



## RESEARCH ARTICLE

### EFFICACY OF TULSI (HOLY BASIL) FOR REMOVAL OF FLUORIDE IN GROUNDWATER

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#### ABSTRACT

Tulsi (Holy basil) is known for its medicinal value. Tulsi contains a number of beneficial compounds such as phytochemicals which possess antibacterial, antiviral, anti-oxidative and adaptogenic properties. Studies carried out by some workers revealed that the Tulsi is effective in removal of 95% fluoride from groundwater within 20 minutes. The effect of tulsi leaves on fluoridated water studied by the authors and analyzed it is observed that it has negligible defluoridation property. Wide publicity has been given by press and media about the efficacy of Tulsi for defluoridation in Nalgonda district of Andhra Pradesh. It is observed that majority of the people started using Tulsi as a defluoridation technique. This has prompted the authors to study the efficacy of Tulsi (Holy Basil) for removal of fluoride from the groundwater.

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#### INTRODUCTION

Fluoride concentration between 0.6 to 1.7 mg/L in drinking water has beneficial effect on the structure and resistance to decay of children's teeth. Fluoride in excess of 1.5 mg/L causes mottled enamel in children's teeth.

Fluoride in excess of 6.0 mg/L causes pronounced mottling and disfiguration of teeth (Todd, 1980). It was reported earlier that fresh, dried leaves and stem of tulsi plant had a fluoride reported efficiency of 74 to 78% (Raaz Maheshwari and Bina Rani, 2013; Kamble, 2012; Raaz *et al*, 2012)

In the present study groundwater samples from different locations of Nalgonda, Warangal and Karimnagar districts of Andhra Pradesh with moderate to high concentrations of fluoride were collected and analyzed after keeping them in contact with tulsi paste, tulsi leaves and Tulsi liquid (Pancha Tulsi).

#### MATERIALS AND METHOD

Groundwater samples of 6 different locations in select areas of Nalgonda, Warangal and Karimnagar districts were collected in cleaned polythene bottles with necessary precautions (Brown *et al*, 1974). The fluoride concentration in water was determined electrochemically, using fluoride ion selective electrode (APHA, 1991).

The electrode used was an ORION fluoride electrode connected to Orion electrometer. Four sets of water sample were taken in 100 mL beakers and they were added with tulsi paste, tulsi leaves and pancha tulsi liquid respectively.

To 100 mL of first set of samples 75 mg of tulsi leaves were added and each sample was analyzed for fluoride ions at

regular intervals of 1hr, 2hr, 3hr and 4hr duration to observe the efficacy of tulsi leaves.

To the second set and third set of samples 0.5 gm and 1.0 gm of tulsi paste was added and each sample was analyzed by the same method as mentioned above. Then to the fourth set of water samples three drops of pancha tulsi liquid is added and each sample was analyzed for fluoride ions by the above mentioned method (Table 1)

#### RESULTS AND DISCUSSION

The raw water fluoride concentrations are given in Table 1. It is observed that in Batlapally area of Nalgonda district there was no change in fluoride ion concentration in the first 3 hrs and dropped by one mg/L after 4 hrs of contact with tulsi paste (Table 1 & Figure 1).

In Anthampet area of Nalgonda district no change in fluoride concentration was observed even after 4 hrs of contact with tulsi leaves (Table 1 & Figure 2). In Narsampet area of Warangal district fluoride ion concentration dropped by 2 units i.e 7 mg/L to 5 mg/L in first one hour and slightly increased by one unit in 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> hour from 5 mg/L to 6 mg/L (Table 1 & Figure 3). In Dwarakapet area of Warangal district the concentration of fluoride decreased by 1 mg/L in 1<sup>st</sup> hour. Then after 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> hour it came up to its original value of 3 mg/L (Table 1 & Figure 4). In the water sample collected from Yekampally area of Karimnagar district fluoride level decreased from 5 mg/L to 3 mg/L in 1<sup>st</sup> hour and it has shown no alteration in concentration in next three hours (Table 1 & Figure 5). And finally the last sample collected from Lakshmidivpally area of Karimnagar district has shown a decrease in concentration of fluoride ions by one unit in 1<sup>st</sup> hour i.e from 4 mg/L to 3 mg/L and after 2<sup>nd</sup>, 3<sup>rd</sup> and 4<sup>th</sup> hour the concentration was same i.e 3 mg/L (Table 1 & Figure 6).

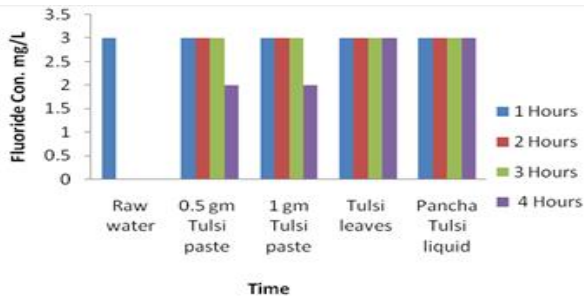
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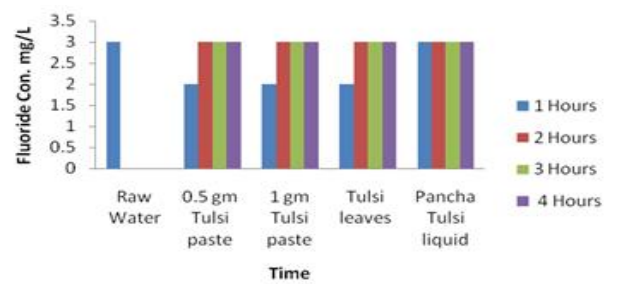
**Table 1** Fluoride concentration in groundwater at different locations

Sample Location Name	Time	Raw water	0.50 gm Tulsi paste (Fresh)*	1.0 gm Tulsi paste (Fresh)*	3 Drops of Pancha Tulsi Liquid ***	75 mg of Tulsi leaves **
Batlapally, Nalgonda District N 16° 56' 07.30" E 78° 51' 48.75"	1 Hours		3	3	3	3
	2 Hours		3	3	3	3
	3 Hours	3 mg/L	3	3	3	3
	4 Hours		2	2	3	3
Anthampeta, Nalgonda District N 17° 02' 01.27" E 78° 53' 13.89"	1 Hours		3	3	3	3
	2 Hours		3	3	3	3
	3 Hours	3 mg/L	3	3	3	3
	4 Hours		3	3	3	3
Narsampet, Warangal District N 17° 55' 28.1" E 79° 52' 31.6"	1 Hours		5	5	5	7
	2 Hours		6	6	6	6
	3 Hours	7 mg/L	6	6	6	7
	4 Hours		6	6	6	7
Dwarakapet, Warangal District N 17° 55' 21.0" E 79° 54' 19.2"	1 Hours		2	2	2	3
	2 Hours		3	3	3	3
	3 Hours	3 mg/L	3	3	3	3
	4 Hours		3	3	3	3
Yekam pally, Karimnagar District N 18° 32' 37.3" E 78° 58' 57.9"	1 Hours		4	3	3	4
	2 Hours		3	3	3	4
	3 Hours	5 mg/L	3	3	3	4
	4 Hours		3	3	3	4
Lakshmidivpally, Karimnagar District N 18° 36' 06.2" E 79° 01' 28.8"	1 Hours		3	3	3	3
	2 Hours		3	3	3	3
	3 Hours	4 mg/L	3	3	3	3
	4 Hours		3	3	3	3

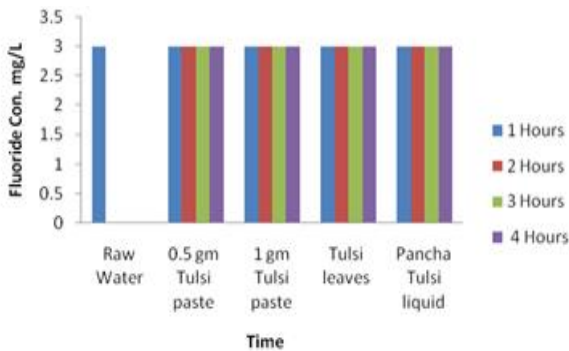
\* 0.5 gm and 1.0 gm of Tulsi paste mixed in 100 mL of groundwater.  
 \*\* 75 mg of Tulsi leaves mixed is 100 mL of groundwater.  
 \*\*\*3 drops of Pancha Tulsi liquid used mixed in 100 mL of groundwater.



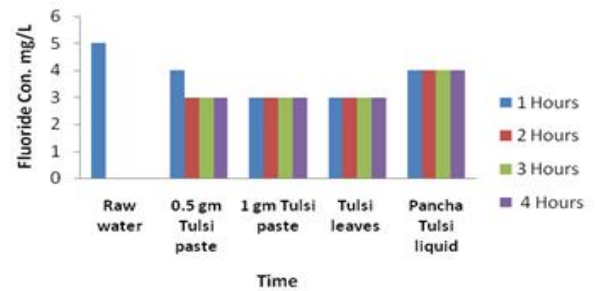
**Figure 1** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in Batlapally, Nalgonda District.



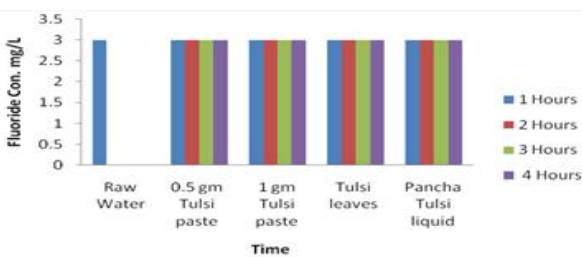
**Figure 4** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in Dwarakapet, Warangal District.



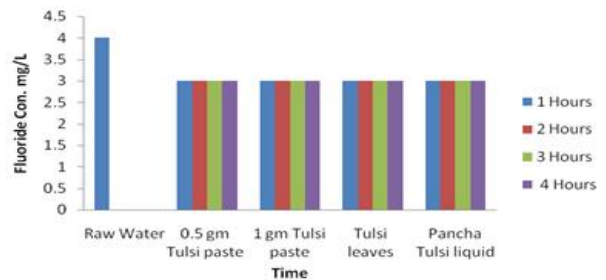
**Figure 2** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in Anthampeta, Nalgonda District.



**Figure 5** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in YekamPally, Karimnagar District.



**Figure 3** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in Narsampet, Warangal District.



**Figure 6** Fluoride concentration in groundwater and groundwater mixed with Tulsi leaves, Tulsi paste, Pancha Tulsi liquid in Lakshmidivpally, Karimnagar District.

## **CONCLUSION**

In the present study it is observed that on treating the groundwater samples containing high fluoride concentration with tulsi leaves there is a slight or no change in fluoride concentration. In the same manner even tulsi paste and panch tulsi liquid were having negligible effect on the concentration of fluoride ions in groundwater. The concentration of fluoride in groundwater samples having high values i.e 7 and 5 mg/L was decreasing by 1 or 2 mg/L and after two to three hours the concentration was increasing again and reaching the levels of fluoride as in raw water. From the study conducted it can be concluded that there is no appreciable decrease in fluoride concentration in the water samples on treating it with tulsi leaves.

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