EP NO: 24 / 2023-24 RESEARCH ON POTENTIAL SPECIES FOR PHYTOREMEDIATION OF INDUSTRIAL EFFLUENTS

SCREENING OF SPECIES FOR POTENTIAL PHYTO REMEDIATION PLANTS FOR SAGO INDUSTRIAL FACTORIES

INTRODUCTION

Phytoremediation is a way to mitigate environment pollutions, such as air, water and soil pollution in virtue of plants, more often combined with their associated microorganisms. This concept has been widely applied to treat pollutants in soil and water. sago industry is agro-based industry that uses tapioca roots as its main raw material. India is the third largest producer of sago in the world, after Indonesia and Thailand and it is major source of income and employment for millions of people. Tamil Nadu leads India in sago production,, contributing over 64% to the nation's total output.? Salem district in Tamil Nadu is the country's largest producer of sago. This district hosts 160 out of the state's 350 sago units. The findings from " The characteristics of sago processing wastewater (SWW) " publsihed in Madras Agricultural Journal indicate that the levels of the mentioned pollutants in sago processing wastewater (SWW) from different sago industries in Salem are exceedingly higher than the standards set by the Central Pollution Control Board'.

It is in this context, phytoremediation techniques emerge as a potential and promising avenue to mitigate the environmental challenges posed by sago industries, offering a greener, cost-effective, sustainable, and aesthetically pleasing remediation to address these pressing concerns.

1. *Derris indica*
2. *Azadirachta indica*
3. *Holoptelea integrifolia*
4. *Wrightia tinctoria*
5. *Samanea saman*
6. *Bassia latifolia*
7. *Albizia lebbeck*
8. *Dalbergia sisso*

OBJECTIVES:

1. To find out the suitable tree species and its effectiveness on phytoremediation of soil and water contamination due to waste water discharged by the sago factories.
2. To screen the best performing tree species for effective phytoremediation of sago waste water contamination.

MATERIALS AND METHODS:

The study was commenced during the year 2023-24 underKallkurichi modern Nursery Range. Seeds were collected from identified Candidate Plus Trees (CPTs) of the respective species. Once the seeds were germinated and reached 15 cm or two leaf stage the seedlings were transplanted into 16 x 30 cm polybags in the nursery.The potting mixture for the polybags was supplemented with inputs such as vermicompost (35 g/bag), VAM (15 g/bag), Azospirillum (6 g/bag), and Phosphobacteria (6 g/bag) to enhance the growth and vigor of the seedlings.The nursery was established at Edaikkal Modern Nursery centre of and totally440 seedlings (including 10% casualities) have been established. Industrial study area has been identified and planting will be done. Soil test will be done before planting of the experiment.The seedlings will be planted with an espacement of 4 m x 4 m pits size of 60 cm^3 and pits were filled with pits filled with farmyard manure (1 m^3/50 plants), tank silt (1 m^3/50 plants), vermicompost (0.5 kg/pit), VAM (25 g/pit), Azospirillum (10 g/pit), and Phosphobacteria (10 g/pit).

OBSERVATIONS TO BE RECORDED:

1. The soil test will be done at the initial stage of the project and thereafter annually with soil under each species and compared with that at untreated (not planted) polluted site.
2. Effluent will be tested for Pollutant level and recorded.
3. Ground water from the nearest water source will be tested for pollutant levels and recorded every year
4. Species wise soil test will be done for level of pollutant presence and facts will be recorded and compared with initial level.
5. Survival percentage, height of the plants will be recorded in the first two years . From the third year onwards height and girth will be recorded every year.

6. Species wise observation on the condition and performance of the planted seedlings will be recorded periodically.
7. The concentration of pollutants in the plant tissues will be measured in the leaves of the plants.
8. Growth rate of the trees. This parameter is measured to determine how well the trees are growing during the phytoremediation experiment. The growth rate of the trees can be measured by measuring the height and health of the trees: the phenological character of tree is measured to determine how well the trees are tolerating the pollutants in the soil.
9. Photos will be taken in each and every stage.

MORPHOMETRIC DATA (as on January 2024):

S.No.	Species	Planted	Survival	survival %	Avg. Height
		(No.)	(No.)	(%)	(m)
1	*Derris indica*	50	50	100	0.92
2	*Azadirachta indica*	50	50	100	1.35
3	*Holopteliainterifolia*	50	50	100	1.38
4	*Wrightia tinctoria*	50	50	100	0.43
5	*Samanea saman*	50	50	100	0.45
6	*Bassia latifolia*	50	50	100	1.00
7	*Albizzia lebbeck*	50	50	100	0.62
8	*Dalbergia sissoo*	50	50	100	0.58

DATA ON SOIL, GROUND WATER AND SAGO WASTE EFFLUENT:

The samples of Ground water, Soil and Sago waste effluents were tested for a range of parameters. The reports provide data on various parameters related to water and soil quality, which are crucial for assessing pollution levels.

The groundwater sample was tested for its chemical and physical parameters. The EC value was measured at 4480 µS/cm, which is significantly higher than the typical admissible level of 1500 µS/cm for drinking water. High EC indicates the presence of dissolved salts and minerals, suggesting potential contamination or natural mineralization. Total Dissolved Solids (TDS): The TDS level was recorded at 2645 mg/l, exceeding the acceptable limit of 500 mg/l for drinking water. Chloride was measured at 835.6 mg/l, and sulfate at 641.5 mg/l. These values are above the acceptable limits of 250 mg/l for chloride and 200 mg/l for sulfate, indicating

possible contamination from industrial or agricultural sources. Further, Total hardness was 1260 mg/l as $CaCO_3$, and total alkalinity was 502.5 mg/l as $CaCO_3$. Nitrate was detected at 2.9 mg/l, within the acceptable limit of 10 mg/l. Ammoniacal nitrogen was below the detection limit, indicating low organic pollution. Further, The microbiological report indicated the presence of Escherichia coli and total coliforms in the groundwater sample. While specific counts were not provided, the presence of these bacteria pose health risk and necessities treatment before use by humans.

The wastewater (Sago waste effluent) sample from the Effluent Treatment Plant (ETP) states that BOD was measured at 750 mg/l, and COD at 2203.5 mg/l. These values are significantly higher than the typical admissible levels of 30 mg/l for BOD and 250 mg/l for COD, indicating high organic pollution and inadequate treatment efficiency. The TDS level in wastewater was 3112 mg/l, far exceeding the acceptable limit of 2100 mg/l for discharge into surface waters. This suggests a high concentration of dissolved solids. Ammoniacal nitrogen was 9.0 mg/l, and total nitrogen was 12.0 mg/l. These levels are above the acceptable limits.

The soil sample was analyzed for nutrient content and physical properties and the report states that Phosphorus was measured at 155.5 mg/kg, and potassium at 3.71 meq/100g. These values are within the range suitable for agricultural use. The TKN content (Total Kjeldahl Nitrogen) was 8204.5 mg/kg, which is relatively high and suggests sufficient nitrogen for crop production but may require careful management to prevent nutrient leaching.The soil pH was 8.42, indicating slightly alkaline conditions. The electrical conductivity was 477 µS/cm, which is within the acceptable range for most crops, suggesting no significant salinity issues.

The initial analysis of the water and soil samples reveals several areas of concern, particularly regarding the high levels of dissolved solids, organic pollution, and microbial contamination in the water samples. The soil analysis indicates suitable nutrient levels for agriculture.

INTERIM FINDINGS:

The experiment is ongoing.