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Research Article

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Efficacy of leaf extract of *Moringa oleifera* in treating domestic effluent

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ABSTRACT

The efficacy of leaf extract of Moringa oleifera using different solvents such as acetone and benzene on domestic wastewater treatment was investigated for 3 consequent days and their phytochemical analysis were analyzed. The extract was effective in the clarification and sedimentation of total solids in the waste water sample. Among the two solvents, benzene showed highest reduction of TDS (25mg/l) on 3rd day. The hardness of the water was also decreased remarkably after treating with the extracts. On the third day sample treated with 10 ml benzene extract showed higher reduction in hardness (190mg/l). Both 5ml and 10ml benzene extract reduced more sulphate content on 1st day itself (10ml/l and 7mg/l). Nitrate content was reduced more by 10ml benzene extract (12.2mg/l).

Keywords: *Moringa oleifera*, Phytochemical, TDS, Hardness, Nutrate, Sulphate.

INTRODUCTION

The increasing population and urbanization in urban areas has serious threat to the limited natural resources. The availability of water is declining at faster rate due to rapid population growth, depleting water storage facilities and contamination of the water resources due to discharge of untreated domestic and industrial effluents into streams and rivers [1]. Along with the rapid depletion of water resources, one of the major water problems is the improper disposal of domestic and industrial waste water which is polluting the remaining water resources, affecting the human health, environment and agricultural productivity [1,2]. Waste water can be considered as s a resource that can be used in a more beneficial way rather than being wasted. Reusing of waste water for agricultural and landscape irrigation is an opportunity that can potentially reduce the use of canal water for irrigation and helps to save the remaining fresh water resources [3]. Now a days municipal wastewater reuse has emerged as an important and viable means of water supply in a large number of regions throughout the world**.** The untreated sewage water is used to irrigate 10% of the world's crops , especially in urban areas, revealing the first global survey of the hidden practice of wastewater irrigation [4]. In many instances, reuse is also promoted as a means of limiting wastewater discharges to aquatic environments. The utilization of municipal wastewater for irrigation purposes has many profits; including the safe and low-cost treatment and disposal of wastewater, the conservation of water and recharge of groundwater reserves; and the use of nutrients in the wastewater for productive purposes [5,6]**.** The domestic waste water consists of harmful chemicals such as sulphate , nitrate, calcium, magnesium and dissolved solids which will affect soil as well as water resources to which it is left over. Aurag Teawari and Ashutosh Dubey (2009) developed various methods to remove harmful fluorides present in ground water [7]. The treated domestic sewage effluents improve soil fertility and physical properties, causing an increase in crop yield.

Moringa oleifera is a tropical multipurpose tree that naturally grows in India, South-Saharan Africa and South-America [8]. Every part of the plant (leaves, flowers, seeds, roots and bark) can be used as food or for medicinal and

therapeutic purposes [9]. Its seeds also contain between 30-35 % (w/w) of vegetable oil [10]. They are also used in the preparation of cosmetics, mechanical lubricant, and lately for potential biofuel production. *M.oleifera* seeds are also used as a primary coagulant in drinking water clarification and wastewater treatment due to the presence of a water-soluble cationic coagulant protein that is able to reduce turbidity of the water treated [11].

In this study, the domestic effluents collected were treated with the leaf extract of *M.oleifera* to remove the turbidity, hardness and harmful chemicals present in it.

EXPERIMENTAL SECTION

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 in solvents such as benzene and acetone to get the plant extract.

Phytochemical analysis
The phytochemical constituents of plant material was analysed for both the extracts.

Steroids, triterpenoids and terpenoids were estimated by Salkowski test. Phenol and flavanoids were estimated by ferric chloride test. Neutral ferric chloride test was followed for tannins. Aminoacid was estimated by ninhydrin test. Carboxylilc acid was analysed by sodium bicarbonate test. Molisch's test was performed for estimating glycosides. Cardiac glycosides were estimated by Killer Killani test. By Borntrager's test anthraquinone was analyzed.

Estimation of carbonyl:
Plant extract was treated with 2,4 diphenyl hydrazine and was shaked well. Fromation of yellow crystals confirms the presence of carbonyl groups.

Saponin Test
Distilled water was added to 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 benzene and acetone 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
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

Sulphate concentration was checked by nephlometry method. About 100ml of sample was treated with 20ml of buffer solution A(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.

Determination of Nitrate

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

RESULTS AND DISCUSSION

The domestic effluents were collected from Thiruvanchery village were treated with acetone and benzene extract of leaves of *M.oleifera* to study its efficacy in the waste water treatment.

Phytochemical analysis of *Moringa oleifera*

The phytochemical analysis of acetone extract showed the presence of phenol, carboxylic acid, glycoside, cardiac glycoside, and carbonyl compounds. The benzene extracts showed additional constituents like tannin, phlobatanin, saponin and anthroquinone as shown in Table.1

Table.1 Phytochemical analysis of *Moringa oleifera*

S.No	Plant constituents	Interference	
		Acetone extract	Benzene extract
1	Steroid	-	-
2	Triterpenoids	-	-
3	Terpenoids	-	-
4	Phenol	+++	+++
5	Flavanoid	-	-
6	Coumarin	-	-
7	Tannin	-	+++
8	Phlobatanin	-	++
9	Aminoacid	-	-
10	Carboxylic acid	+++	++
11	Glycoside	+++	+++
12	Cardiac glycoside	+++	++
13	Carbonyl	+++	+++
14	Saponins	-	++
15	Anthraquinone - Bond	-	++
16	Anthraquinone - Free	-	-

Total Dissolved solids

Solids are found in liquid streams in two different forms such as suspended and dissolved form. Suspended solids will not pass through a filter, whereas the dissolved solids will pass through it.

A high concentration of dissolved ions is an indication that a stream is polluted or unhealthy. If total dissolved solid content is high, many forms of aquatic life will be affected. The salts dehydrate the skin of animals. High concentrations of dissolved solids can add a laxative effect to water or cause the water to have an unpleasant mineral taste. Hence removal of TDS is a primary factor. In this study benzene extract reduced more TDS on 3rd day of treatment (Table.2,3).

Hardness

Water accumulates many dissolved substances before it reaches our taps. Hardness is a measurement of the concentration of divalent metal ions such as calcium, magnesium, iron, zinc etc. 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 benzene extract reduced more salts (190mg/l) on third day than acetone extract (198mg/l). Lesser quantity of acetone extract (5ml) has not reduced much hardness when compared with 10 ml extract.(Table.2,3)

Nitrate

If nitrate level is more in water, it can interfere with the ability of red blood cells to transport oxygen. This high nitrate containing water leads to blue baby disease to infants and difficulty in breathing since their bodies are not receiving enough oxygen. The maximum allowable limit of nitrate 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 of benzene extract (12.2mg/l) than acetone extract on third day (Table.2,3).

Table.2 Parameters of wastewater treated with acetone extract of *Moringa oleifera*

S.No	Parameters (mg/l)	Untreated sample	Volume of extract (ml)	Treated sample		
				Day1	Day2	Day3
1	TDS	80	5	79	75	50
			10	75	65	40
2	Hardness	500	5	380	232	201
			10	350	221	198
3	Nitrate	25.5	5	25	23.5	22.9
			10	20.2	18.1	16.6
4	Sulphate	28	5	28	20	18.5
			10	23.5	18.5	13

Table.3 Parameters of wastewater treated with benzene extract of *Moringa oleifera*

S.No	Parameters (mg/l)	Untreated sample	Volume of extract (ml)	Treated sample		
				Day1	Day2	Day3
1	TDS	80	5	65	60	25
			10	60	60	20
2	Hardness	500	5	350	340	250
			10	320	260	190
3	Nitrate	25.5	5	24.6	17.1	16.6
			10	18.1	14.3	12.2
4	Sulphate	28	5	8.5	10	10
			10	3.5	7	7

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. In the Netherlands, the sulfate concentration of drinking-water from 65% of water treatment plants was below 25 mg/litre in 1985 [13]. A water quality survey carried out on British tap water supplies indicated a mean sulfate concentration of 59.5 mg/litre, with a maximum of 236 mg/litre[14].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 treating with the extract, sulphate concentration was found to be very less in 10ml benzene extract treated sample.

CONCLUSION

Hardness and total dissolved solids are the major criteria which were reduced significantly by extract of leaves of *Moringa oleifera*. It is also having the capacity of reducing sulphate and nitrate concentration in the water. Further more work can be carried out to find out the effects of these extract on other harmful chemicals present in domestic waste as well as industrial effluent.

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