Enhancing quality of distillery spent wash (DSW) through sequential adaptation of indigenous bacterial and algal consortium and its reuse potential for irrigation

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Background

Distilleries effluents comprise high load of pollutants like chemical oxygen demand (COD), biological oxygen demand (BOD), melanoidin etc. Disposal of the untreated or partially treated DSW are toxic and causes adverse effects on soil, water, air, human and animal health. Attempts are seldom made by some industries to sprinkle the DSW on press mud and convert it as value added bio-manure for safe and productive disposal. Yet COD, BOD and melanoidin of the effluent which is beyond the permissible limit remains a challenge leading to soil health problems. Therefore a cost-effective hybrid treatment sequence combining bio and phyto remediation to improve quality of DSW and demonstrate its reuse potential in agriculture is vital.

Materials and Methods

- A four stage squential process comprising of bacteria, algae, charcoal followed by constructed wetland was adopted to remediate the anearobic treated DSW.
- Isolated indigenous bacterial (*Terribacillus* sp., *Bacillus enclensis, Exiguobacterium indicum and Pseudomonas putida*) and alage (*Merismopedia sp. and Phacus sp.)* were adapted to DSW and their consortium was used in the first and second stages respectively.
- Then the effluent was passed through the activated charcoal to the CWL where *Sesuvium portulacastrum* an halophyte is used for phyto remediation.
- Stage wise water quality monitoring is done periodically and Improved DSW is reused in agriculture for cultivating sweet corn (F1 hybrid), halophytes like *Sesuvium portulacastrum* and *Suaeda maritima*

Results and output

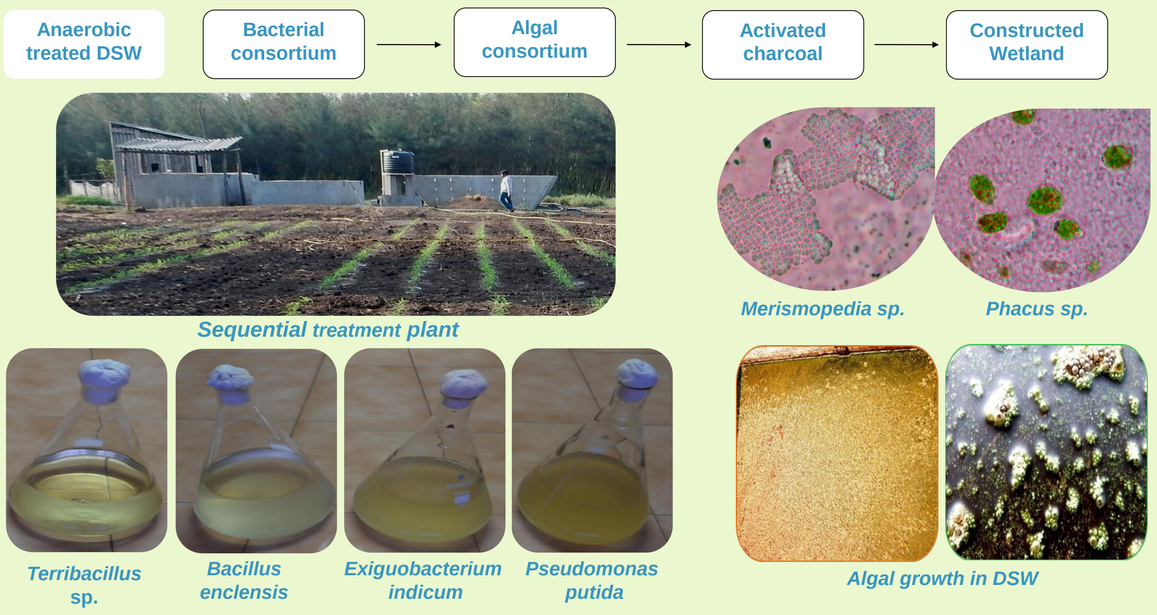
- The novel sequential treatment of DSW enhanced its quality significantly by reducing COD (82%), colour (58%) and increasing the pH from acidic to above neutral which is higher than in-situ reports.

Water quality changes in sequential treatment

Parameters	Anaerobic Treated water	Bacterial consortium	Algal consortium	Activated Charcoal
pH	6.7	7.2	7.4	7.5
Eh (mV)	19.2	-7	-23	-23.8
Ec (mS/cm)	18.6	17.9	17.3	17.2
Salinity (PPT)	9.8	9.5	9.2	9.1
Temperature (°C)	32.0	31	30.7	30.3
COD (mg/L)	52000	18200	11600	9425
% Colour removal	Control	32	51	58.0

- Better penetration of sunlight due to melanoidin degradation and enhanced pH promoted by bacteria creates enabling environment for the growth and adaption of algae in DSW which is a novel finding
- Sweet corn irrigated with bio-treated DSW comparatively performed better than anaerobic treated DSW. No significant difference was observed in crop quality irrigated with bio-treated DSW and fresh water indicating its suitability for irrigating edible crops
- Halophytes like *Sesuvium portulacastrum* and *Suaeda maritima* showed luxuriant growth due to saline content in DSW

Sequential treatment of DSW using bacterial and algal consortium



Sweet corn and halophytes cultivated reusing biotreated DSW

Major Outcomes

- Novel and low cost approach to ehnance treatment efficiency acheived by sequencing bacterial follwed by algal contortia
- Halophyte can be a potential phyto remediant for uptaking salinity from DSW
- Bio treated DSW is potential source of irrigation for edible crops without affecting crop and soil health

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