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# The Influence and Biodegradation activity of *Pseudomonas aeruginosa* (MTCC 1934) on Alcohol and Chemical Industry Waste Water.

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### ABSTRACT

The disposal of industrial waste is becoming hassle all over the world. In recent years, industrial effluents have been regarded as common source of pollution due to lack of technical treatment methods and inappropriate disposal modes generated by industries. Water pollution is a major pollution that affects the environment much and one of main source of this pollution is industrial effluent. Industry waste is a major hazard that affects the drinking water and hence it should be treated effectively before release. In this work we have tried a biological treatment to treat alcohol and chemical effluent since it ecofriendly. The present work is done to analyze the effectiveness of the *Pseudomonas aeruginosa* (MTCC 1934) against alcohol and chemical industry effluent in its possible biological treatment. Results of the above project work showed the level of turbidity (O.D), pH and Physio-chemical parameters found to decreases from high to moderate or optimum level and resulted water can be used for agricultural purpose.

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### Introduction

Country's progress and elevated life styles of individuals are the indicators of industrialization and economic development. However industrialization has brought several novel environmental problems like water, land and air pollution.<sup>1-3</sup> All sectors like industry, agriculture, mining, energy, transportation, construction and consumers of our society generate waste materials.<sup>4,5,6</sup> Waste contains pollutants which are discarded materials, process materials or chemicals.<sup>7,8</sup> Pollution could be caused by these pollutants when they are released beyond the assimilation capacity of the environment.<sup>9</sup> Industrial wastes are generated from different processes and the amount and toxicity of waste released varies with its own specific industrial processes.<sup>10,11,12</sup> Tannery effluents are ranked as the highest pollutants among all industrial wastes.<sup>13,14</sup>

Water pollution is a major pollution that affects the environment much and one of main source of this pollution is industrial effluent.<sup>15, 16</sup> The tanning sector is the basic skeleton on which the entire leather industry depends and it is also one of the largest polluters. The inherent nature of the tanning process is such that large quantities of water are consumed.<sup>17</sup> Tannery waste is a major hazard that affects the drinking water and hence it should be treated effectively before release.<sup>18,19</sup> In this work we have tried a biological treatment to treat tannery effluent since it ecofriendly. Microbes are effective in control of pollution, remarkable power to degrade and utilize complex organic substances to less toxic and simpler compounds. The present work is done to analyze the effectiveness of the *Pseudomonas aeruginosa* (MTCC 1934) against alcohol and chemical industry effluent in its possible biological treatment

### Materials and methods

#### 1. Collection of Alcohol distillery and Chemical industry waste water

The Alcohol distillery waste water was collected freshly from the company Pearl Distillery Limited in Singarayakonda, Prakasam dt, Ongole and Chemical industry waste water collected freshly from the company Bhagiradha Chemicals & Industries Limited, Prakasam dt, Ongole It stored in a brown bottle. Prior to the collection, the sample water bottle was rinsed with sterile water. The samples were taken to the laboratory as early as possible; it has to be protected from the direct sunlight during transportation. The samples were stored in a refrigerator.

#### 2. Collection of Microbial Strain

*Pseudomonas aeruginosa* (MTCC 1934) were used for the effluent treatment. The above strains were obtained from Microbial Type of Culture Collection (MTCC), Institute of Microbial technology (IMTECH), Chandigarh. The cultures were maintained as per required norms.

#### 3. Growth and maintenance of the culture:

Primary culture of *Pseudomonas aeruginosa* (MTCC 1934) was prepared by inoculating the lyophilized cultures in Nutrient Broth and incubated at 25 ° C for 48 hours. The cultures were maintained by subculture process done once in 30 days.

#### 4. Alcohol distillery waste water treated with microbes

The collected Alcohol distillery Tannery water samples were inoculated with equal volume of *Pseudomonas aeruginosa* (MTCC 1934) in a conical flask. The above treatment was incubated for 14 days at 37°C and pH and O.D were noted periodically up to 14th day. Physio-chemical parameters were observed on the 12 th day since, there is no significant change in O.D and pH. The above sample used for further analysis.

### 5. Chemical industry waste water treated with microbes

The collected Chemical industry Tannery water samples were inoculated with equal volume of *Pseudomonas aeruginosa* (MTCC 1934) in a conical flask. The above treatment was incubated for 14 days at 37°C and pH and O.D were noted periodically up to 14th day. Physico-chemical parameters were observed on the 12 th day since; there is no significant change in O.D and pH. The above sample used for further analysis.

### 6. Evaluation of Physicochemical properties<sup>20, 21, 22</sup>

The *Pseudomonas aeruginosa* treated water samples were tested like following properties as per the Standard procedure prescribed by Bureau of Indian standards (BIS) like Appearance, Colour, Odour, Turbidity, Total dissolved solids, pH, Total alkalinity, Total hardness, Calcium, Magnesium, Barium, Residual free chlorine, Copper, Nitrate, Nitrite, Sulphate, Ferrous, Manganese, Aluminium, Fluoride and Zinc.

### Results and Discussion

Results of the above project work showed that tannery effluent was grey coloured, turbid with a disagreeable odour, acidic in pH, with high organic and inorganic load indicating high values of TDS, Total hardness, calcium, magnesium, sodium, chloride, sulphate, heavy metal and chromium. From the present findings, the level of turbidity (O.D), pH and Physico-chemical parameters found to decrease from high to moderate or optimum level and shown on table 1. The most attractive feature of the *Pseudomonas aeruginosa* (MTCC 1934) strain is its resistance to those substances which are the better representative of the major groups of pollutants present

in water vis-a-vis a natural bacterium thriving under the unfavourable environment conditions. Hence, the present study has demonstrated that the *Pseudomonas aeruginosa* (MTCC 1934) would play an important role in tannery effluent treatment.

### Conclusion

Bioremediation has been used as a strategy to remove pollutants, not necessarily completely, but to compounds with decreased solubility, mobility and toxicity. It may be due to the concurrent process of absorption and metabolism properties of the microbial consortia, includes the heavy metal tolerance by permeability barrier, intra- and extra-cellular sequestration, active transport efflux pumps, enzymatic methods and also reduction in the sensitivity of targeted cellular organelles to metal ions.<sup>10, 23</sup> From the above work it is evident that *Pseudomonas aeruginosa* (MTCC 1934) is very effective against Alcohol distillery waste water, and Chemical industry waste water.<sup>15, 24</sup> Also the obtained physicochemical values compared with drinking and raw water sample collected from in and around Ongole. The thorough analysis of water samples shows the *Pseudomonas aeruginosa* (MTCC 1934) microorganism is very effective against tannery effluent and microbes treated water can be used for irrigation purpose.<sup>25</sup> The obtained physicochemical values compared with standards for safe drinking water prescribed by Indian Bureau of Standards (BIS).

**Table 1. Effect of *Pseudomonas aeruginosa* on Alcohol and Chemical industry waste water.**

S.No	Properties	Acceptable limits	S1	S2	S3	S4	DW	RW
1	Appearance	-	Turbid	Slight Turbid	Turbid	Slight Turbid	Clear	Slight Turbid
2	Colour	Hazard unit (Less than 2)	Dark yellow (3Hazard)	Slight yellow (2 Hazard)	Orangih yellow (4Hazard)	Slight yellow (2Hazar)	white (Less than1)	white (Less than 1)
3	Odour	Agreeable	Non agreeable	Agreeable	Non agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	< 2 NTU	4.5 NTU	3 NTU	4.9NTU	3.1 NTU	0.05 NTU	0.1 NTU
5	Total dissolved solids	< 500 mg/lit	2340 mg/lit	1530mg/lit	2820mg/lit	1400 mg/lit	<500 mg/lit	1000 mg/lit
6	pH	6.5-8.5	9.2	6.8	8.6	8	6.8	8.5
7	Total alkalinity	< 200 mg/lit	1708 mg/lit	244 mg/lit	3538 mg/lit	976 mg/lit	24 mg/lit	36 mg/lit
8	Total hardness	< 200	3600 mg/lit	1100 mg/lit	2900 mg/lit	1800 mg/lit	26 mg/lit	48 mg/lit
9	Calcium	<75 mg/lit	560 mg/lit	480 mg/lit	720 mg/lit	360 mg/lit	9 mg/lit	14 mg/lit
10	Magnesium	<30 mg/lit	550.8 mg/lit	250.0 mg/lit	375.4 mg/lit	225.3mg/lit	30 mg/lit	35 mg/lit
11	Barium	< 1.0 mg/lit	1.922 mg/lit	1.83 mg/lit	2.552 mg/lit	1.648 mg/lit	0.01 mg/lit	0.2 mg/lit
12	Residual free Chlorine	< 0.2 mg/lit	425.4 mg/lit	106.3 mg/lit	283.6 mg/lit	212.7 mg/lit	0.1 mg/lit	0.8 mg/lit
13	Copper	< 0.05 mg/lit	0.36 mg/lit	0.15 mg/lit	0.26 mg/lit	0.17 mg/lit	0.02 mg/lit	0.08 mg/lit
14	Nitrite (NO <sub>2</sub> )	< 0.02 mg/lit	0.085 mg/lit	0.05 mg/lit	0.09 mg/lit	0.062 mg/lit	0.01 mg/lit	0.03 mg/lit
15	Nitrate	< 45 mg/lit	148 mg/lit	136 mg/lit	142 mg/lit	129 mg/lit	0.2 mg/lit	0.9 mg/lit
16	Sulphate	< 200 mg/lit	550 mg/lit	340 mg/lit	650 mg/lit	320 mg/lit	9 mg/lit	28 mg/lit
18	Ferrous	< 0.1 mg/lit	36.2 mg/lit	28.4 mg/lit	39.6 mg/lit	31.2 mg/lit	0.01mg/lit	0.1mg/lit
17	Manganese	<0.1 mg/lit	0.8 mg/lit	0.6 mg/lit	0.6 mg/lit	0.7 mg/lit	0.04 mg/lit	0.08 mg/lit
20	Aluminium	< 0.03mg/lit	0.197 mg/lit	0.061 mg/lit	0.153 mg/lit	0.77 mg/lit	0.001 mg/lit	0.08 mg/lit
21	Fluoride	< 0.2 mg/lit	1.8mg/lit	1.4 mg/lit	2 mg/lit	1.4 mg/lit	0.01 mg/lit	0.15 mg/lit
22	Zinc	< 5 mg/lit	25 mg/lit	15 mg/lit	31 mg/lit	14 mg/lit	0.3 mg/lit	3.3 mg/lit

S1 =Alcohol distillery waste water

S2= *Pseudomonas aeruginosa* treated with Alcohol distillery waste water

S3 = Chemical industry waste water

S4 = *Pseudomonas aeruginosa* treated with Chemical industry waste water

DW = Normal Drinking Water

RW = Normal Raw Water

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