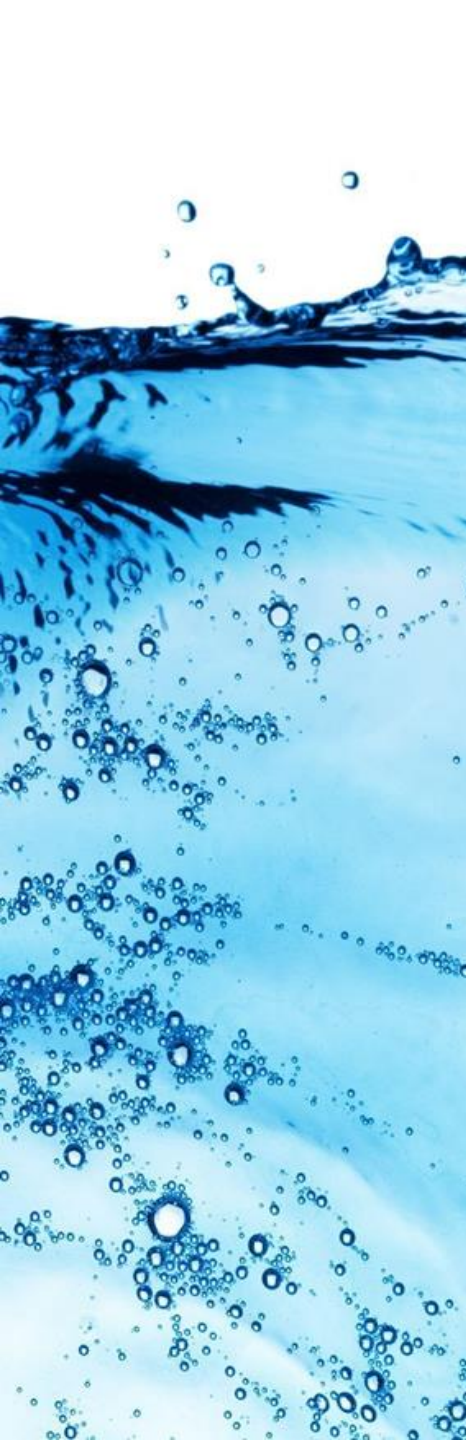
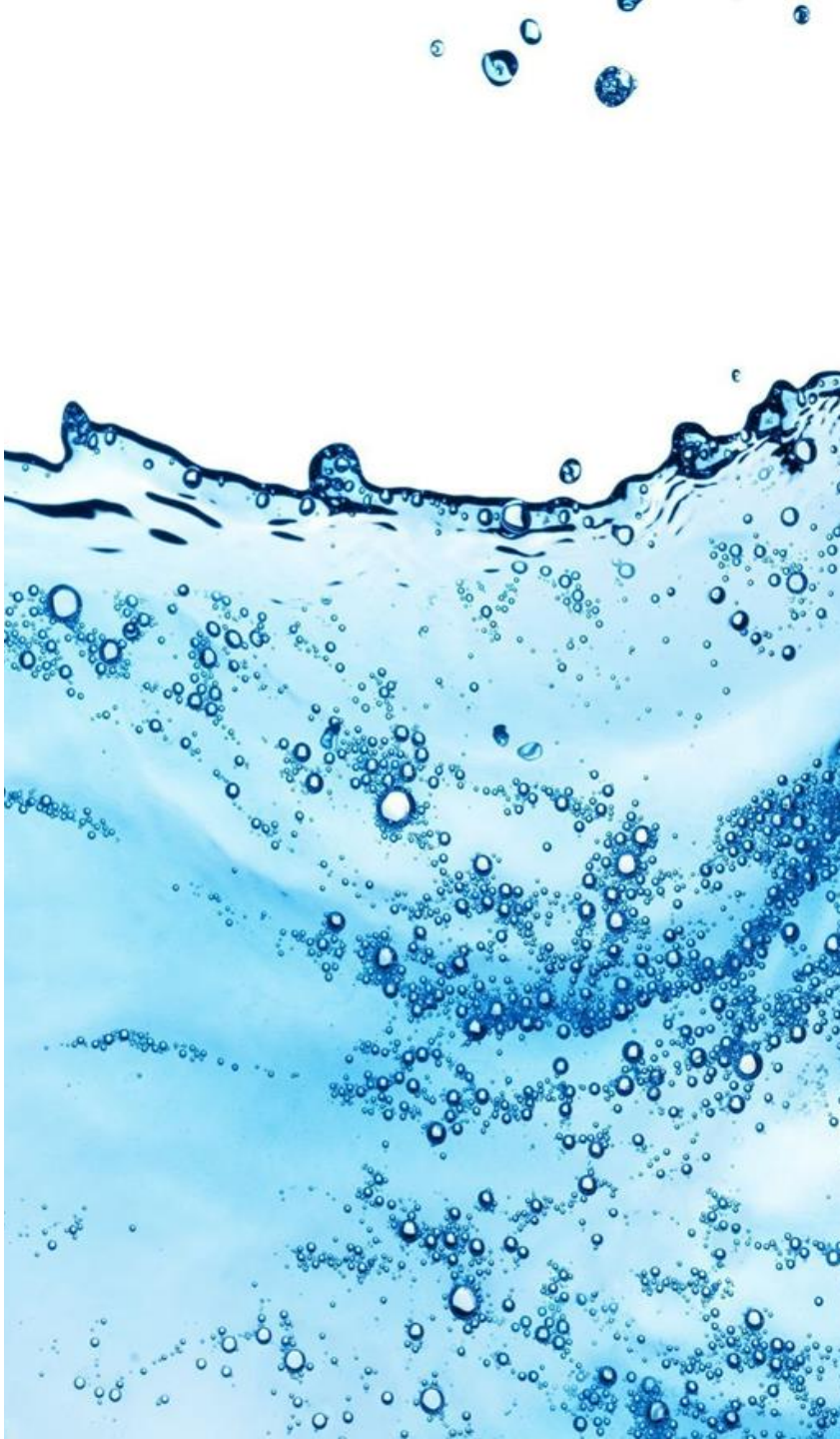


GREY WATER FILTER



BY- SHACHI PANDEY

GREY WATER FILTER

PROJECT IDEA

Idea is to provide a window of opportunity to compact urban households to contribute towards resolving water pollution crisis in India. By filtering grey water to make it fit for irrigation/release into water bodies and turning sustainable urban living into a reality.

The inspiration behind this project is-
"The Change Starts from You"

PROBLEM IDENTIFICATION

What is Grey water?

Greywater or sullage is all wastewater generated in households or office buildings from streams without fecal contamination, i.e. all streams except for the wastewater from toilets. if left to sit, will eventually turn to black water in a matter of 48 to 72 hours.

Greywater accounts for up to 75% of the wastewater volume produced by households.

Why treat grey water?

- The greywater can be harmful to the receiving aquatic environment, especially in marinas, mooring locations and sheltered bays.
- Greywater discharge plumes may remain on the surface of aquatic environments and accumulate pollutants (particularly nutrients) Excessive nutrients contribute to the growth of algae.
- If given the needed attention can help reduce the over-reliance on freshwater resources and reduce the pollution caused by discharge of untreated greywater into freshwater resources.
- Constituents found in greywater also include nitrates, phosphate, surfactant, triclosan, etc.

In India

- an estimated 62,000 million liters per day (MLD) sewage is generated in urban areas, while the treatment capacity across India is only 23,277 MLD, or 37% of sewage generated, according to data released by the government of India in December 2015.
- Each day, 2.9 billion liters of waste water from sewage, domestic and industrial sources are dumped directly into Ganga alone.
- This is wreaking havoc on Ganga's natural ecosystem, and in many places along her stretches, fish and aquatic creatures are dying.
- Many of these people have no other alternative but to continue to use Ganga's polluted waters for their very existence, and thus contract waterborne illnesses such as dysentery, cholera, diarrhea and typhoid.

We know lions and tigers, but do we know them?



These are the animals that inhabit our rivers. (left to Right)- National Animal- Ganges Dolphin, Smooth coated Otter, Critically endangered- Gharial

They are at our mercy for their survival and maintenance of a healthy River ecosystem… And what are we doing to them?


Ganges Dolphin

Exposure of dolphins to toxic chemicals can affect their reproduction and survival.

Approximately 15% of the Indian population contributes phosphorus-containing wastewater effluents to rivers and lakes, resulting in eutrophication

We see these problems often on internet and on TVs but the question is,

“How can we, the urban people, living far from nature’s lap can actually help?”

Existing methods of wastewater treatment in India

1. Sewage System 2. Septic tank and Soak Pit

Chemical wastewater treatment

Chemicals are used during wastewater treatment in an array of processes to expedite disinfection. used alongside biological and physical cleaning processes to achieve various water standards. It's different types are-

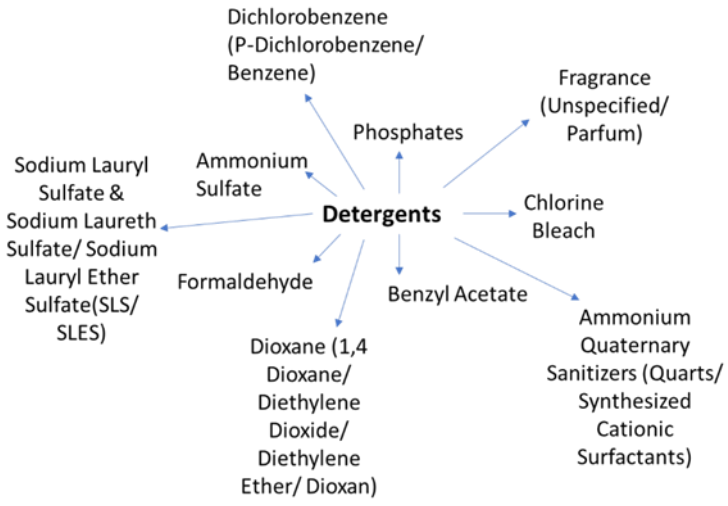
1. Chemical precipitation 2. Chemical Coagulation 3. Chemical Oxidation and Advanced Oxidation 4. Ion Exchange 5. Chemical Stabilization

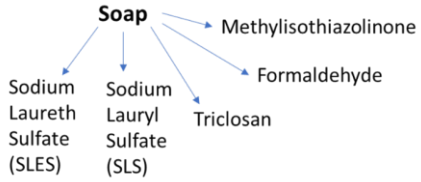
Laws and regulations related to wastewater management in India

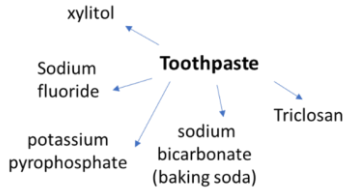
India as a participatory nation by the 42nd amendment of the constitution incorporated provisions under Art. 48A and Art. 51A (g) for protection and improvement of natural environment. Environment (Protection) Act, 1986, is the elaborate text of such constitutional mandate. The Act has made provisions for creation of institutions to shape an environmentally sound future. Consequently, by considering alarming effects of wastes – solid, liquid or e-waste – on environment, various rules are framed by the Central Government for the establishment of regulatory authorities to manage the situation.

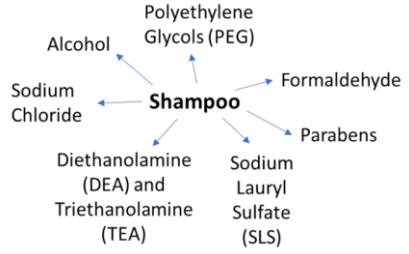
MATERIAL STUDY

Composition of grey water- 1. Bathroom- Water used in hand washing and bathing generates around 50-60% of total greywater and is considered to be the least contaminated type of greywater. 2. Cloth Washing- Water used in cloth washing generates around 25-35% of total greywater.









Broadly classifying the composition-

Common Chemicals in Grey Water	General Classification (if any)
1. Triclosan	
2. Sodium Lauryl Sulfate	Sulphates
3. Sodium Laureth Sulfate/ Sodium Lauryl Ether Sulfate (SLS/ SLES)	
4. Ammonium Sulphate	
5. Benzyl Acetate	Benzene
6. Formaldehyde	Aldehyde
7. Sodium Fluride	
8. Dichlorobenzene (P-Dichlorobenzene/ Benzene)	Benzene
9. Potassium Pyrophosphate	Phosphates
10. Sodium Chloride	
11. Dioxane (1,4 Dioxane/ Diethylene Dioxide/ Diethylene Ether/ Dioxan)	Ether

Finding suitable water purification agent-

Purification agent	Major Statement	Fit for this use?
1. Chlorine	Chlorine tablets are also highly flammable and potentially explosive when mixed with acids or other common chemicals	No
2. NaDCC (Sodium Dichloroisocyanurate)	More active against Gram- positive than Gram-negative bacteria, triclosan	No
3. Iodine	The biggest challenge when using Iodine for water purification is the resulting taste, odour and colour. Iodine often causes a yellowing of the water upon treatment and produces a taste and odour that many find unpalatable.	No
4. Chlorine Dioxide	The downfall of Chlorine Dioxide when used to purify water includes both cost and taste.	No
5. Activated Charcoal	Has lower quality and less surface area, thus cant adsorb triclosan effectively	No
6. Coconut Shell Activated Carbon (CSAC)	It is a form of carbon processed to have small, low-volume pores that increase the surface area available for adsorption or chemical reactions. CSAC is used at varying concentrations and time intervals to decrease hardness and chloride present in the water sample .CSAC also reduces the colour and odour of the water sample. So, CSAC can be categorized as a very efficient purifier of water. Can remove Triclosan.	Yes

Coconut Shell Activated Carbon (CSAC)-

- The use of activated carbon to remove harmful impurities like organic contaminants from water has been practiced since Roman times.
- Activated carbon is extremely porous with a very large surface area, which makes it an effective adsorbent material.
- An approximate ratio of surface area is one square meter per gram.
- Coconut shell-based activated carbons are the least dusty. Predominantly microporous, they are well suited for organic chemical adsorption. Coconut shell-based carbon has the highest hardness compared to other types of activated carbons, which makes it the ideal carbon for water purification.

Sourcing of CSAC-

- Activated carbon is a non-graphite form of carbon, which can be manufactured from any carbonaceous material such as coal, lignite, wood, paddy husk, coir pith, coconut shell, etc.
- Around 24 companies, mostly located in south India, are producing activated carbon. They are dependent on coconut shells from Tamil Nadu, Karnataka and Kerala.

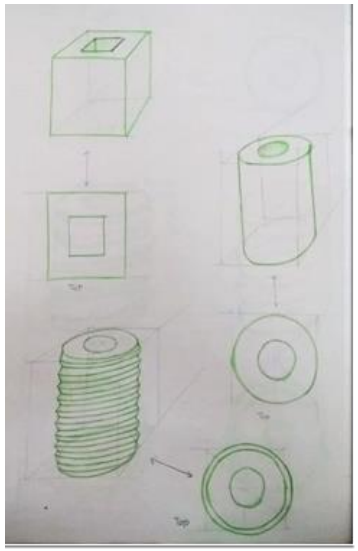
- IGCL, Raj Carbons, UCI Carbons, Shri Krishna Enterprises, Active Carbon India Pvt Ltd and many more. UCI Carbons are Pioneers in India with over 35 Years in Activated Carbon business.
- Global trade of activated carbon from coconut shells surged at a CAGR of 5% from 2014-2018.

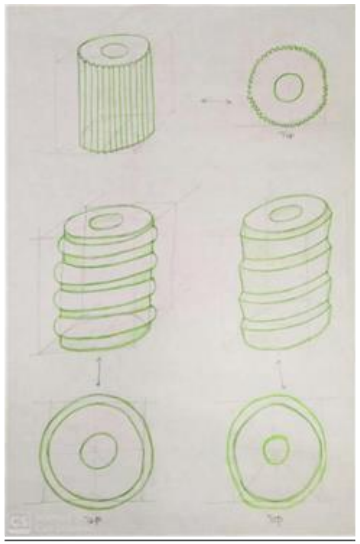
Sustainability of CSAC-

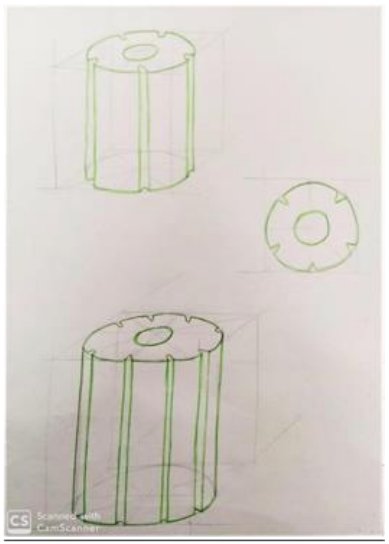
- The research by Department of Chemical Engineering, b Department of Electrical Engineering, Xavier
- University – Ateneo de Cagayan, Philippines in their research, Generating Electricity from Spent Activated Carbon: Life cycle environmental benefits, prove that-
- The SAC has combustibles composition and a heating value that makes it a suitable for cofiring with coal in a large combustion plant for power generation. By generating power, it can potentially offset the burning of coal, as well as emissions from coal-fired facilities, while making it possible for the oleo chemical company to circumvent the cost of SAC disposal.

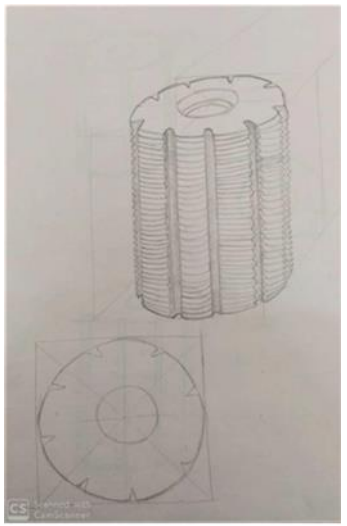
PRODUCT DEVELOPMENT

Form generation for CSAC cartridge -





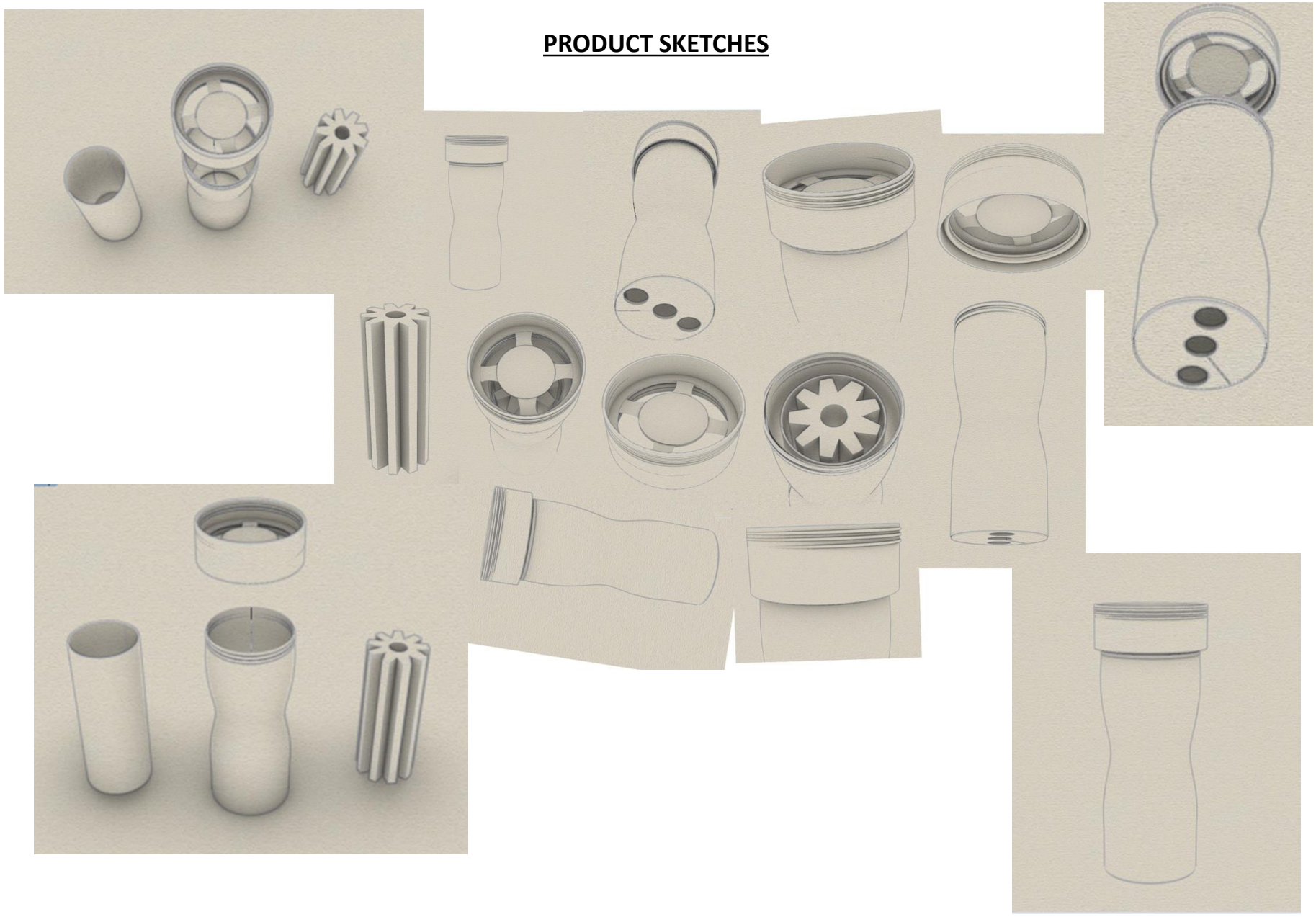


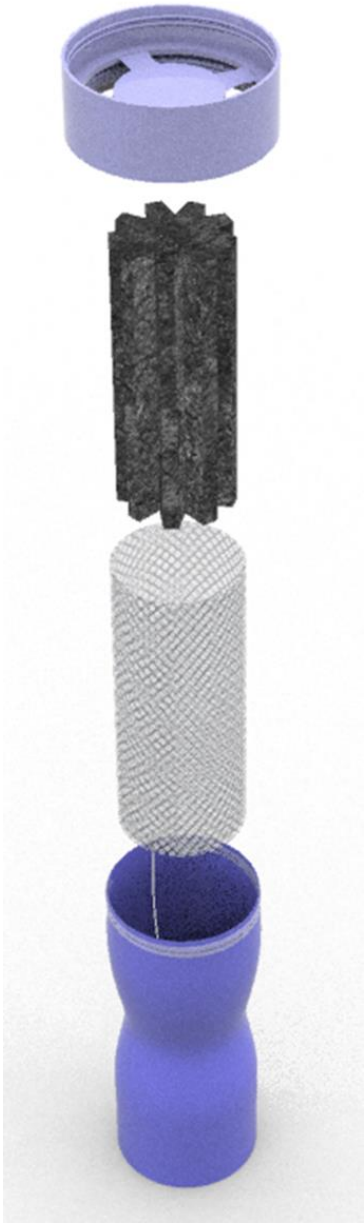


Selected form

Why this form?
Serration help in increasing the surface area. The combination of longitudinal and horizontal serrations in this form give the maximum surface area to CSAC for adsorption, thus can make the filter last longer.

PRODUCT SKETCHES



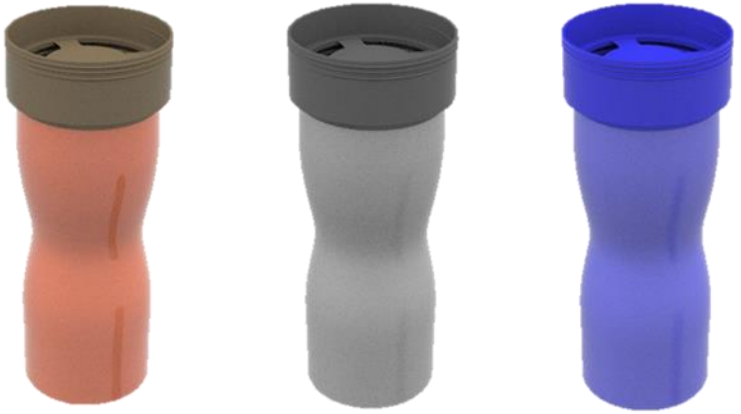


Closing lid- Will have threads at bottom to attach to the housing, a covering for cartridge's top, opening for water inlet and an extension above to attach to the pipe opening.

CSAC cartridge

Tissue and wire mesh- To support the cartridge and prevent disintegration of carbon particles. This will attach to closing lid on the top.

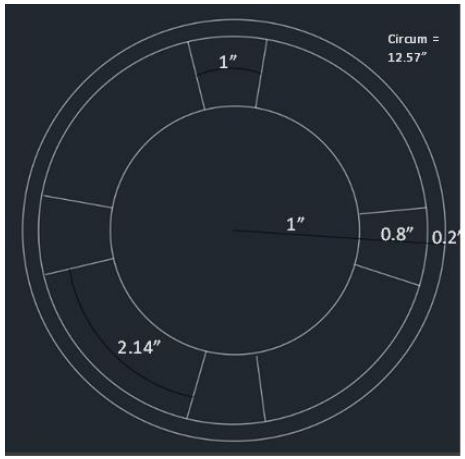
Filter housing- has threading on top to attach to closing lid. Its form is slightly concave from mid and has 3 smaller openings for water outlet to regulate the water pressure.



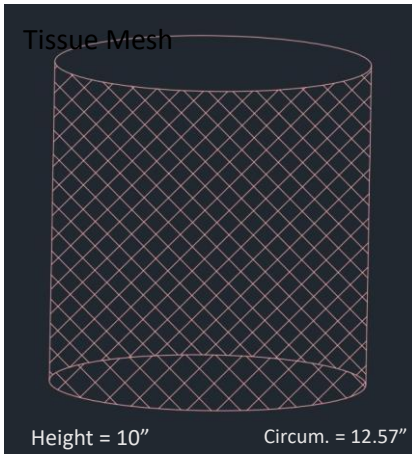
DIMENTIONING

A typical septic tank has a 4-inch inlet located at the top. The pipe that connects to it must maintain a 1/4-inch-per-foot slope toward it from the house. This means that for every 10 feet of distance between the tank and the house, the inlet must be 2 1/2 inches below the point at which the pipe exits the house.

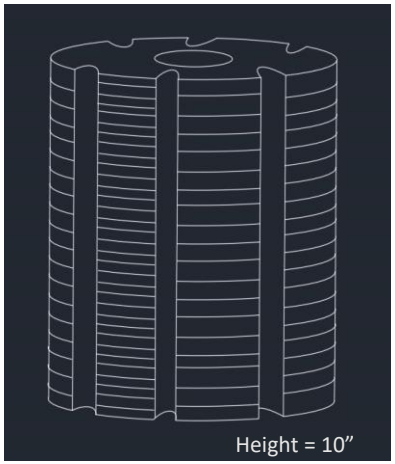
Top Lid



Wired Mesh

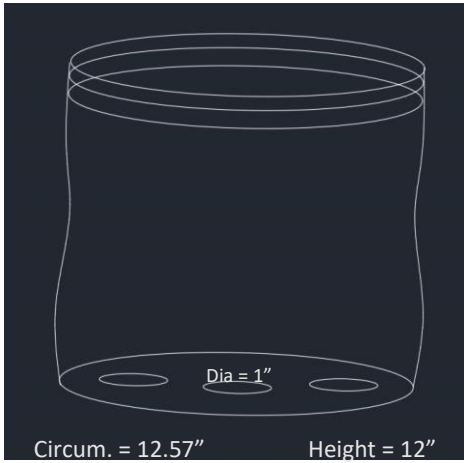


CSAC cartridge



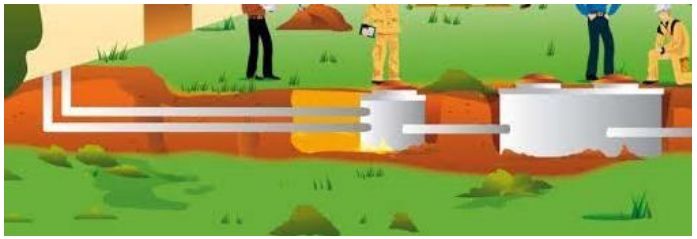
Cirum. = 12” Dia = 4”

Filter Housing



INSTALLATION

- It is specifically designed for individual house/ apartment, and the filter has to be installed to their greywater pipe only.
- Can be installed where the greywater is entering septic tank or where its entering soak pit of that house.
- It follows a simple installation process where it can just be fitted by threads or with the help of rubber gripping on the lid and can be slid inside the standard sewage pipe.



MAINTAINCE

- The device will have to be changed in every 6 to 8 months, depending upon the number of occupants in a house.
- Its replacement and maintenance can be synced with the maintenance of septic tank itself.
- The filter will be ineffective if connected to organic waste pipe.
- The spent CSAC cartridges can be sent to thermal power plants for energy production.

OPPORTUNITIES / FUTURE PROSPECTS

- There are 8 sustainability projects undertaken by the government. One which is Sustainable habitat which includes urban waste management.
- Green Rating for Integrated Habitat Assessment (GRIHA) is national rating system for green buildings-

-Developed by TERI (The Energy and Resource Institute) and endorsed by the MNRE (Ministry of New and Renewable Energy) It is based on nationally accepted energy and environmental principles, and seek to strike a balance between established practices and emerging concepts, both national and international.

-GRIHA attempts to minimize a building's resource consumption, waste generation and overall ecological/environmental impact by comparing them to certain nationally acceptable limits /benchmarks.

▪ GRIHA allots points to the buildings called green points which provides star ratings to buildings. 50 to 60 points = 1 star building

61 to 70 points= 2 star building , 71 to 80 points = 3 star building, 81 to 90 points = 4 star building , 91 to 100 points = 5 star building

Which as of now works as USP and positive marketing point for business, but in near future will convert into mandatory standards. E.g. As happened with electronics.

▪ There are 17 sustainability goals decided by the UN which are to be achieved by 2030.

This project comes under the category of-

<u>Stakeholders of Project-</u>

- Citizens of India, Municipal corporations , State Governments
- CSAC manufacturers- IGCL, Raj Carbons, UCI Carbons, Shri Krishna Enterprises, Active Carbon India Pvt Ltd, etc.
- Purifier companies- Kent, Sintex, Aquaguard, etc
- NGOs – Jal Bhagirathi foundation, Neer foundation, We are water, Water action hub, etc. and Sanitation workers
- Fresh water biodiversity of India
- OUR FUTURE