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Domestic waste water treatment using leaf extract of *Moringa oleifera*

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ABSTRACT

The leaf extract of *Moringa oleifera* using different solvents such as ethanol and propane-2-ol were treated with domestic wastewater for three consequent days. Their phytochemical constituents were analyzed. The extract was effective in the clarification, sedimentation of total solids and also reduction of hardness in the waste water sample. Among the two solvents, propane-2-ol reduced more dissolved solid (51.2mg/l) on 3rd day. The hardness of the water was also decreased after treating with ethanolic extract (138mg/l) on third day. An aliquot of 10 ml of ethanolic extract reduced more amount of nitrate content (8mg/l) present in the waste water than other three extracts. Sulphate concentration was also reduced remarkably by both the 10ml of both the solvent extracts (5mg/l).

Keywords: *Moringa oleifera*, leaf extract, domestic waste water, Phytochemical.

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INTRODUCTION

Water is an essential thing for all living beings. Our daily chores such as bathing, doing laundry, flushing toilets, preparing meals, washing dishes and other activities generate wastewater. Waste water discharged from houses is released into the water bodies. The major sources of organic pollution in fresh water bodies are sewage. A study in the year of 2007 revealed that discharge of untreated sewage is single most important cause for pollution of surface and ground water in India. The problem is not only due to lack sufficient treatment capacity but also that the sewage treatment plants that exist do not operate and are not maintained properly. The uncollected wastes accumulate in the urban areas cause unhygienic conditions and release pollutants that leach the surface and groundwater [1].

The World Health Organization report submitted in 1992, clearly state that out of India's 3,119 towns and cities, just 209 have partial sewage treatment facilities, and only 8 have full wastewater treatment facilities [2]. Open defecation is widespread even in urban areas of India [3, 4].

Disposal of waste water is one of the major problems. Since domestic waste water is rich in organic materials and plant nutrients, they have been used to investigate agricultural lands as a cheap way of disposal. Use of domestic waste water in agriculture may contribute considerably to alleviate the pressure in using fresh water resources. The waste water containing organic matter & plant nutrients (N, P, K, Ca, S, Cu, Mn, &Zn) has been reported to increase crop yield [5-10]. Sewage sludge consists of multi-element organic wastes that are also used commonly as manure [11]. Along with nutrients, harmful chemicals are also present in untreated domestic waste water that will affect the agriculture and also the aquatic life. Varieties of techniques have been employed to treat the waste water. Aerobic and anaerobic treatments are usually employed for treating the municipal waste water. According to Central Pollution Control Board India (2005) report, the sewage discharged from cities and towns is the predominant cause of water pollution in India. Investment is needed to treat 29,000 million litres per day of sewage in India [12]. A large number of Indian rivers are severely polluted as a result of discharge of domestic sewage. *Moringa oleifera* belongs to the family *Moringaceae* which is a single genus of shrubs and trees used for a variety of purposes [13]. The dry seed suspension is known to be a natural coagulant and coagulant aid [13-17]. *Moringa oleifera* seed suspension was already used for the softening of hardwater [18]. Leaves of *Moringa oleifera* were also used as a source of protease enzyme [19]**.** In this study, the fresh leaf extract of *Moringa oleifera* was used to treat the domestic effluent.

MATERIALS AND METHODS

Collection of sample

The waste water was collected from the canal in which the domestic effluents from Thiruvanchery village, Chennai, Tamil Nadu, India are released. *M.oleifera* leaves were collected from the surrounding area of effluent collection. Then the leaves of *M.oleifera* were separated

manually and dried under sun light for three days. After complete drying, it was made as a fine powder and was stored.

Preparation of plant extract

The powdered samples were soaked for 24 hrs in solvents such as ethanol and propane-2-ol to get the plant extract.

Phytochemical analysis

The phytochemical constituents of plant material was analysed for both the extracts using the tests mentioned in Table.1

Estimation of carbonyl:

Plant extract was treated with 2, 4 diphenyl hydrazine and was shaken well. Formation of yellow crystals confirms the presence of carbonyl groups.

Saponin Test

Distilled water was added to plant extract and heated to boil and mixed vigorously. Frothing confirms the presence of saponins.

Coumarin Test

Extract was treated with 1N NaOH or KOH. Appearance of dark yellow color confirms the presence of coumarin.

Phlobatanin Test

Extract was dissolved in water and filtered. Filtrate was boiled with 2% HCl. Red precipitate gives confirmation of the presence of phlobatanin.

Treatment of effluent

Domestic effluents were treated with 5ml and 10ml of plant extract of ethanol and propane-2-ol for three days at acidic pH.

Estimation of TDS

The sample was filtered and the sediment leftover on the filter was scrapped off and dried in oven. Then the dry weight of the sediment was measured.

Determination of Hardness level

An aliquot containing 25ml of extract was dissolved in 50ml of distilled water and 1 or 2 drops of EBT indicator was added to it. The solution was titrated with EDTA solution till the colour changes from reddish to blue tinge.

Analysis of Sulphate amount

Sulphate concentration was checked by nephlometry method. About 100ml of sample was treated with 20ml of buffer solution (30 g of $MgCl_2$ was dissolved in 5g of sodium acetate, 1g of KNO_3 and 20ml of CH_3COOH in 500ml distilled water). A spoonful of $BaCl_2$ was added to it. The turbidity was measured. Using standard graph, the concentration of sulphate was measured.

Estimation of Nitrate concentration

Aliquot containing 50ml of sample was added to 1ml of HCl and the OD was measured using calorimeter. The nitrate concentration was measured for the given sample using standard graph.

RESULTS AND DISCUSSION

The domestic effluents collected from Thiruvanchery village were treated with ethanol and propane-2-ol extracts of leaves of *M.oleifera* to study its effect on TDS, hardness, nitrate and sulphate content present in the waste water.

Phytochemical analysis of *Moringa oleifera*

The phytochemical analysis of both the extracts showed the presence of terpenoids, carboxylic acid, cardiac glycoside, and carbonyl. Apart from these constituents, the ethanolic extracts showed positive result for the presence of phenol, flavanoids, glycoside and saponin.(Table.1)

Total Dissolved solids

A total dissolved solid (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in water. The main constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogencarbonate, chloride, sulfate, and nitrate anions. The maximum TDS was removed more by 10ml propane-2-ol extract (51.2mg/l) than 10ml ethanolic extract (55mg/l). Both 5ml extracts showed same reduction (65mg/l) (Table 2,3).

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Table 1: Phytochemical analysis of *Moringa oleifera*

S.No	Plant constituents	Inference	
		Ethanolic extract	Propane-2-ol extract
1	Steroid (Salkowski test)	-	-
2	Triterpenoids (Salkowski test)	-	-
3	Terpenoids (Salkowski test)	+	+++
4	Phenol (Ferric chloride test)	++	-
5	Flavanoid (Ferric chloride test)	+	-
6	Coumarin	-	-
7	Tannin (Neutral ferric chloride test)	-	-
8	Phlobatanin	-	-
9	Aminoacid (Ninhydrin test)	-	-
10	Carboxylic acid (Sodium bicarbonate test)	+	+++
11	Glycoside (Molisch's test)	++	-
12	Cardiac glycoside (keller killani test)	++	+++
13	Carbonyl	+++	+++
14	Saponins	++	-
15	Anthraquinone – Bond (Borntrager's test)	-	-
16	Anthraquinone – Free (Borntrager's test)	-	-

Table 2: Analysis of wastewater treated with ethanolic extract of *Moringa oleifera*

S.No	Parameters (mg/l)	Untreated sample	Volume of extract (ml)	Treated sample		
				Day1	Day2	Day3
1	TDS	80	5	75	72	65
			10	72	60	55
2	Hardness	500	5	225	172	161
			10	200	142	138
3	Nitrate	25.5	5	20.2	17.1	11
			10	18.2	12.5	8.9
4	Sulphate	28	5	19	15	9
			10	11	9	5

Table 3: Analysis of wastewater treated with propane-2-ol extract of *Moringa oleifera*

S.No	Parameters (mg/l)	Untreated sample	Volume of extract (ml)	Treated sample		
				Day1	Day2	Day3
1	TDS	80	5	70	65	65
			10	65	60	51.2
2	Hardness	500	5	330	252	221
			10	211	192	147
3	Nitrate	25.5	5	22.1	18.6	16.9
			10	20.5	15.3	11.5
4	Sulphate	28	5	15	12	8
			10	10	7	5

Hardness

Water hardness is defined as the total concentration of calcium and magnesium ions in water. The U.S. Environmental Protection Agency (EPA) has classified hardness into four categories namely, soft (0-50mg/l), moderately hard (50-150), Hard (150-300), Very hard (>300). In most water it consist mainly of calcium and magnesium salts, with trace amounts of other metals. If the hardness is more than 300, then it will become very hard which will not lather with soap.

Water hardness affects fish health because it influences osmoregulation [12]. Sample treated with 10ml of ethanolic extract showed less hardness than other three extracts (138mg/l) after third day of treatment. Hence the treated water becomes under moderately hard type. The other three extracts also reduced the harness from 500mg/l. The 10ml propane-2-ol extract showed 147mg/l of hardness followed by 5ml ethanolic extract (161mg/l), and 5ml propane-2-ol extract (221mg/l) (Table.2, 3).

Nitrate

High nitrate containing water leads to blue baby disease to infants. The maximum allowable limit of nitrate concentration in drinking water by Bureau of Indian standard is 45 mg/l. Even though the untreated sample contained less nitrate concentration, after treatment the level got reduced more in sample treated with 10ml ethanolic extract (8.9mg/l) followed by 5ml ethanolic extract (11 mg/l). The 5ml and 10 ml propane-2-ol extract showed that 16.9mg/l and 11.5mg/l of nitrate concentration after the third day treatment (Table.2, 3).

Sulphate

Water with high levels of sulfate leads to dehydration and diarrheoae. Kids are often more sensitive to sulfate than adults. Animals are also sensitive to high levels of sulfate. In young animals, high levels may cause severe, chronic diarrheoae, and in some cases, death. The desirable limit of sulphate concentration is set as 150mg/l by IS 10500. But in the waste water sample, the sulphate concentration was 28mg/l. After the treatment on third day, sulphate concentration was found to be very less in both 10ml ethanolic and propane-2-ol extracts (5mg/l). Because of the sulphate reduction property of the *Moringa oleifera* extract, it could be used for treating paper and pulp mill effluent where the sulphate concentration is found to be more.

CONCLUSION

Moringa oleifera is a natural product, and the chemical constituent and structure is not fully known. The interaction of the phytochemical constituents with chemical and other substances in waste water are also not fully understood and the products of interaction are not all known. Further work may be carried out to provide insight into the interaction between

Phytochemical constituents of *Moringa oleifera* with harmful chemicals present in domestic waste as well as industrial effluent.

REFERENECES

[1] Central Pollution Control Board, Ministry of Environment & Forests 2007.
[2] Russell Hopfenberg and David Pimentel. Environment development and sustainability 2001; 3(1): 1-15.
[3] Trisha gupta, Boloji.com 2013.
[4] Mark Jacobson, National Geographic 2007.
[5] Central Pollution Control Board, Ministry of Environment & Forests, Govt of India 2005.
[6] Pathak H, Joshi H C, Chaudhar A, Chaudhary R, Kalra N, Dwivedi M K, Journal of Indian Society & Soil Science 1998; 46: 155-157.
[7] Pathak H, Joshi H C, Chaudhary A, Chaudhary R, Kalra N, Dwivedi M K, Water, Air and Soil Pollution 1999; 113: 133-140.
[8] Ramana S, Biswas A K, Singh A B, Yadava R B R, Bioresource Technology 2001; 81: 117-121.
[9] Lubello C, Gori R, Paolo N F, Ferrini F, Water Research 2004; 38: 2939-2947.
[10] Nagajyothi P C, Dinakar N, Suresh S, Udaykiran Y, Suresh C, Damodharam T, Journal of Environmental Biology 2009; 30: 385-388.
[11] Nath K, Singh D, Shyam S, Sharma Y K Journal of Environmental Biology 2009; 30: 227-234.
[12] Otobbang E, Sadovnikova L, Lakimenko O, Nilsson I, Persson J, Soil Plant Science 1997; 47: 65-70.
[13] Jahn S A A, Proper use of African natural coagulants for rural water supplies –Research
[14] in the Sudan and a guide to new projects 1986; GTZ Manual No. 191.
[15] Folkard G K, Sutherland J P and Grant W P Tech. Rep. No. R4254. University of Leicester 1989.
[16] Kaser F, Werner C and Nahayo D, Natural Resources Development 1990; 33: 33-47.
[17] Sani M A, The use of Zogale seeds for water treatment. B. Eng., Final year project report, Bayero University, Kano, Nigeria 1990.
[18] Bina B. PhD. Thesis Univ. of Newcastle upon Tyne 1991.
[19] Suleyman A, Muyibi and Lilian M Evison. Wat Res 1995; 29(4): 1099-1105.
[20] S Sharmila, L Jeyanthi Rebecca, Merina Paul Das and Md Saduzzaman. J Chem Pharm Res 2012; 4(8): 3808-3812.