TO RECYCLE GREY WATER FROM HOUSEHOLD BATHS AND LAUNDRY, FOR USE IN GARDENS

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INTRODUCTION

Water is an extremely valuable, scarce natural resource in Africa, being the 30th driest country in the world. News reports that the dams supplying water to our areas would turn to mud if we have no rain by December, concerned me.

Greywater is wastewater from non-toilet plumbing fixtures such as showers, basins and taps. **Black water** is water that has been mixed with waste from the toilet.

At present, most homes use potable (drinkable) water for almost everything in the house and garden. In this project, I shall look at building a filtration system for recycling grey water to be used for irrigation purposes in the garden.

The end goal is for all households to implement such a system, leading to vast amounts of fresh water being saved.

RESEARCH TOPIC QUESTION

Recent water restrictions and reports from the news that the dams supplying water to our area will turn into mud if we have no rain by December, alerted me to the severity of the current drought. This frightened me and I thought that I should do something to help the situation. I wanted to do something cheap and simple, yet effective to get many people to use it. I therefore decided to devise a household DIY grey water filtration system for this project. The filter will save water and the incentive to use the filter is to save money by reduced water consumption.

AIM OF PROJECT

The aim of this project was to develop a simple DIY filtration system to encourage the average household to recycle grey water for use in the garden.

HYPOTHESIS

Grey water from the bath, shower and washing machines can be cleaned using a simple filtration system and reused in the garden. In an average household, recycling grey water would reduce its total water usage by 25-50%.

ENGINEERING GOAL

Water is necessary for preserving life and civilization on Earth. There is a world-wide shortage of water. In addition, Africa is classed as a "water-stressed" country. We need to investigate ways to conserve water.

If we look at total water usage in Africa, 20% is utilized for domestic purposes. Presently, most homes use potable (drinkable) water for practically everything in the house and garden. There is opportunity to recycle wastewater for re-use; thereby reducing household water consumption. This can reduce domestic potable water use by 25-50%.

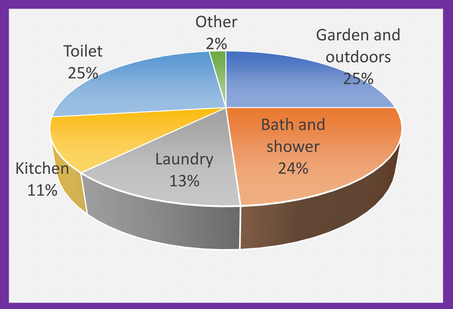
BACKGROUND RESEARCH

Water scarcity is a global challenge, this is no exception for Africa. As mentioned earlier, Africa is ranked as the 30th driest country in the world. Water availability affects the development of the entire country; it affects the economic, social and environmental well-being of Africa over the next decade. We are sure to experience water shortages similar to the electricity load shedding we had last year as the demand for water increases.

The annual rainfall level in Africa is around 50% lower than the world average; we encounter unevenly distributed rainfall across the country. The east and west coast, as well as the inland have highly variable climates, where droughts and floods are common. Climate changes due to global warming also affect rainfall patterns.

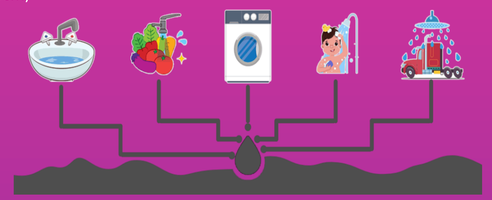
Blackwater is water that has been mixed with waste from the toilet. This water has a high organic loading (nitrogen) and contains harmful germs; it requires biological or chemical treatment and disinfection before reuse. This is not in the scope of this project.

Grey water is water from the bathroom and washing machine. The organic loading is much lower, so it can be recycled for re-use. The definition according to Greywateraction.org, "*Greywater* is gently used *water* from your bathroom sinks, showers, tubs, and washing machines. It is not *water* that has come into contact with faeces, either from the toilet or from washing diapers. *Greywater* may contain traces of dirt, food, grease, hair, and certain household cleaning products", In this experiment, water from kitchens and dishwashers were excluded from grey water as they contain oil, grease, and food particles which has the potential for contamination by pathogens. Therefore, they will fall into the black water category. Grey water can be safely used to water plants.



MATERIALS

- Grey water (1 litre water mixed with 2ml of the following, shower gel, shampoo and liquid laundry detergent)
- 2L clear plastic cool drink bottles cut around 1/3rd from the top and inverted (settling tank)
- Charcoal (charcoal crushed down to below 0.5mm in size)
- Pool Filter Sand (average particle size of 0.6 – 1.5mm)
- White muslin cloth cut into squares (6 x 6cm)
- Tap water (used as the control)
- Clear tumblers (surge tank)
- Gravel used in fish tanks
- Mild bleach solution
- Large, clear glass jug
- Black cable ties
- Scissors



PROCEDURES

Step 1

- The best method that would work in the average home was selected.
- This had to be practical and easy to implement.
- A gravity feed filtration system was chosen, as no expensive plumbing changes, and pumps would be required.

Step 2

- From the wide range of products available to filter water, the most suitable materials were assessed in terms of efficiency, cost and availability.
- A four step multi-media filtration process using muslin cloth, gravel, sand and coal respectively was selected as the ideal system to clean the grey water.
- The muslin cloth was bought from a fabric shop, the gravel was that used in a fish tank, the sand was pool sand and crushed household braai charcoal was used.

Step 3

- Grey water from bath, sinks, showers and the washing machine was replicated.
- This was prepared by adding 2mL each of shower gel, shampoo and liquid laundry detergent to 1.5 litre of tap water.

Step 4

- The 'settling tank' was the cut top of the clear cool drink bottle.
- The 'tank' had to be large enough to capture all the grey water, be water-proof and durable; ideally a hard plastic.
- In a practical situation, the tank has to have an opening at the top for periodic cleaning and maintenance.
- In this tank, oils and grease particles from the grey water float to the top and sediments settle at the bottom.

Step 5

- The multi-media filtration system was set up.
- As this was a gravity fed system, the materials went into the 'tank' in reverse order; that is the last filtration medium went in first.
- A piece of the white muslin was placed at the bottom of the 'tank'.
- This served as a lining to make the cleaning that is required easier.

Step 6

- The bottle top was suspended over the tumbler.
- 250mL of grey water was poured over the filter system
- This was left to filter through to the surge tank for 10 minutes.
- The water collected in the 'surge tank' was tested.

ERRORS & LIMITATION GAPS

The main limitation was that we did not have the equipment to do quantitative testing of the water. For this exercise, the qualitative results were fine, but it would have been interesting to see the changes in chemical and biological activity before and after filtration.

Assessing colour and odour are subjective tests. With the results being quite similar, some of the test checks got confusing.

The aim of this exercise was to achieve a 25 to 50% water saving. This range cannot be narrowed as water usage differs significantly in households. Key factors are the location, either rural or urban; the size of the house and household, whether the house has a garden or not, and the size of the garden.

FUTURE RESEARCH

25% of domestic water is used in toilets. Future research could look at disinfecting the recycled grey water for use in the toilets.

I could also look at using activated coal to purify the water to a level that can be used in swimming pools.

I could also investigate by discussion with various professionals, the effect on the water table, the flora and fauna downstream, if my filter had to be adopted in households.

CONCLUSION

This project demonstrated how a simple "DIY" filtration system could be set up using readily available materials (cloth, sand and charcoal), to successfully clean grey water for use in gardens. The exercise aimed to reduce the daily water need in households by 25-50%. Almost 40% of household water is used for bathing and laundry. If households adopt this system of recycling grey water, then water usage per home would decrease by up to 50%, thereby saving precious drinking water, and money.

RESULTS

- This was a qualitative study based on cleaning grey water.
- Water quality was assessed after each filtration stage.
- The results tested were odour and appearance in terms of colour and clarity
- Normal tap water was used as the control.

	COLOUR	CLARITY * 1 = BEST 6 = WORST	ODOUR
TAP WATER (CONTROL)	Clear	1	No odour
GREY WATER BEFORE FILTERING	Milky to grey colour	5	Mild soap smell detected
FIRST FILTRATION MUSLIN CLOTH	Milky to grey colour	5	Mild soap smell remains
SECOND FILTRATION COARSE GRAVEL	Milky to grey colour, but a little lighter	4	Mild soap smell remains
THIRD FILTRATION SAND	Milky to grey colour, but lighter	4	Slight soap smell
FOURTH FILTRATION CRUSHED COAL	Milky to grey colour, but lightest in colour	3	Slight soap smell

ACKNOWLEDGEMENT

Finalist would like to thanks his/her mother, ……(type mother name in here) …… for her assistance, financial help and patience with me on this project.

Finalist would like to thanks his/her father, …… (type father name in here) …. helped to build the home for demonstration purposes.

Finalist would like to thanks his/her teacher, …. (type teacher name in here) ….. helped by using her laboratory experience to guide me through the project, lending me his/her laboratory and proof reading and correcting my report.