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Diversity of Fungi from Three Different Industrial Effluent Soils

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Abstract: ***Fungi provide much valuable service to the mankind and in the soil ecosystem. The continuous irrigation of waste water results dramatic change in the soil nutritional status may favour certain fungal groups while hampering the growth and diversity of spores. In the present investigation suggests that the isolation of fungi from 10^{-3} dilution factors in the highly population diversity from the three different industry of Dalmia cement soil, sugarcane molasses soil, and Leather factory soil were determined. The following fungi of Alternaria alternata, Aspergillus awamori, A. flavus., A, fumigatus, A. niger, A.nidulan, A. compae, Cladosporium sp, Curvularia lumata, Fusarium sp, F. oxysporum, Heliminthosporium sp, Pencillium sp, P.chrysogenum, P.citrinum, Trichoderma sp, T. harzianum, T.viride, and Verticillium sp were isolated and identified. The results indicates that the most of the physicochemical parameters such as pH, electrical conductivity, organic carbon, organic matter, available nitrogen phosphorus, potassium, zinc, copper, iron, manganese, calcium, magnesium, sodium and potasium were analysed. The three different industries of Dalmia cement soil sugarcane molasses soil, and leather factory soil was 71, 66 and 40 colonies were isolated respectively.***

Keywords: Population dynamics, Mycoflora, Physicochemical parameter, Industrial soil.

1. Introduction

The uses of wastewater in agriculture has increased in recent years due to inherent treatment capacity of soil and high contents of major and micronutrients in it. In industrial waste water particularly from industries contains high concentration of heavy metals which enter into human beings and animals through food chain. Therefore it is desirable to remove these heavy metals from wastewater particularly industrial effluent though low cost technology. The physiochemical methods such as reverse osmosis, solvent extraction, lime coagulation ion exchange and chemical precipitation (Donmez, and Aksu. 2001; and peters *et al.*, 1985).

Oyinloda *et al* (2005) studied that the heavy metals and residues from industry and town industry wastes has been found to be the causes of pollution in the soil. Waste water and waste effluent possesses different biological, physical and chemical effects on the environment. Some physiochemical analysis of soil affected by industrial pollution. Potential of filamentous fungi in bioremediation of heavy metal containing industrial effluent and wastewaters has been increasing industrial effluent and increasingly reports from different parts the world (Gadd 1993). The filamentous fungi of heavy metals polluted habitat in India are not much screened and expected that soil receiving long term application of wastewater or industrial effluents containing toxin metal may results in the development of selection pressure on soil fungi which may cause increase level of metal tolerance as well as metal degradation capacity

2. Material and Methods

Soil sample were collected from Dalmia cement effluent soil in Dalminapuram, Ariyalur, sugarcane molasses soil in Pennadam , Cuddalure, and leather factory soil in Perundurai Erode of Tamilnadu. The collected soil samples were brought to the Laboratory in sterile polythene bags and bottles were stored at 4^0C until further work.

Isolation of fungi from soil

Isolation of fungi from the industrial effluent soil sample was carried out by soil dilution plate method by using PDA medium. The fungi were identified with the help of standand manual Soil physicochemical properties collected samples were brought to the laboratory by a sterile polyethene bag and sieved through 2mm sieve at field moist conditions and determination of soil moisture content and pH was analyzed. Air dried ground and sieved (0.25mm) samples were used for the estimation of organic C, total N, available P and K content. Moisture content was determined by weight loss after drying 10g of soil at 105◦C for 24 hours and expressed as percentage dry weight. Soil pH was measured in 1:5 water suspension using a portable digital pH meter, colorimetric method (Anderson and Ingram, 1993), Micro kjelhal distillation and titration method (Jackson 1967) were applied to estimate organic carbon, total nitrogen, available phosphorus and exchangeable potassium.

Identification of fungi (zafar *et al*., 2006)

Identification of fungi the fungal cultures were identified on the basis of macroscopic (colonial morphology, color, texture, shape, diameter and appearance of colony) and microscopic (septation in mycelium, presence of specific reproductive structures, shape and structure of conidia, and presence of sterile mycelium) characteristics (Zafar *et al*., 2006). Pure cultures of fungi isolates were identified with the help of literature (Domsch *et al.*, 1980; Barnett, Hunter, 1999).

Soil physiochemical properties

The soil samples were air dried crushed and passed through a 2-mm sieve and then mixed thoroughly to obtain a homogeneous mixture .Particles size analysis was

performed using the Bouyoucous hydrometer method6. Bulk Density was determined by clod method (Black.1965)7. Maximum water holding capacity was measured by Piper (1996). The soil pH was determined in1:2.5 soil-water suspension by potentiometer method (Jackson1973). Electrical conductivity was determined extract using Conductivity Bridge and expressed as dSm-1 (Jackson 1973) Organic carbon was determined by Walkley and Black (1934) Wet Oxidation method10. The cation exchange capacity of the soil was determined by equilibrating the soil with neutral normal sodium acetate solution and the excess salts were removed by 95 % isopropyl alcohol (Anon.1987). Available Macrnutrients: i.e.vailable Nitrogen (N), Phosphorus (P) and potassium
(K) were estimated by the methods suggest by Subbiah and Asija (1965)11and Bray and Kurtz (1945)12and Hanway and Heidal (1945) respectively13. Available Micronutrients: Micronutrients Fe, Mn, Zn and Cu were determined by using DTPA extraction (Lindsay and Narvell, 1987) and by atomic absorption spectrophotometer (AAS).

3. Results and Discussion

In the present investigation suggests that the 20 colonies of fungi were isolated by three different factors of Dalmia cement soil, Ambika sugarcane molasses and Leather effluent soil. Totally 20 Species belongs to 7 genera such as *Alternaria, Aspergillus, Cladosporium, Fusarium, Helminthassporium, Penicillum, Trichoderma* and *Verticillium* sp were isolated. The maximum number of colonies were represented including *Aspergillus* sp belongs to seven. Among the three different effluent soils, Dalmia cement soil contains maximum number of fungal colonies (71) followed by Ambika sugarcane molasses soil (66) and leather factory effluent soil (40) were recorded respectively (Table-1).

Prevailing favorable moisture and temperature setting during the period of leaf litter and other plant residues are decomposed faster during rainy season and sufficient soil organic matter and humus accumulates that may have enhanced the colonization of the soil microbes in subsequent period Domsh *et al.,* (1993). Hackl *et al.,* (2000) the indicated the plant species growing on the soil also equally influence the population and composition of species in the soil fungi.

Fungi isolated from contaminated soil

Joshi *et al* (2011) studied that the bioremediation of heavy metals in liquid media through west water particularly from electroplating paint, leather, metal and tanning contain enormous amount of heavy metals reported to exclude heavy metals from waste water through bioaccumulation. The fungi from sites contaminated with heavy metals for higher tolerance and degradation of heavy metals from various sources

Kennedy *et al* (2005) reported that the microbial population was determined the number of environmental factors like pH, moisture content and soil organic matter highly represented with responsilde for fungal population from the effluent soil samples. In the present study that the physiochemical parameters such as pH, electrical conductivity, organic carbon, organic matter, available nitrogen, Phosphorus, Pottasium, zinc, copper iron and manganese cat iron exchange capacity of Calcium, Magnesium, Sodium and Potassium from Dalmia cement factory effluents soil of 7.46, 0.38 dsm^{-1}, 0.29%, 0.58%, 123.6mg/g , 3.75mg/g, 119.2 mg/g, 0.74ppm, 0.46ppm, 4.23 ppm, 2.16 ppm, 19.8 C. mole proton/kg, 10.8, 7.2, 1.45, 0.24 C .mole. Proton /kg recorded respectively and followed Ambika sugarcane molasses effluent soil and them leather factory effluent soil was recorded (Table -2). The dominate of the genus *Aspergillus* sp greater rate of spore production dispersal and party due to thus resistance dispersal and conditions (Schimel, 1995).

In the same treat was observed that the isolates were able to utilize the content of heavy metal from the population of fungi to grow well at the specific physiochemical properties was more suitable conditions. However the fungi can be recommended for degradation of chemical properties from the effluent contaminated soil.

Table 1: Isolation of fungi from industrial effluent soil

S.No	Name of the fungi	total no.of colonies ×CFU 10^{-3}			
		Dalmiacement soil	Sugarcane molasses soil	Leather factory Soils	Total
1	*Alternaria alternata*	5	2	-	7
2	*Aspergillus awamori*	11	8	4	23
3	*A.flavus*	6	-	-	6
4	*A.fumigatus*	5	8	10	23
5	*A.niger*	8	6	7	21
6	*A.nidulans*	2	-	1	3
7	*A.oryzae*	-	2	-	2
8	*Cladosporium* sp	-	1	-	1
9	*Curvularia lunata*	1	3	-	4
10	*Fusarium* sp	2	-	1	3
11	*F.oxysporum*	3	1	-	4
12	*F.solani*	3	5	1	8
13	*Helminthosporium* sp	-	2	-	2
14	*Penicillium* sp	5	3	4	12
15	*P.chrysogenum*	2	3	1	6
16	*Penicillium citrinum*	9	7	6	22

17	*Trichoderma* sp	2	5	-	7
18	*T.harzianum*	4	3	3	10
19	*T.viride*	3	5	2	10
20	*Verticillium* sp	-	2	-	2
	Total number of colonies	71	66	40	255

Table 2: Physico chemical properties soil samples of Dalmia cement Soil, Sugarcane molasses soil and Leather factory soil

S.No	*Name of the parameters*	*Dalmia cement soil*	*Sugarcane molasses soil*	*Leather factory soil*
1.	pH	7.46	7.25	7.86
2.	Electrical conductivity (dsm^{-1})	0.38	0.34	0.48
3.	Organic carbon (%)	0.29	0.24	0.26
4.	Organic matter (%)	0.58	0.48	0.52
5.	Available nitrogen (mg/g)	123.6	106.8	120.3
6.	Available phosphorus (mg/g)	3.75	3.89	3.75
7.	Available potassium(mg/g)	119.2	124.6	115
8.	Available zinc (ppm)	0.74	0.76	0.89
9.	Available copper (ppm)	0.46	0.49	0.69
10.	Available iron (ppm)	4.23	4.56	4.56
11.	Available manganese (ppm)	2.16	2.16	2.19
12.	**Cat ion Exchange Capacity** (C. Mole $Proton^{+}$/kg)	19.8	25.0	19.8
	Ex changeable Bases (C. Mole $Proton^{+}$/kg)			
13.	Calcium (mg/g)	10.8	11.6	16.3
14.	Magnesium(mg/g)	7.2	7.9	7.9
15.	Sodium (mg/g)	1.45	1.24	1.45
16.	Potassium(mg/g)	0.24	0.21	0.19

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