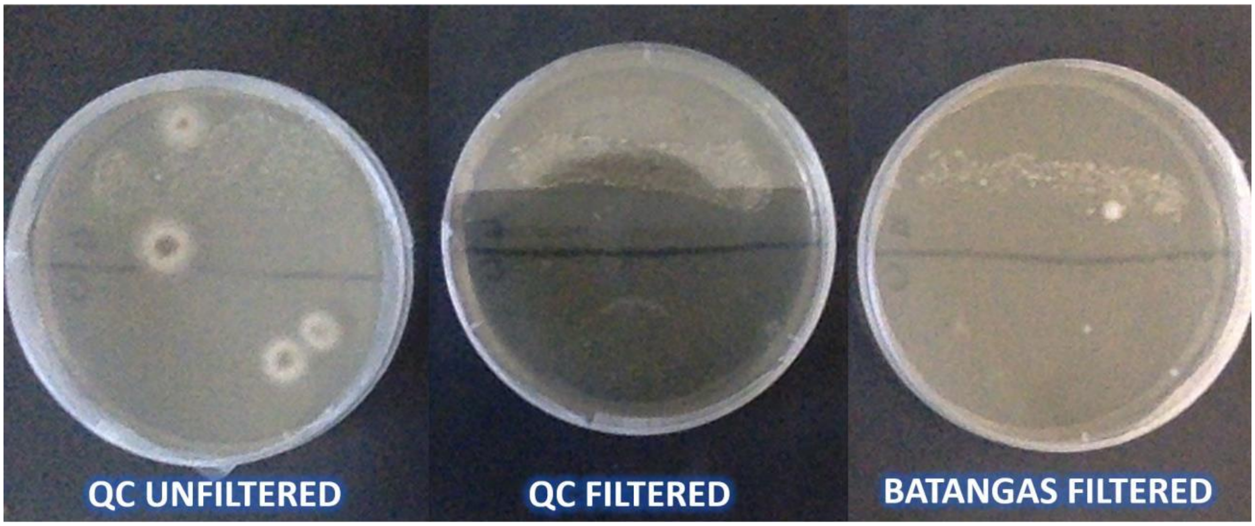

Figure 2. Plates after 24 hours

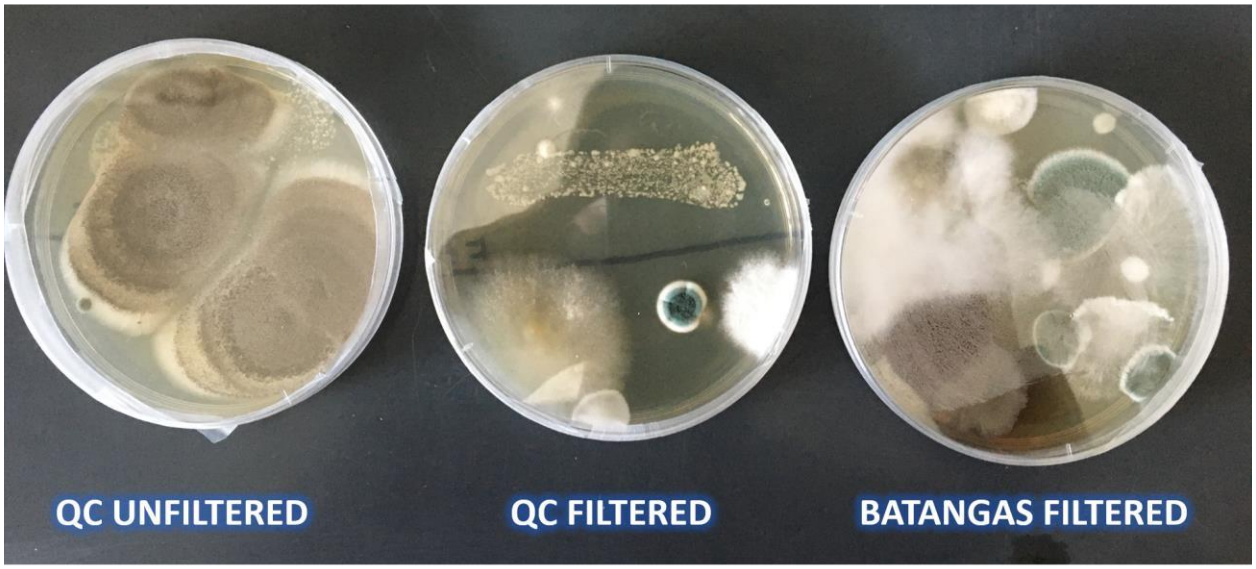

Figure 3. Plates after 120 hours

Antimicrobial Assays Summary

Time frame	QC Unfiltered	QC filtered	Batangas Filtered
0 h	NO GROWTH	NO GROWTH	NO GROWTH
24 h	SIGNIFICANT GROWTH	**NO GROWTH**	MINIMAL GROWTH

CLAIM 4: REDUCTION OF WATER TREATMENT CHEMICALS

Water treatment chemicals like fluorides and chlorides linger in water even after treatment and contaminates our water supply as part of the total dissolved solids (TDS). For this claim, the TDS of the QC unfiltered and QC filtered were compared to check whether the Kinetic Reactor filter has the capability of reducing these chemicals. The figure below shows the dried water samples after the overnight drying.

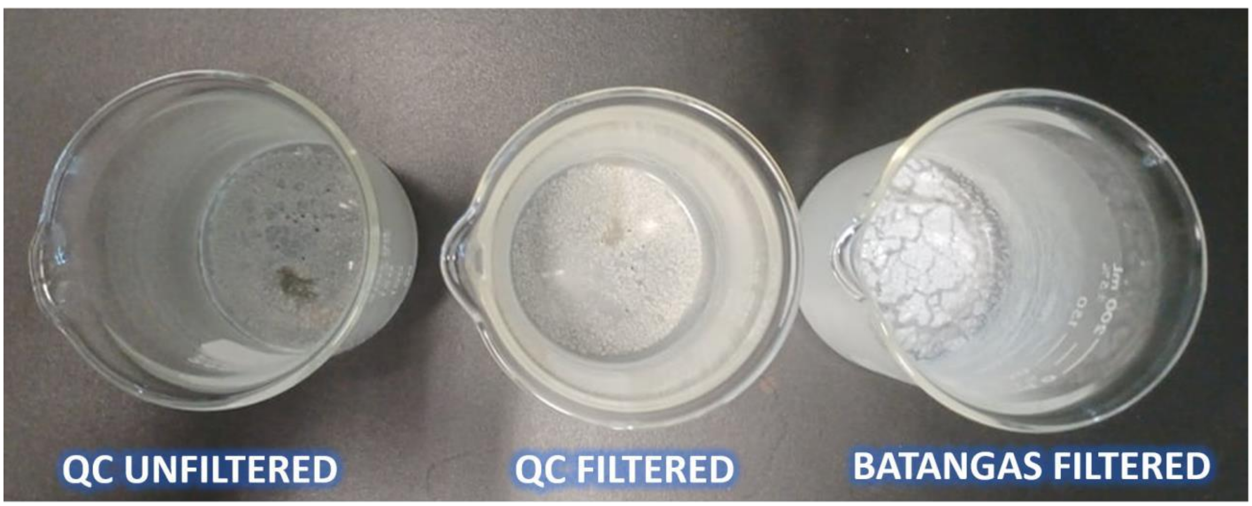

Figure 4. Dried Water Samples

Calculations show that the TDS content of the QC unfiltered, QC filtered, and Batangas filtered water samples are 119 ppm, 98.5 ppm, and 422 ppm, respectively. It is important to check the TDS content of water as high concentrations of dissolved solids can add a laxative effect to water or cause the water to have an unpleasant mineral taste. Comparing the results of the QC filtered and unfiltered, there was a 17% reduction of TDS content of the water samples. Although not significant, the results warrant the claim of removing water treatment chemicals. **Therefore, we can suggest that the Kinetic Reactor filter removes most of Chlorine from the drinking water as evidenced by the reduced TDS content.**

TDS Analysis Summary

QC Unfiltered	QC filtered	Batangas Filtered
119 ppm	98.5 ppm	422 ppm

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