



## REMOVAL OF TOTAL DISSOLVED SOLIDS FROM GROUNDWATER USING HERBS

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**Abstract:** The present study is a preliminary attempt to explore plant materials such as lemon peel (*Citrus limon*), Thulasi commonly called as holy basil (*Ocimum tenuiflorum*), Neem leaves (*Azadirachta*) and vetiver root (*Vetiveria zizanoides*) for reducing the total dissolved solids (TDS) and Hardness in ground (hard) water using herbs. The water samples were collected from bore well in the out skirts of krishnagiri (dt) to screen the TDS and hardness, using a TDS meter. The selected plant materials were packed in vertical glass columns separately and 50mL of hard water is supplied to the column to switch on the process with the flow rate of 10 ml per minute. The reduction of dissolved solids content in the samples were screened. The % decrease of TDS in the elute water samples are calculated. It is evident that vetiver root has shown a maximum reduction in TDS (55.93%) followed by neem leaves (42.14%), lemon peel (42%) and basil leaves (41.14%).

**Keywords:** Total Dissolved Solids(TDS), Hardness, Herbal treatment.

### 1. Introduction:

The rapid population growth, both in rural and urban areas, has stressed existing water supply systems. This is accompanied by the sustainability of operation and maintenance of water supply infrastructure that has hindered access to water by the poor in many developing countries. The situation is again aggravated by deterioration of the quality of water resources, attributed to the direct industrial and municipal waste discharge rendering existing treatment units ineffective to meet the water quality standards, both on a national and WHO level.

Clean, potable, drinking water can make all the difference between healthy and unhealthy living, and sometimes even between life and death.

However, even in this age of scientific researches, the rhetoric of 'water for all' remains a distant dream as the government has failed to come to the aid of all, especially those living in the rural areas. Developing safe drinking water supplies is one of the most urgent challenges facing developing nations. In order to alleviate the prevailing difficulties, approaches should focus on sustainable water supply and treatment systems that are cost effective. It is important that these technologies are affordable and preferably use local materials.

Judicious usage of available resources and employing green technology to recycle water are the right paths for combating this universal problem. Towards this goal, the present work focuses on treating tannery effluent with plant products as a viable pre-treatment. The experiment had been designed to capture the efficacy of bio products in reducing the Total Dissolved Solids, and other parameters in order to improve the quality of tannery effluents.

This approach uses herbal plants and their parts to lessen TDS content and hardness in hard water. Most of the plants have the capacity to absorb inorganic mineral salts through roots and store them as organic minerals. Some plant parts have the capacity to absorb the dissolved salts over their surface. Adsorption phenomena in some plants were already reported and been used as in the form of activated carbon filters.

In this approach the herbal plant parts such as lemon peel, thulsi leaves, Neem leaves, and vetiver root are used to infer whether they can reduce the hard water TDS content. Using herbal approaches to reduce water pollution may be cost effective and simpler than other synthetic methods.

## 2. MATERIALS METHODS

### 2.1 Plant parts in water purification

New approaches are discovered to minimize or even eliminate the above mentioned defects and disadvantages of the water purification techniques. This approach uses herbal plants and their parts to lessen TDS content in the hard water. Most of the plants have the capacity to absorb inorganic mineral salts through roots and store them as organic minerals.

Some plant parts have the capacity to absorb the dissolved salts over their surface. Adsorption phenomena in some plants were already reported and been used as in the form of activated carbon filters. In this approach the herbal plant parts such as Neem, Vettiver, Thulsi and lemon peel are used to infer whether they can reduce the hard water TDS content. Using herbal approaches to reduce water pollution may be cost effective and simpler than other synthetic methods.

The primary objective of this study is to identify the most appropriate herbal plants for the removal of total dissolved solids from water. Four herbs namely Neem, Vettiver, Thulsi and lemon peel were chosen for this study. The effectiveness of these herbs in the removal of total dissolved solids (TDS) has been investigated. The results obtained from this study satisfied that the TDS has removed to a tolerable limit in the waste water and which can be used for domestic treatment purposes.

### 2.2. Expiremental setup

The jar test method was followed in this study. Raw sample was taken in a beaker of one litre volume. The raw herbs was added to a beaker in varying quantities from 1 gm to 10gms (1gm, 2gm,4gm, 6gm and 8gm) (fig:4.9) This solution was mixed rapidly for 2 min followed by 15 min of gentle mixing.

The suspensions were allowed to stand untill without any disturbance for a period of 1.5 hrs before determining the optimum dosage. Finally, the supernatant was filtered through Whatman filter paper for analysis. Similar procedure was carried out for other herbal coagulants like, lemon peel (*Citrus limon*), Thulasi commonly called as holy basil (*Ocimum tenuiflorum*),Neem leaves (*Azadirachta*) and vetiver root (*Vetiveria zizanoides*) and data were tabulated.

### 2.3 Measurements and analysis

The filtered water was subjected to pH, turbidity, total dissolved solids, total hardness, iron, fluoride, chloride, calcium, magnesium and alkalinity measurements. All analysis was carried out according to standard methods (APHA-AWA-WPCF, 1992).



Fig 1. Jar Test Setup

### 2.4 Herbal mixtures

Use of herbs for clarifying and disinfecting water has been in practice for long time now. Different stages of tannery effluents contain different pollutants. . Towards this goal, the present work focuses on treating tannery effluent with plant products as a viable pre-treatment.

The experiment had been designed to capture the efficacy of bio products in reducing the Total Dissolved Solids, and other parameters in order to improve the quality of tannery effluents.

**Table 1. Herbal mixture**

SL. NO	NAME AND PARTS OF PLANT	QUANTITY TAKEN(gram)
1	Neem leaves	10
2	Vetiver root	10
3	Thulsi leaves	10
4	Lemon peel	10
Total quality		40

**3. Results and Discussion**

**3.1 Parameters of ground water**

**Table 2. Parameters of ground water**

Hardness	990 mg/L
Total dissolved solids	1600 mg/L
Color	Brownish color
Odor	Objectionable level

**Table 3. Parameters of ground water**

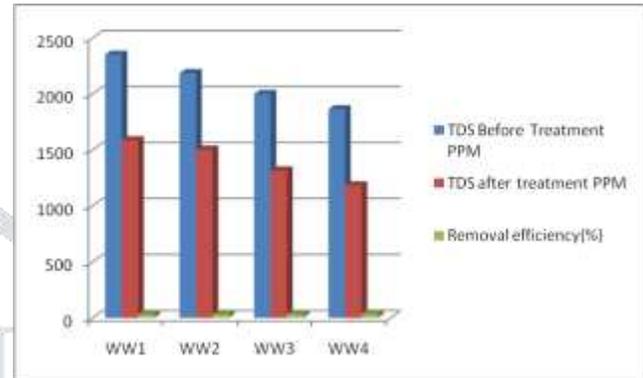
SL. NO	Total Amount of sample water taken(ml)	Quantity of Herbs(mg)	Amount Of TDS in Sample Water(ppm)	Average of TDS in ppm
1	1000	40	598	592
			585	
2	1000	40	704	755
			805	
3	1000	40	585	583
			578	
4	1000	40	426	634
			416	

**3.2 TDS Comparison after 60 minutes**

After 1 hour the filtered solution was estimated to find out the TDS concentration. It is observed that maximum efficiency 36.51% TDS removed for waste water sample WW4, which has showed initial TDS value 1863 mg/l to the final value of 1182 mg/l. The minimum removal efficiency is showed by the sample WW2 with efficiency 31.25% and the amount of TDS reduced from 2185 to 1502 mg/l.

**Table 4. TDS Comparison in Water after 60 Minutes**

SL.NO	Sample code	TDS Before Treatment	TDS after treatment	Removal efficiency (%)
1	WW1	2350	1586	32.48
2	WW2	2185	1502	31.25
3	WW3	1998	1315	34.18
4	WW4	1863	1182	36.51



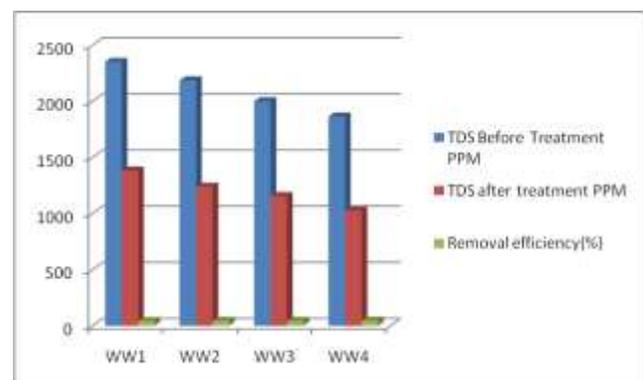
**Fig.2TDS Comparison in Water after 60 Minutes**

**3.3 TDS Comparison after 90 minutes**

The second set of waste water samples mixed with 40 gm of herbal mixture and allowed to withstand 90 minutes. It is observed that maximum efficiency 44.87% TDS removed for waste water sample WW4, which has showed initial TDS value 1863 mg/l to the final value of 1027 mg/l. The minimum removal efficiency is showed by the sample WW3 with efficiency 41.17% and the amount of TDS reduced from 2350 to 1382 mg/l.

**Table 5. TDS Comparison in Water after 90 Minutes**

SL. NO	Sample code	TDS Before Treatment	TDS after treatment	Removal efficiency (%)
1	WW1	2350	1382	41.17
2	WW2	2185	1237	43.36
3	WW3	1998	1155	42.16
4	WW4	1863	1027	44.87



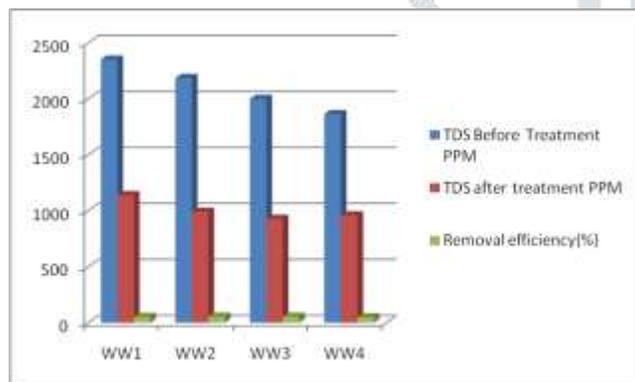
**Fig.3TDS Comparison in Water after 90 Minutes**

### 3.4 TDS Comparison after 120 minutes

The last set of waste water samples mixed with 40 gm of herbal mixture and allowed to withstand 120 minutes. It is observed that maximum efficiency 54.60% TDS removed for waste water sample WW2, which has showed initial TDS value 2185 mg/l to the final value of 992 mg/l. The minimum removal efficiency is showed by the sample WW4 with efficiency 48.49% and the amount of TDS reduced from 1863 to 959 mg/l.

**Table 6. TDS Comparison in Water after 120 Minutes**

SL .NO	Sample code	TDS Before Treatment	TDS after treatment	Removal efficiency (%)
1	WW1	2350	1139	51.49
2	WW2	2185	992	54.60
3	WW3	1998	928	53.53
4	WW4	1863	959	48.49



**Fig.4 TDS Comparison in Water after 120 Minutes**

### 4. CONCLUSION:

The reduction of TDS by using herbal plant parts are effective and can be implemented in the field of water purification systems. The herbal mixture is used in reducing the dissolved solids effectively in the waste water. Time is also an important factor in removal of TDS. The increase in time from 60 min to 120 min helps in removing excess dissolved solids from the same domestic waste water samples.

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