International Journal of Ecology and Environmental Sciences
www.ecologyjournal.in
Online ISSN: 2664-7133, Print ISSN: 2664-7125
Received: 26-07-2022, Accepted: 11-08-2022, Published: 29-08-2022
Volume 4, Issue 3, 2022, Page No. 115-118

Studies on industrial waste water fungi from Baramati MIDC area, district Pune, Maharashtra, India

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Abstract

Present investigation emphasizes on Industrial Waste Water Fungi from Baramati MIDC area, Dist. Pune, Maharashtra., India. The isolation of Industrial Waste Water Fungi was done by using serial dilution method and Potato Dextrose Agar (PDA) medium Czapek- Dox Agar medium (CDA). Morphological characters of fungi were used for their identification. In the present study total 16 fungal genera and 22 species were noticed as the Industrial waste water fungi. By using serial dilution technique followed for isolation of fungi *Viz. Pythium debaryanum, Rhizopus oryzae, Rhizopus Stolonifer, Rhizopus sp., Mucor mucedu, Chaetomium globosum, Trichoderma viride, Trichoderma harzianum, Alternaria alternata, Aspergillus* sp., *Aspergillus brunneo-uniseriatus, Aspergillus kanagawaensis, Aspergillus niger, Botrytis* sp., *Cladosporium* sp., *Drechslera* sp., *Curvularia lunata, Fusarium oxysporum, Helminthosporium* sp, *Nigrospora* sp., *Penicillium aurantiogriseum* and *Rhizoctonia* sp. were as reported.

Keywords: industrial waste water, pathogenic fungi and disease fungi

Introduction

Industrial processes are causing the production of large amount of toxic and stable pollutants, which are all collected into the water out coming from the plant. The disposal of these contaminated effluents into receiving waters can cause environmental damages, directly influencing the aquatic ecosystem and even human being (Prigione *et al*., 2008). It stands to reason that an effective treatment of these effluents is necessary. However, textile and pharmaceutical effluents are usually recalcitrant to the standard biological treatments, due to the complex aromatic compounds, the extreme chemico-physical parameters and the presence of an autochthonous bacterial microflora (Hai *et al*., 2008; Rosales *et al*., 2011). Moreover, to be competitive in the market, industries should continuously update their products, strongly influencing the industrial process itself. Consequentially, these wastewaters are very heterogeneous and complex with an inner composition which could deeply vary time by time (Vanhulle *et al*., 2008). The chemical industry is of importance in terms of its impact on the environment. The wastewaters from this industry are generally strong and may contain toxic pollutants. Chemical industrial wastes usually contain organic and inorganic matter in varying degrees of concentration. It contains acids, bases, toxic materials, and matter high in biological oxygen demand, color, and low in suspended solids. Many materials in the chemical industry are toxic, mutagenic, carcinogenic or simply hardly biodegradable. Surfactants, emulsifiers and petroleum hydrocarbons that are being used in chemical industry reduce performance efficiency of many treatment unit operations (EPA, 1998). The best strategy to clean highly contaminated and toxic industrial wastewater is in general to treat them at the source (Peringer, 1997) and sometimes by applying onsite treatment within the production lines with recycling of treated effluent (Hu *et al*., 1999). Since these wastes differ from domestic sewage in general characteristics, pretreatment is required to produce an equivalent effluent (Meric *et al*., 1999). In chemical industry, the high variability, stringent effluent permits, and extreme operating conditions define the practice of wastewater treatment (Bury *et al*., 2002). Hu *et al*. 1999 proposed concept to select the appropriate treatment process for chemical industrial wastewater based on molecular size and biodegradability of the pollutants. (1184) TESCE, Vol. 30, No.2 v s December 2004.he occurrence of heavy metals in industrial wastewater is known to cause serious damage to aquatic life, beside the fact that these metals kill microorganisms during biological treatment of wastewater with a resultant delay in the course of water purification (Wierzba, 2010). Metals are extensively used in several industries, including mining, metallurgical, electronic, electroplating and metal finishing. The presence of metal ions in final industrial effluents is extremely undesirable, as they are toxic to both lower and higher organisms. Heavy metals are defined as metals with a specific weight usually more than 5.0g/cm3, which is five times higher than the specific weight of water. The toxicity of heavy metals occurs even in low concentrations of about 1.0-10mg/l while some strong toxic metals ions such as Mercury (Hg), Chromium (Cr), Lead (Pb), Zinc (Zn), Copper (Cu), Nickel (Ni), Cadmium (Cd), Arsenic (As), Cobalt (Co), Tin (Sn), etc., are very toxic even in lower concentration of 0.001-0.1 mg/l Kapoor *et al*., 1999; Wang and Chen., 2009)

Wastewater is the primary area of concern at the food and beverage industry. With the exception of some toxic cleaning products, wastewater from food-processing facilities is organic and can be treated by conventional biological technologies (Tchobanoglous, 1991). Primary issues associated with food and beverage industrial wastewater are biochemical oxygen demand (BOD); chemical oxygen demand (COD); total suspended solids (TSS); excessive nutrient loading *viz*. nitrogen and phosphorus compounds; pH of the water; total alkalinity and pathogenic organisms. Solid wastes from the food and beverage industries include both organic and packaging waste. Organic wastes from raw materials such as food grain, flavoring and coloring agents result out from processing operations. Inorganic waste typically includes excessive packaging items like plastic, glass, and metal (Katzel, 1994).

Environmental pollution is becoming the global problem in which water pollution is an important issue as water is used directly for various purposes. (Vidya and Usha, 2007). The major sources of water pollution are industrial effluents which are being discharged to the common drainage. The effluent pollute not only the nearby soil but may cause the pollution of drinking water also (Lokhande and Vaidya, 2004) [14]. It is difficult to put a price tag on the cost of pollution (Arora, 2001) [3]. Untreated industrial effluent discharged on the surface cause severe ground water pollution in the industrial belt of the country. This poses a problem of supply of hazard-free drinking water in the rural parts of the country (Vidya and Usha, 2007). Pollution is the greatest threat posed to humanity and even to the whole biosphere. (Shivakumar and Thippeswamy, 2012).

The main focus of this research was to investigate the isolation of fungal strains from municipal wastewater, and to test their ability to remove pharmaceutical substances. To achieve this, fungal isolates were isolated and cultivated on a synthetic wastewater media in the presence of selected pharmaceuticals. During this study, the effect of the pH on removal efficiency was studied. The most promising isolate was further identified and analyzed in non-sterile municipal wastewater. Finally, a biosorption experiment was conducted with the isolate, and enzyme activity was measured to better understand the removal mechanisms of pharmaceutical substances. All results of fungal isolate were compared to T. versicolor to evaluate the potential of an isolated fungal strain and the advantages of its application in wastewater treatment to remove pharmaceutical substances.

Materials and Methods

The survey and collection of industrial waste water was carried out from Baramati MIDC area during 16 March, 2021 to 20 March, 2021. Field photography of industrial waste water was also done. Waste water was brought to the laboratory using plastic bottles and stored properly for their further analysis. Waste water was isolated by using serial dilution method (Aneja, 2003). The Czapek's Dox Agar (CDA), (Kanade *et al.*,2018) [17] and Potato Dextrose Agar (PDA), (Shitole *et al.*, 2019) [18] media supplemented by Penicillin antibiotic. Inoculated plates were kept for incubation at room temperature for 7 days. At the time of incubation fungal growth was observed regularly and observations were noticed. After 7days of incubation the photographs of plates were taken. Isolated fungal colonies were used for preparation of slides. Slides were prepared using cotton blue stain and lactophenol as mounting medium. Slides were observed under light microscope and microphotography was also done. Fungi were identified on the basis of morphological characters of spores by using standard literature (Nagamani*et al.*, 2006).

Table 1: Observation

Sr. No	Locality of industrial Area	PDA media	CDA media
1.	Sample 1 [cc]	*Pythium debaryanum, Chaetomium globosum, Aspergillus kanagawaensis,Curvularia lunata*	*Rhizopus* sp., *Alternaria alternate,Botrytis* sp., *Helminthosporium* sp
2.	Sample2 [GC]	*Mucor mucedo, Alternaria alternate, Aspergillus niger,Fusarium oxysporum, Nigrospora* sp.	*Rhizopus oryzae, Trichoderma viride,Cladosporium* sp., *Rhizoctonia* sp.
3.	Sample 3 [IC]	*Rhizopus stolonifer, Trichoderma harzianum, Botrytis* sp., *Penicillium aurantiogriseum*	*Mucor mucedo, Aspergillus brunneo-uniseriatus, Drechslera* sp.

Table 2: Fungal Observation and their Sub-Division

Sr. No	Fungi	Sub-Division	%. of Contribution.
1.	*Pythium debaryanum*	Mastigomycotina	4.54%
2.	*Rhizopus oryzae*	Zygomycotina	18.18%
3.	*Rhizopus stolonifera*	Zygomycotina	
4.	*Rhizopus* sp.	Zygomycotina	
5.	*Mucor mucedo*	Zygomycotina	
6.	*Chaetomium globosum*	Ascomycotina	13.63%
7.	*Trichoderma viride*	Ascomycotina	
8.	*Trichoderma harzianum*	Ascomycotina	

9.	*Alternaria alternate*	Deuteromycotina	63.63%
10.	*Aspergillus* sp.	Deuteromycotina	
11.	*Aspergillus brunneo-uniseriatus*	Deuteromycotina	
12.	*Aspergillus kanagawaensis*	Deuteromycotina	
13	*Aspergillus niger*	Deuteromycotina	
14.	*Botrytis* sp.	Deuteromycotina	
15.	*Cladosporium* sp.	Deuteromycotina	
16.	*Drechslera* sp.	Deuteromycotina	
17.	*Curvularia lunata*	Deuteromycotina	
18.	*Fusarium oxysporum*	Deuteromycotina	
19.	*Helminthosporium* sp	Deuteromycotina	
20.	*Nigrospora* sp.	Deuteromycotina	
21.	*Penicillium aurantiogriseum*	Deuteromycotina	
22.	*Rhizoctonia* sp.	Deuteromycotina	

Results and Discussion

In the present study total 16 fungal genera and 22 species were noticed as the Industrial waste water fungi. They were identified on the basis of morphological characters, spores structure and fruiting bodies. *Rhizopus oryzae, Rhizopus stolonifer, Rhizopus* sp., *Mucor mucedu, Alternaria alternata, Aspergillus* sp., *Aspergillus niger, Fusarium oxysporum, Helminthosporium* sp, *Nigrospora* sp., *Penicillium aurantiogriseum* and *Rhizoctonia* sp. were found frequently throughout the study. On the contrary *Pythium debaryanum, Chaetomium globosum, Trichoderma viride, Trichoderma harzianum, Aspergillus brunneo-uniseriatus, Aspergillus kanagawaensis, Botrytis* sp., *Cladosporium* sp., *Drechslera* sp., *Curvulari alunata*, were reported uncommonly. The frequency of Deuteromycotina fungi were dominant (14) followed by Zygomycotina (04), Ascomycotina (03) and Mastigomycotina (01) (Table 1).

Fungi are a type of water that is more numerous than bacteria and other microorganisms (Gnanasekaran *et al.*, 2015). Waste water's organic composition, moisture content, and pH all have a significant impact on fungus diversity (Gaddeyya *et al.*, 2012). The fungal variety of waste water influences crop plant growth in both good and negative ways (Ratna Kumar *et al.*, 2015). Waste water samples were collected from three different industrial hubs. Sewer pollution has been shown to reduce the diversity of sensitive mushrooms while boosting the diversity of less sensitive species (Cooke, 1970). In comparison to the other two industrial centers, the presence of organic pollutants created by leather tanneries in Chrompet may have selected for and led the adapted fungal species to survive and multiply. Table 1 summarizes the findings of the wastewater sample experimental study. The ideal pH range for most aquatic organisms, according to Science Junction (www.ncsu.edu, 2006), is between 6.5 and 8.5. The pH values of the GSDL and GBDML sample wastewater (Table 1) were within the recommended range although on the lower end.

The current ineffective onsite wastewater treatment methodology should be replaced with current approaches such as those given in this study report. This is also significant for solid waste.

Because water is the key ingredient in the beverage sector, long-term water recycling and reuse should be considered. Recycled water can be used to wash, cool, and perform a range of other chores. Packaging products that generate solid waste can have a lesser environmental impact by using creative design, conserving resources, and emphasizing recycling and reuse.

At these two locations, specialists should be allocated duties for environmental protection and garbage management. Waste reduction and handling training should be provided to all connected personnel. Training should be performed on a regular basis to teach waste tolerance as well as the impact of various wastes on the solid waste and wastewater streams.

Conclusion

Industrial processes produce a considerable number of dangerous and stable pollutants, which are all gathered in the factory's effluent water. The discharge of these polluted effluents into receiving waters will harm the environment by directly affecting the aquatic ecosystem and even humans. Metal concentrations in some aquatic habitats exceed water quality standards established to protect the ecology, wildlife, and humans. Any essential element is poisonous in excess, and essential elements have a therapeutic dose range between deficiency and toxicity. This investigation showed that increasing the pH, time, biomass concentration, and temperature to a certain level resulted in a considerable rise.

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