Achieving clean energy from waste water

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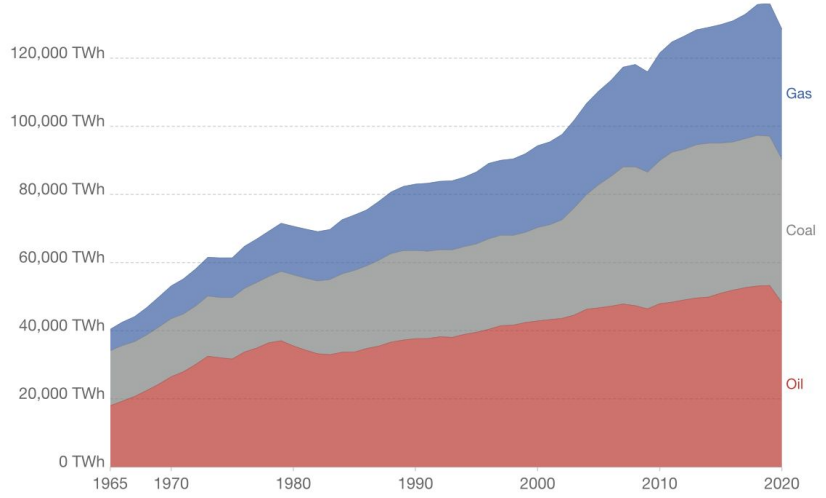
Problem statement

Fossil fuels are getting depleted day-by-day. At present we, globally, consume 35 billion tonnes of Fossil Fuels each year. Octopus Energy says that at our current rate of depletion, coal and natural gas will last till 2060. This is detrimental and therefore, renewable energy is the future. There are many problems with renewable energy. For example: Solar energy being available only in the day. There is a source of green energy which is always available; hydrogren. Nevertheless, hydrogen is very costly to produce because it requires a lot of infrastructure.



Sewage Water - Problem & Opportunity

Problem:

- Disposal of domestic sewage from cities and towns is the biggest source of pollution of water bodies in India . All Class I cities and Class II towns together generate an estimated 29129 Million litre in a day sewage (as per population in 2001 census).
- All the sludge generated from this amount of sewage goes to landfills

Opportunity:

- Sewage water contains double the amount of energy than clean water
- Sludge generated at sewage treatment plants can be used as a biomass to generate Bio- hydrogen
- Sludge from sewage treatment plant can be used as a high quality fertilizer

Aim of our product

- **Our project aims to use waste water and generate clean bio-hydrogen**.

- Our product is an extension in the pre existing facility at water treatment plant.
- We are using photo fermentation and dark fermentation to generate clean hydrogen using sludge generated during the water cleaning process.
- We will multitask by using the unused waste to generate clean energy

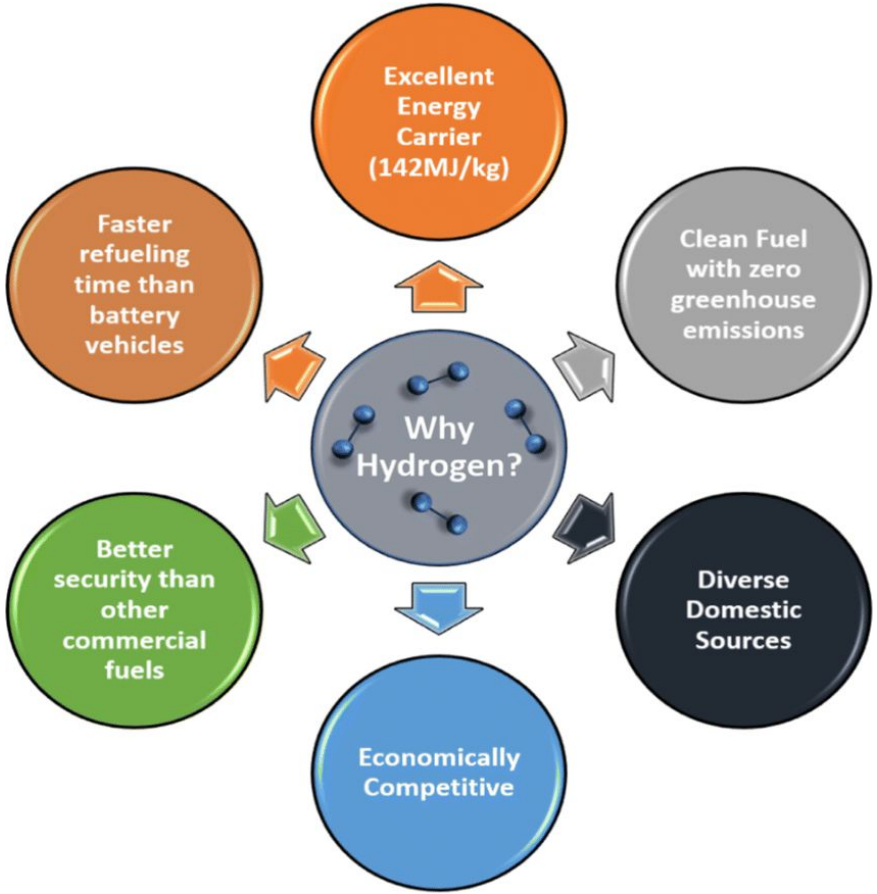
Benefits of hydrogen

There are some benefits to using hydrogen as a fuel:

- unlike petrol and diesel, hydrogen does not generate carbon dioxide when burnt
- hydrogen fuel cells are very efficient

However, there are also some downsides too:

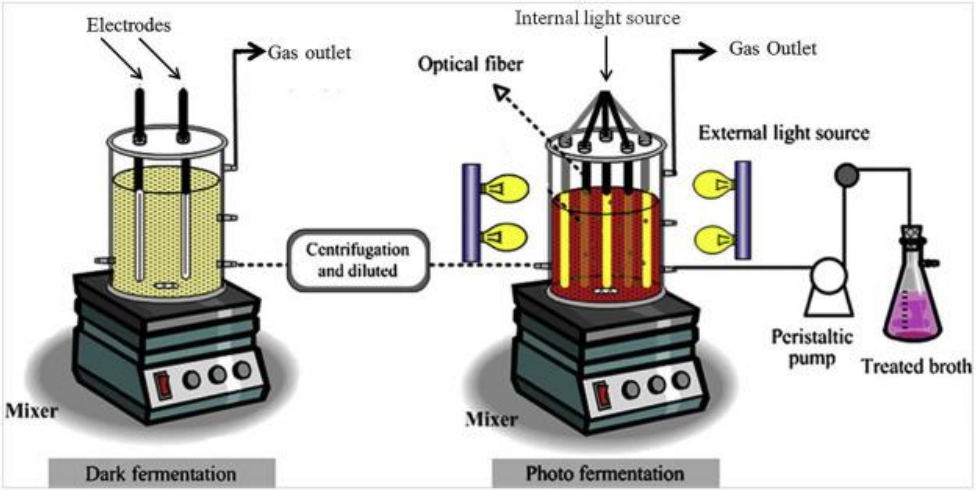
- few filling stations sell hydrogen
- hydrogen must be compressed and liquefied, and then stored in tough, insulated fuel tanks



Innovation and concept

Every day millions of gallons of water is wasted from houses,factories etc. Our concept will help the environment as it will convert this waste water into clean hydrogen.

- We will be using the Sludge from the waste water which will be converted to clean hydrogen.
- To carry out this process we will be using 2 types of fermentation - dark fermentation and photo fermentation in order to achieve clean hydrogen.



Method and working

- This form of hydrogen generation is conducted in a Water Treatment Plant. The first step is to extract the sludge or algae from the wastewater and take it into the plant for drying.
- Once it is turned into the state of dried sludge. It is reduced and we remove it of its microorganisms using syngas.
- From there, it is stored as a biomass. After that it is taken into dark and then photo fermentation respectively.
- It is at this point, hydrogen is extracted and then compressed and finally taken into storage.

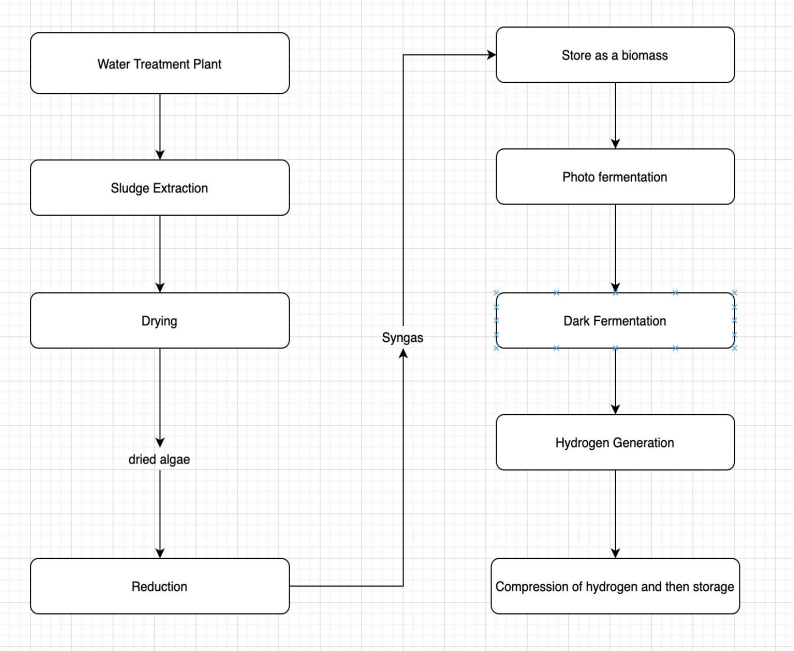
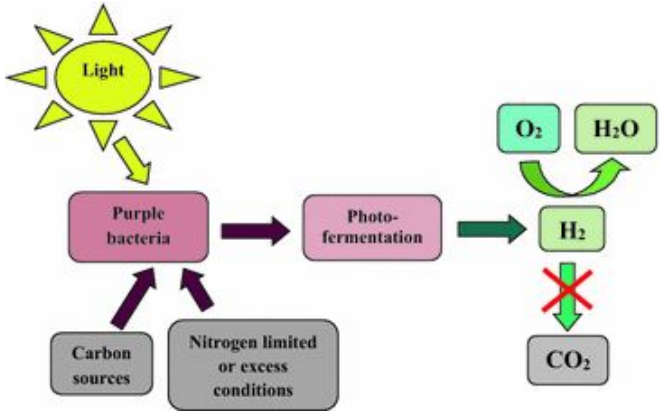


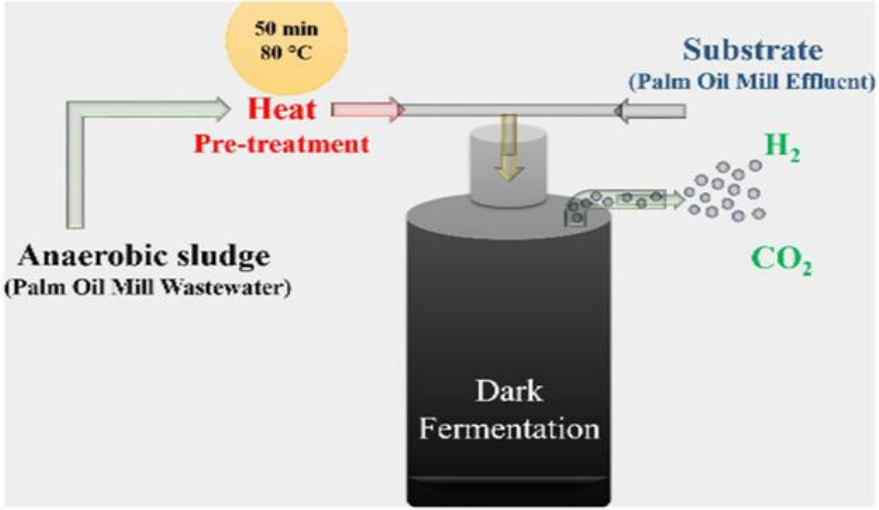
Photo fermentation

Photo Fermentation - Photo fermentation is the first process to convert the organic substrate to biohydrogen using a diverse group of photosynthetic bacteria by a series of biochemical reactions. Photofermentation takes place in the light.



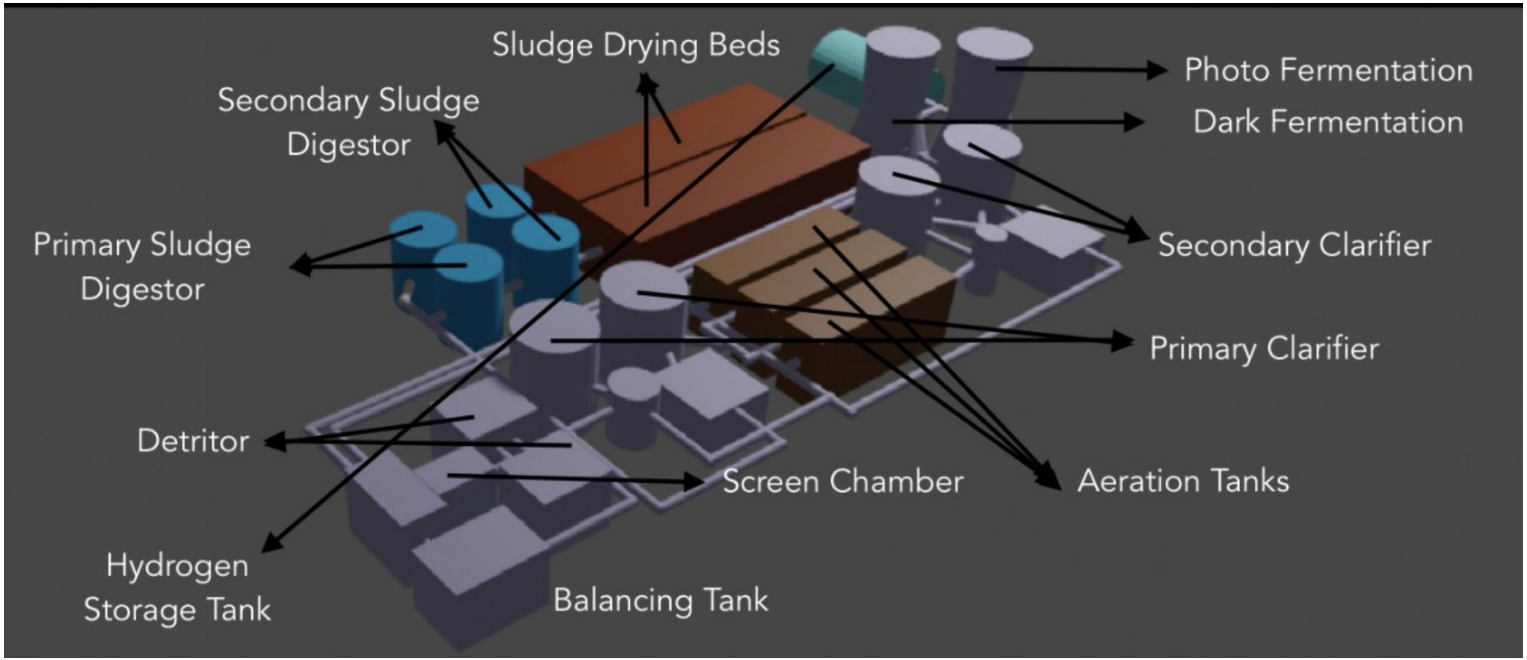
What is Dark Fermentation?

Dark fermentation - Dark fermentation is the second process to convert the organic substrate to biohydrogen also, like photofermentation, using a diverse group of photosynthetic bacteria by a series of biochemical reactions. Dark fermentation takes place in the dark in contrary to photofermentation.

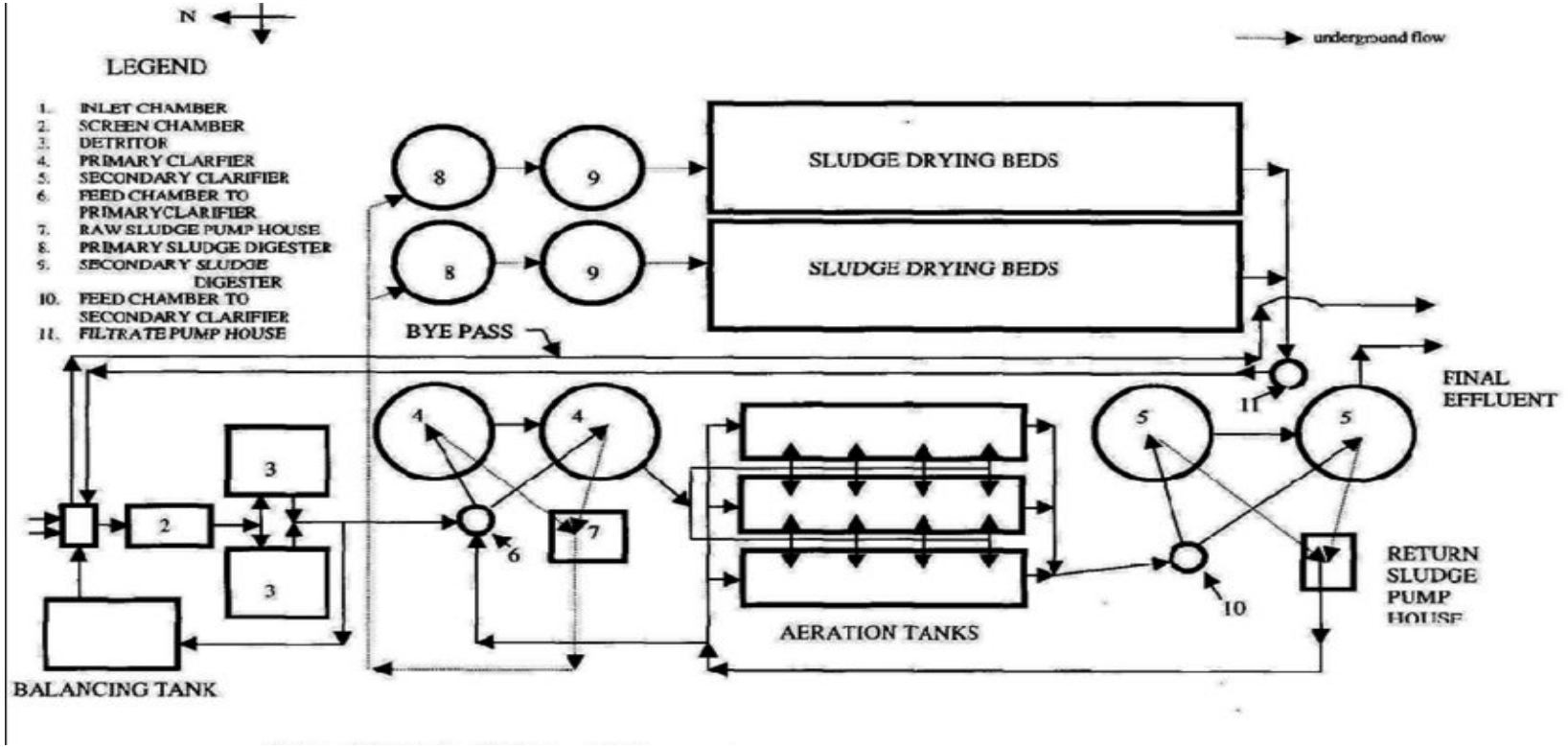


CAD Design

We made a 3D CAD design of the full water treatment plant with hydrogen generation extension using blender software



Blueprint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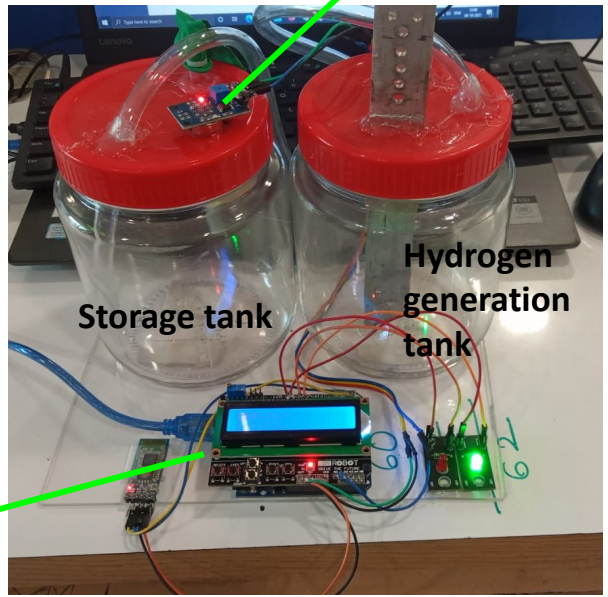
LEGEND
1. INLET CHAMBER
2. SCREEN CHAMBER
3. DETRITOR
4. PRIMARY CLARIFIER
5. SECONDARY CLARIFIER
6. FEED CHAMBER TO PRIMARY CLARIFIER
7. RAW SLUDGE PUMP HOUSE
8. PRIMARY SLUDGE DIGESTER
9. SECONDARY SLUDGE DIGESTER
10. FEED CHAMBER TO SECONDARY CLARIFIER
11. FILTRATE PUMP HOUSE
underground flow
SLUDGE DRYING BEDS
SLUDGE DRYING BEDS
BYE PASS
FINAL EFFLUENT
RETURN SLUDGE PUMP HOUSE
AERATION TANKS
BALANCING TANK

Prototype

In our prototype model we have designed a small smart hydrogen generation model explaining the working of the plant

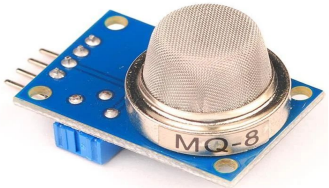
- We have used electrolysis process to generate the hydrogen in the hydrogen generation tank
- Second is the storage tank with the balloon and the compressor to compress the gas
- We have used a gas sensor along with a hydrogen gas sensor to check the quantity of the gas in the tank. It works on the arduino and displays the output on the screen



Technology Used

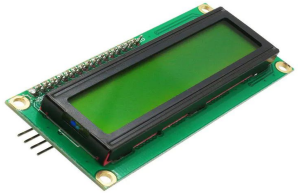
In our prototype model we have used the following:

Arduino +

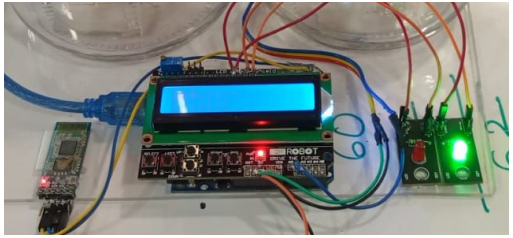


Gas Sensor +

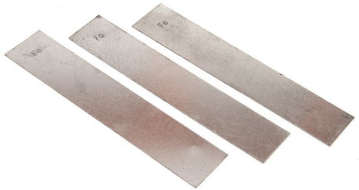
Bluetooth +



LCD-Display =



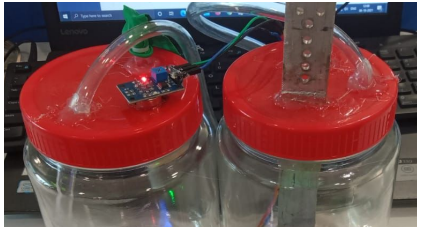
Monitoring Circuit



Electrodes for electrolysis +

12V battery +

Air Pump =



Controlling Circuit

Impact

- Hydrogen is said to be the best fuel as it has zero carbon emission and its residue is water
- Our solution will increase the clean production of bio-hydrogen
- It will also utilise the waste sludge from the sewage treatment plants
- It will promote the usage of clean fuel vehicle
- Most important - it will help in increasing the availability of hydrogen in the cities creating and supporting the infrastructure

Experts Review:

- **BMC Ex-chairman Yashodhar Phanse** told us that Mumbai alone produces 2.7 billion litres of sewage per day and big amount of sludge gets generated everyday and our solution of hydrogen generation is a really good utilisation of the waste sludge. It will also provide a infrastructure to the city to generate an alternative source of green energy within the city.
- **FUTURE SCOPE:** What we aim to provide is an eco-friendly sustainable alternative to energy. Our area of expertise being renewable energy is to use a renewable gas like hydrogen. We would use this hydrogen to generate energy which would be able to run multiple things without the use of power, electricity, petrol or diesel. Our main problem of this idea becoming a reality is how costly this is. Making this an exclusive for the wealthy...