

Ecotechnologies for Removal of Heavy Metals from Wastewater



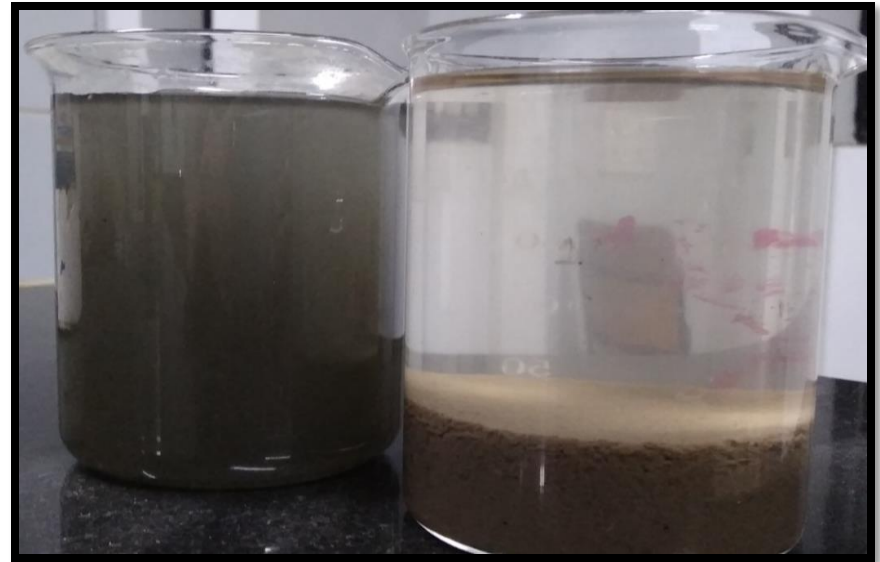
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Tertiary Treatment of Domestic Sewage Using Algae



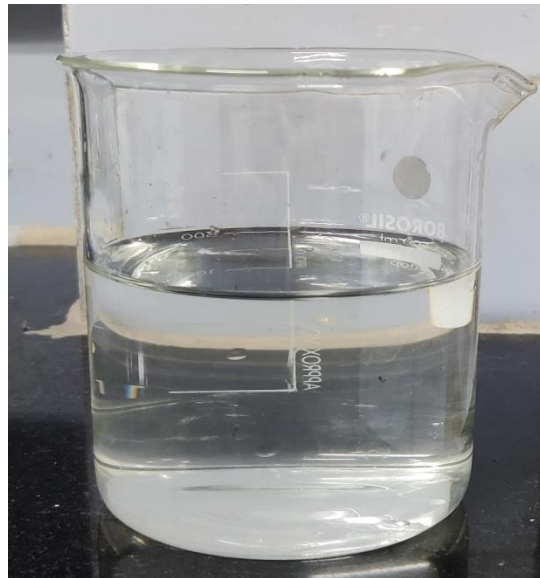
Raw Domestic Sewage



Domestic Sewage After Secondary Treatment



After Algal Treatment

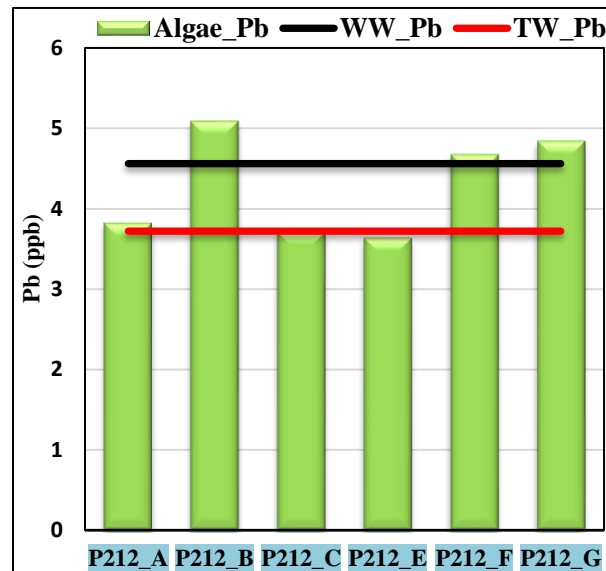
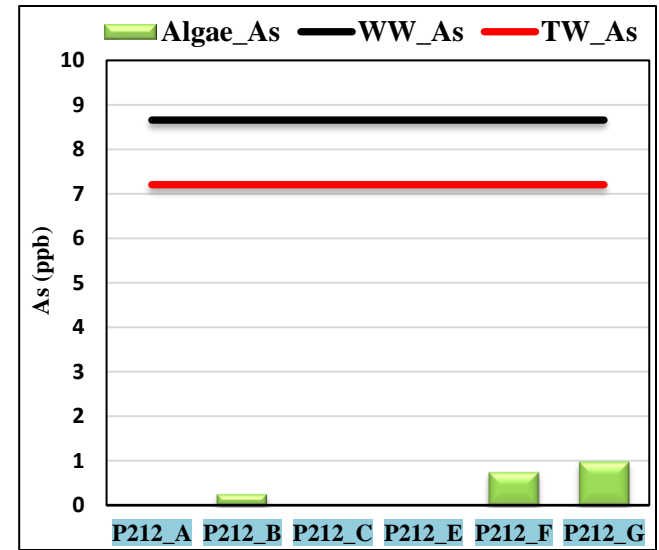
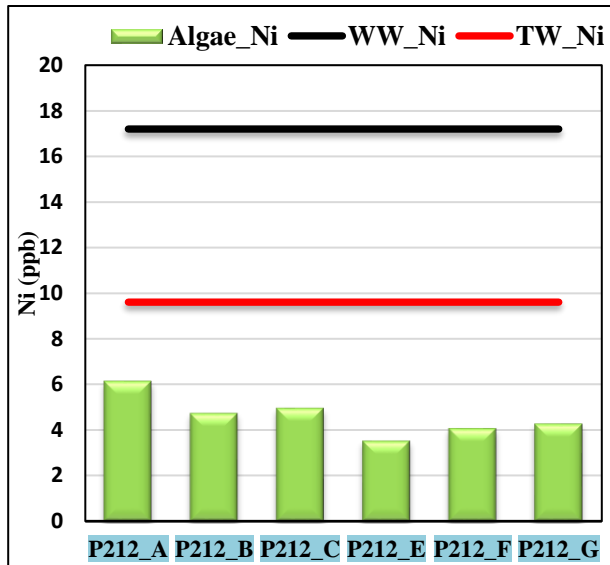


After Removal of Algae

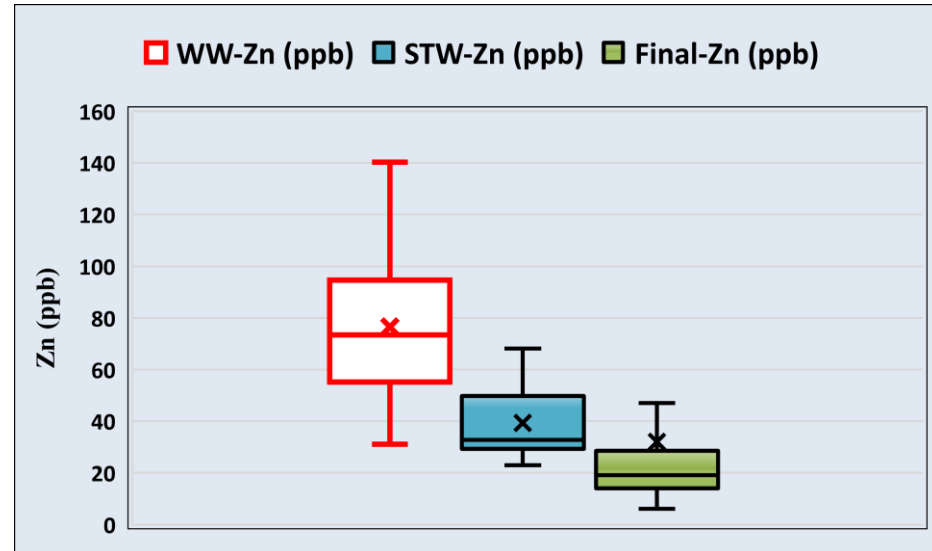
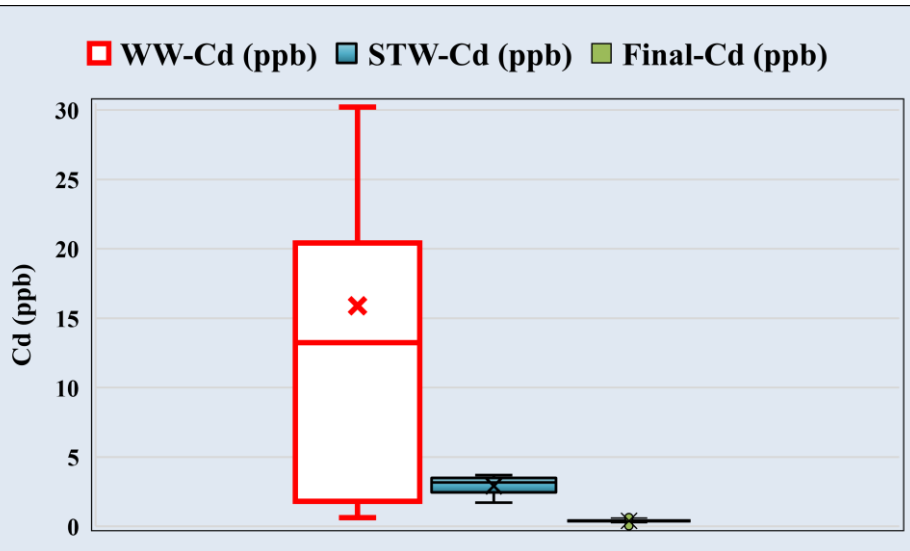
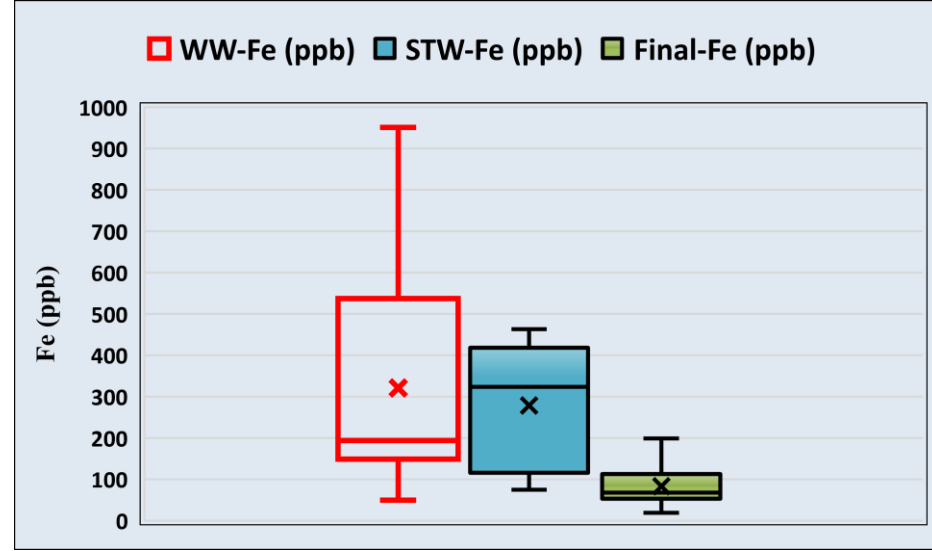
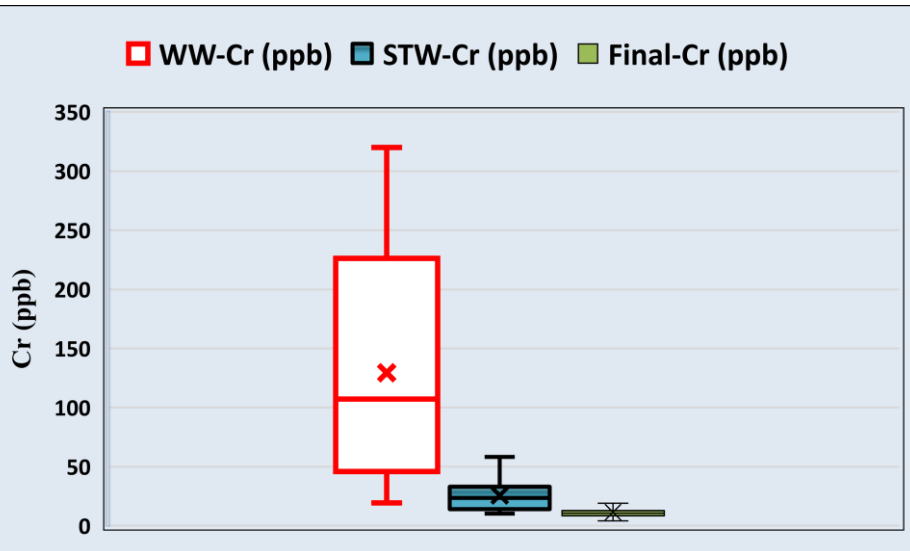
Final treated water is low in:

- 1. BOD/COD**
- 2. Nutrients**
- 3. Particles**
- 4. Heavy Metals**

Removal of Heavy Metals during Treatment



Removal of Heavy Metals during Treatment



Heavy Metal Uptake by Algae

Algae was grown in synthetic mineral media solution containing only the heavy metals essential for algal growth



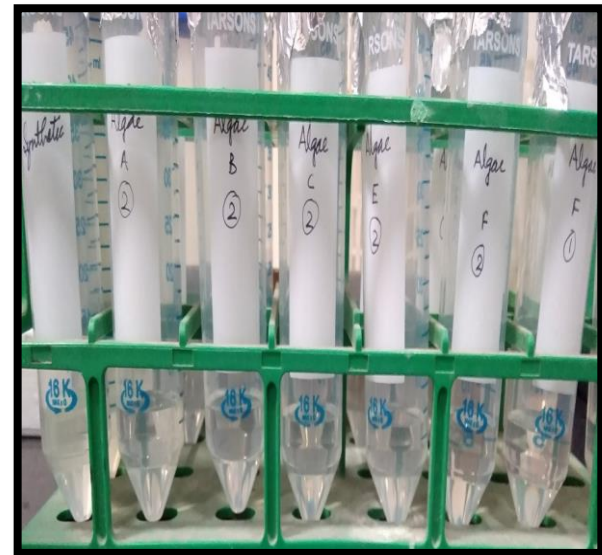
Algae was grown in secondary treated sewage



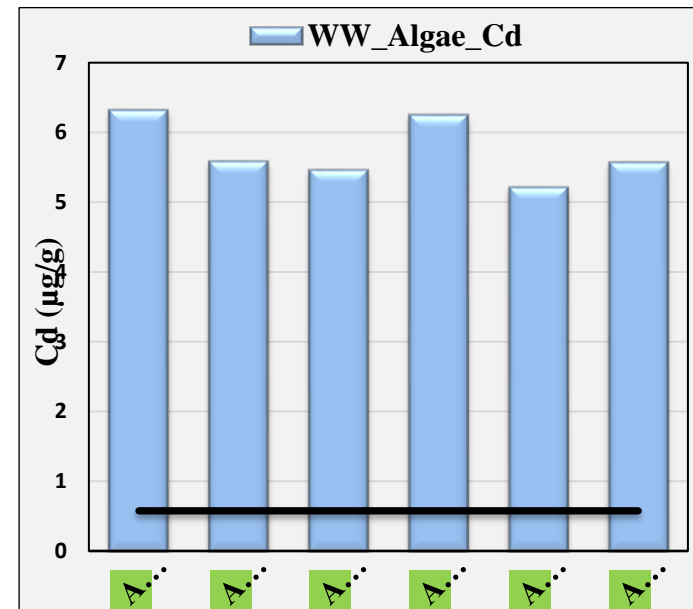
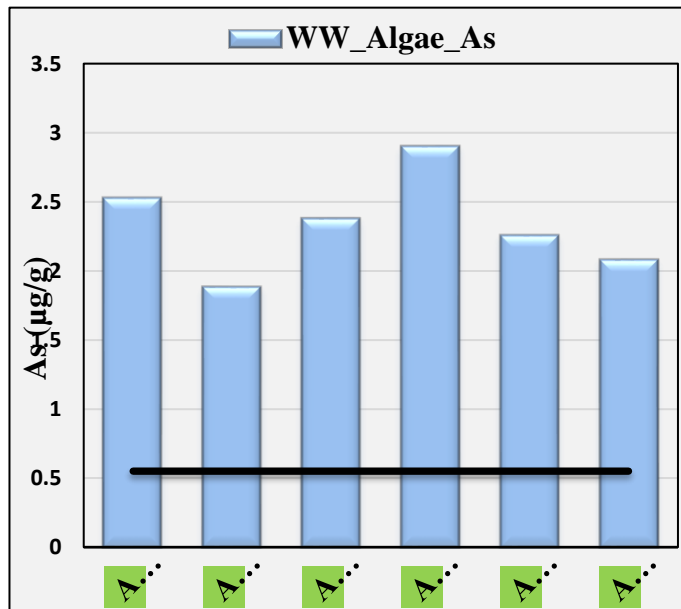
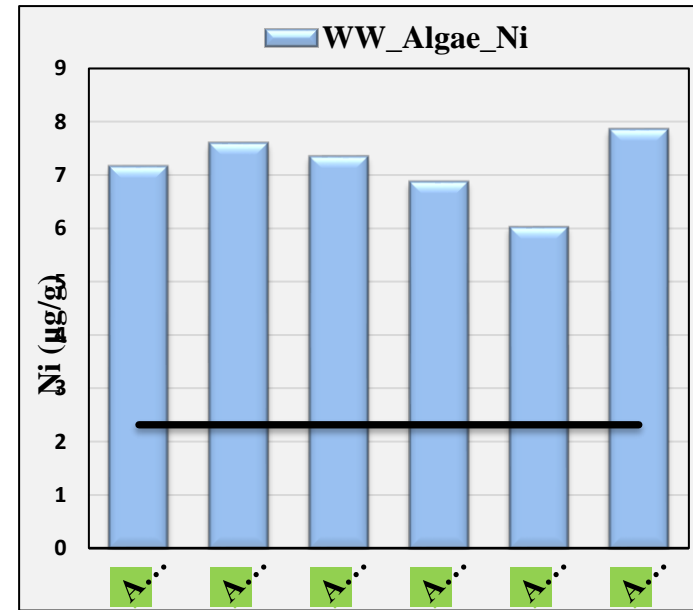
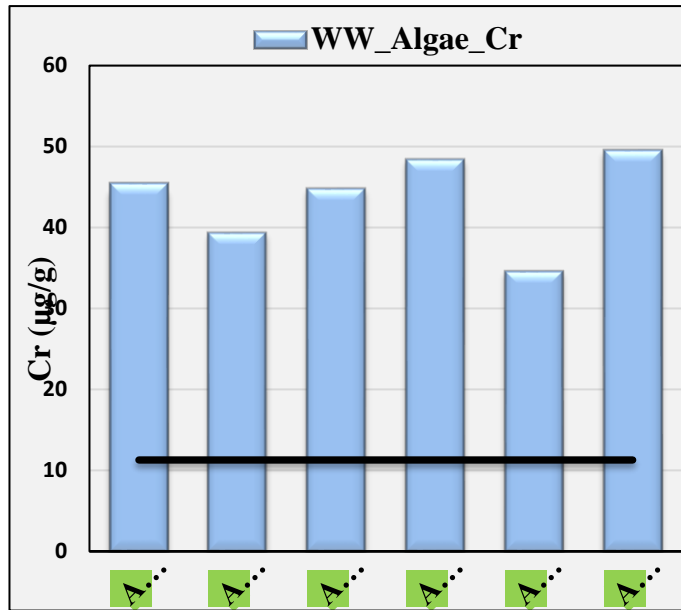
Algae harvested
Dried and ground
into fine powder

Microwave-Assisted Algae Digestion

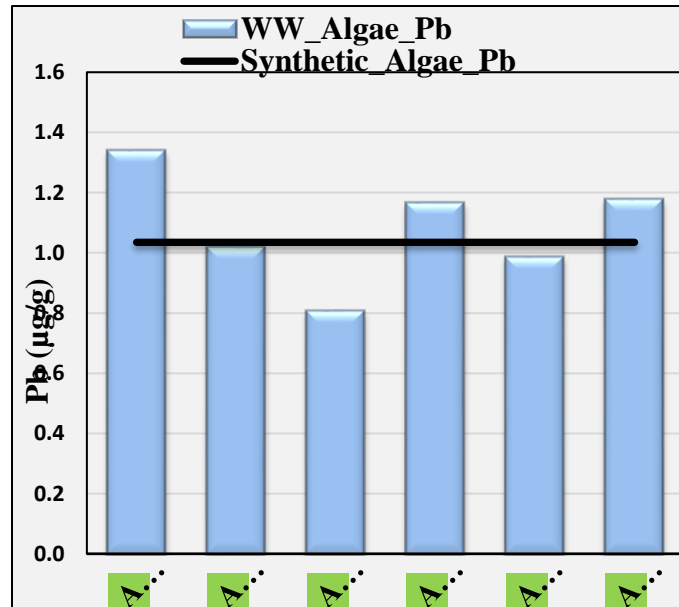
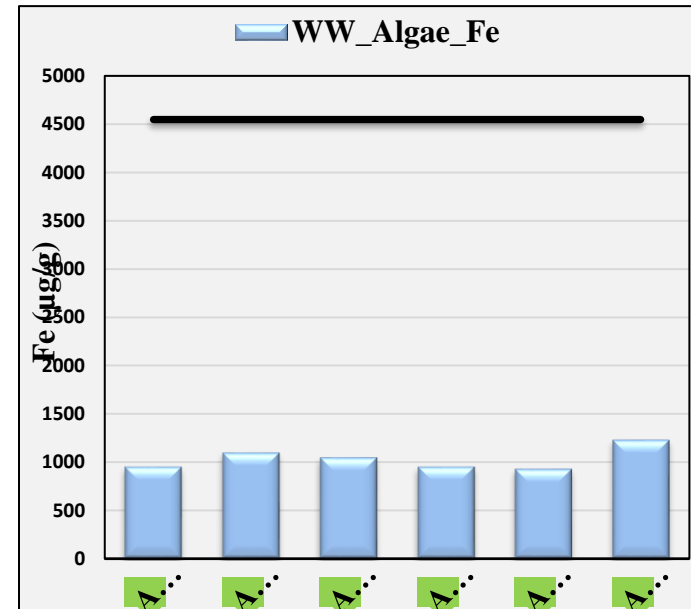
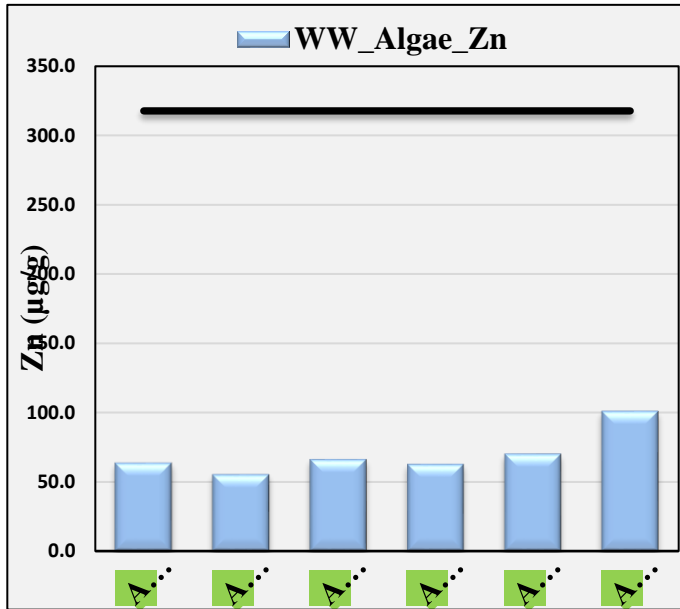
- Take 250 mg of dried algal biomass in a Teflon bomb
- Add 6 ml of conc. Nitric acid (Analytical grade)
- Ramp time 20 min from room temperature to 180 degrees Celsius
- Hold time is 10 min at 180 degrees Celsius
- Cooling time is 20 min from 180 degrees Celsius to room temperature
- Brown fumes appear after the digestion
- A clear solution indicates successful digestion
- All the algae samples are digested in duplicates
- Same digestion is done with a 1 ml ultrapure water for blank
- Synthetic algae samples are also digested



Heavy Metal Uptake by Algae



Contd.



CONSTRUCTED WETLAND PLUS

Process Description:

The modified Constructed Wetland technology combines vertical flow constructed wetlands (VFCW) with adsorptive elements to target the removal of heavy metals. VFCW will be composed of several layers consisting of gravel, sand, and sorbents planted with local vegetation such as *Canna indica*.

Objective:

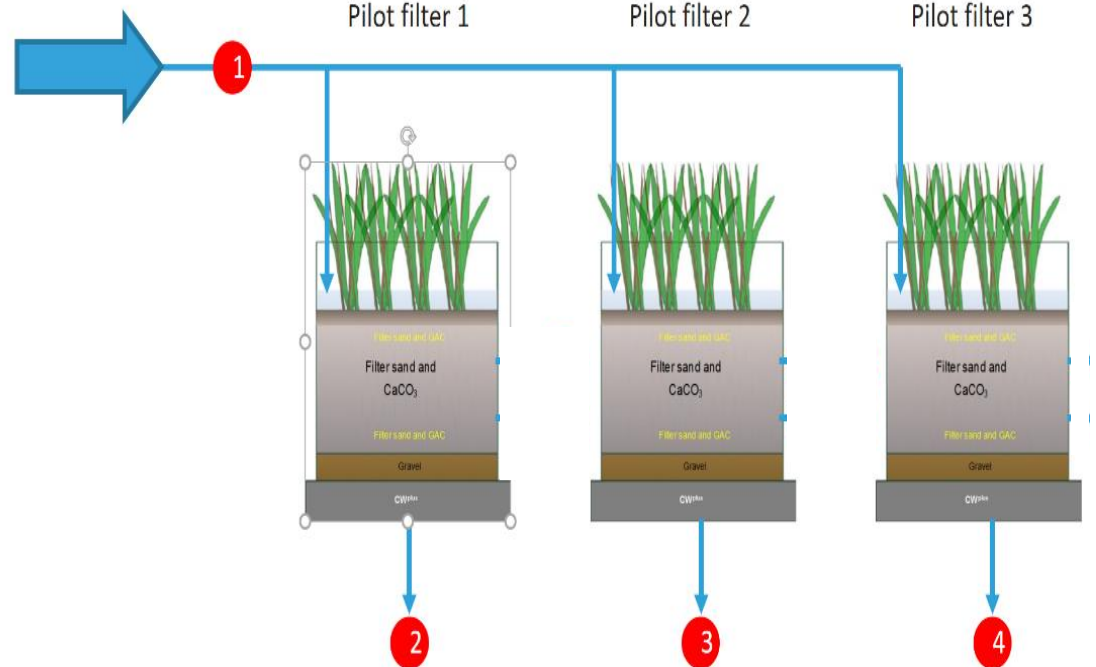
- Treatment of secondary treated effluent to such extent that it is suitable for reuse/recycling.

Work Set-up:

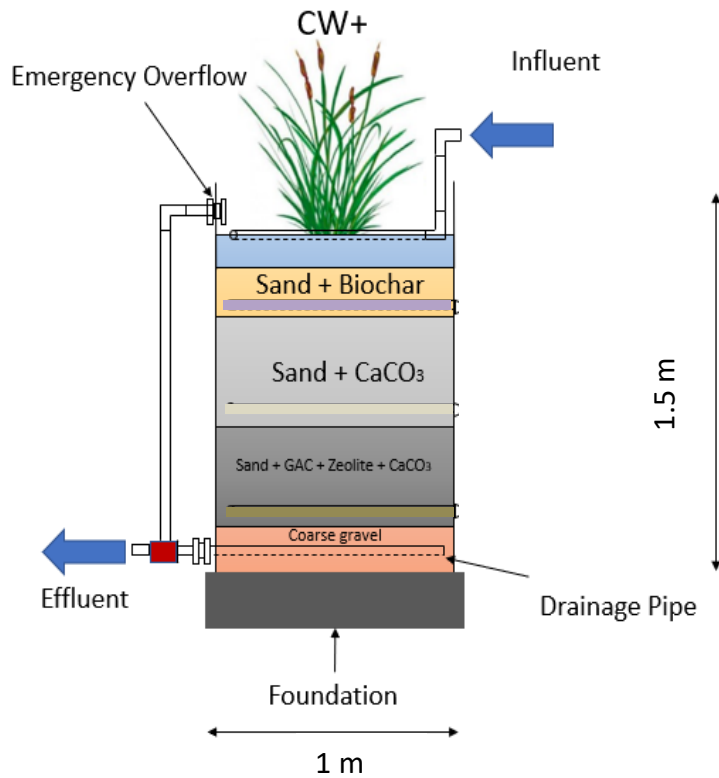
- Four wetlands have been set-up for the effluent coming out from SFD-MBR.
- Two wetlands are installed for the effluent coming out from IPC-Membrane system.

Effluent from

- SFD-MBR (phase 1)
- ANDICOS (phase 2)



CONSTRUCTED WETLAND PLUS



Schematic representation of one of the modified constructed wetlands (CW+) clearly showing each layer.



Work update: Pilots are operational since the second week of January 2023.

CONSTRUCTED WETLAND PLUS



HEAVY METAL REMOVAL IN CONSTRUCTED WETLAND PLUS

