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Potential of *Azadirachta indica* and *Calendula officinalis* in treatment and purification of potable water

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Abstract- Water is essential for proper metabolic activities and is considered sacred in all religions and faith. It is also known that all civilizations flourished near a water body. When we look at the world map, we find that the geographical areas near rivers and other water bodies are thickly populated. Unfortunately, increasing population and unplanned industrialization have made water bodies easily sink for domestic and industrial effluents. In such a condition different source of water have become highly polluted and its proper management is a serious environmental issue. Drinking water is an important matter of concern because of its qualitative and quantitative shrinking. Most of the rural population in India fulfil their water needs from unprotected sources, for example, rivers, lakes, open wells, supply water, etc. These are the major source of contamination and cause of gastrointestinal diseases among people. So, this research was carried out to study the efficacy of *Azadirachta indica* and *Calendula officinalis* seeds for turbidity and removal of coliform bacteria from the supply water of Hazaribag district, Jharkhand. It is evident from the result that the dried seeds of *Azadirachta indica* and *Calendula officinalis* can reduce the coliform bacteria by 48.70% and 98.15% respectively depending upon the dose and the period of the treatment. *Calendula officinalis* seed was found to be more effective than the *Azadirachta indica* seed in reducing the bacterial population.

Key words: Metabolic activities, Efficacy, *Azadirachta indica, Calendula officinalis,* Bacterial population

INTRODUCTION

More than 80% of the Indian population reside in rural areas, but only 60% of them have access to some form of potable water supply.[1] United Nations Committee on Economic, Social and Cultural Rights in the year 2000 prepared a road map for environmental management, highlighted the necessity of drinking water and included it in the list of person's rights.

According to this report, every human being has the right to use safe drinking water. Similarly, sustainable development goals, in their various points have put the availability of drinking water as one of the goals which need to be achieved. Apart from that various other points related to health are indirectly concerned with safe drinking water.

Although various chemical pollutants are also a matter of concern, agriculture holds a major share of the economy in tropical countries like India, so biological pollutants are very significant. Coliform bacteria among them are high nuisance creator and is responsible for the outbreak of gastrointestinal disease in the monsoon and post monsoon seasons. This cost heavily on the economy as it consumes

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a sizable fund because of medical expenditure. Apart from that the loss of human working is further resulting decreasing working capacity.

At present various techniques are available for the removal of coliform bacteria but they are costly and very complicated. Apart from that, the available techniques require electricity or some other source of energy hence the treatment of water produce pollutant on the other side. So, these techniques are not eco-friendly.

Various plants are known for their anti-microbial properties and such references are available in ancient literature like Charak – Sanhita, Bhav Prakash Nighantu, Vrishk Ayurveda, etc. A large number of modern-day scientists has also worked on the anti-microbial properties of various plants, especially for removing coliform bacteria from potable water.

Plants with antimicrobial properties were screened from existing literatures and only two were selected for the study. Keeping the above scenario in mind the present work was designed to investigate the efficacy of two plants that were selected to find out their possible use in purifying potable water.

In the present study, *Calendula officinalis*, an important species of the genus *Calendula* and is well known for its medicinal properties was used.[2]

Calendula is a phyto-therapeutic plant with many biologically active secondary metabolites like saponins, triterpenes, tannins, and volatile oils.[3-8]

Azadirachta indica has also shown strong bio-sorbent potential by removing several harmful toxic metals.[9,10]

MATERIALS & METHODS

Test material *Azadirachta indica* and *Calendula officinalis* seeds were obtained from different locations of the Hazaribag district and air dried in the shed for further treatment.

Supply water of Hazaribag, near Chhat Talab, was collected and used to observe total coliform, fecal coliform, *E.coli*, and fecal *streptococci.* Apart from that some normal physio-chemical parameters like pH, Temperature, Turbidity, COD, and BOD, were also investigated.

Ten replicas of the test were set for every parameter and the final conclusion was made based on their average.

The serial dilution method (MPN) was followed to study the bacterial population whereas the chemical parameters were investigated following APHA (2005) method.[11]

RESULTS

Results obtained with respect to *Azadirachta indica* are presented in Table 1 whereas results of *Calendula officinalis* are presented in Table 2. After 12hrs of treatments with *Azadirachta indica*, no significant reduction was noted concerning total coliform, fecal coliform, *E.coli*, and fecal *Streptococci*, with the treatment period further increased to 24 hrs total coliform reduced by 21.4% whereas the reduction in total fecal coliform was 17.64%. 26.35% reduction was reported in the case of *E.coli*, a most significant reduction was observed in the case of fecal *streptococci* and the value was more than 50%. After 36 hours of treatment. Reduction in Coliform bacteria was observed slightly more than reduction after 24 hours & the value was 36.35%. So far, fecal Coliform is concerned no further reduction was recorded, whereas, in the case of *E.coli*, the population was reduced by 36.48%, highly significant reduction was recorded in the population of fecal *streptococci* & the value was 87.3%.After 48 hours of treatment, total Coliform reduced up to 48.70% whereas fecal Coliform reduced by 28.50%. The reduction in *E.coli* was 60.81%. The value for fecal *streptococci* was the same as in the case of 36 hours of treatment which indicated that enhancements of the treatment period after 36 hours have a significant impact.

Coming to the influence of *Calendula officinalis*, after 12 hours of treatment total coliform reduced by 59.23% whereas fecal coliform reduced by up to 23.52%. No significant reduction was observed in the case of *E.coli* and fecal *streptococci*. After 24 hours of treatment highly significant reduction was observed in the case of total coliform bacteria & the value was 93.72% fecal coliform was reduced by up to 23.52% & the population of *E.coli* was low up to 18.9%,with a 50% reduction in the population of fecal *streptococci* was noticed. When the treatment period was increased to 36 hours total coliform population was reduced by 95.4% whereas the population of fecal coliform was reduced by 29.4%. Reduction in *E.coli* was observed to be 57.43%. The population of fecal *streptococci* was reduced by more than 50%. After 48 hours of treatment, a slight increase in the reduction of Coliform bacteria was noticed, which means that the impact has reached its optimum value. Fecal Coliform on the other hand reduced up to 88.2%. *E.coli* population was reduced by 83.10% reduction in fecal *streptococci* was stagnant by more than 50%.

Table 1- Efficacy of *Azadirachta indica* seeds in removal of coliform bacteria from water sample

Treatment	Microbiological Parameters							
	Total coliform (1)		Fecal coliform (2)		*E.coli* (3)		Fecal *Streptococci* (4)	
	MPN count	Reduction in %	MPN count	Reduction in %	MPN count	Reduction in %	MPN count	Reduction in %
Control	542		17		148		4	
After 12hrs	542	0%	17	0%	148	0%	4	0%
After 24hrs	426	21.5%	14	17.6%	109	26.35%	<2	<50%
After 36hrs	345	36.34%	14	17.6%	94	36.48%	<0.5	<75%
After 48hrs	278	48.70%	10	41.17%	58	60.81%	<0.5	<75%

Table 2- Efficacy of *Calendula officinalis* seeds in the removal of coliform bacteria from the water sample

Treatment	Microbiological Parameters							
	Total coliform (1)		Fecal coliform (2)		*E.coli* (3)		Fecal *Streptococci* (4)	
	MPN count	Reduction in %	MPN count	Reduction in %	MPN count	Reduction in %	MPN count	Reduction in %
Control	542		17		148		4	
After 12hrs	221	59.22%	13	23.52%	148	0%	4	0%
After 24hrs	34	93.72%	13	29.41%	120	18.91%	2	50%
After 36hrs	25	95.38%	12	76.47%	63	57.43%	<2	<50%
After 48hrs	10	98.15%	2	88.23%	25	83.10%	<2	<50%

Chart showing reduction of coliform bacterial count after treatment with *Azadirachta indica*

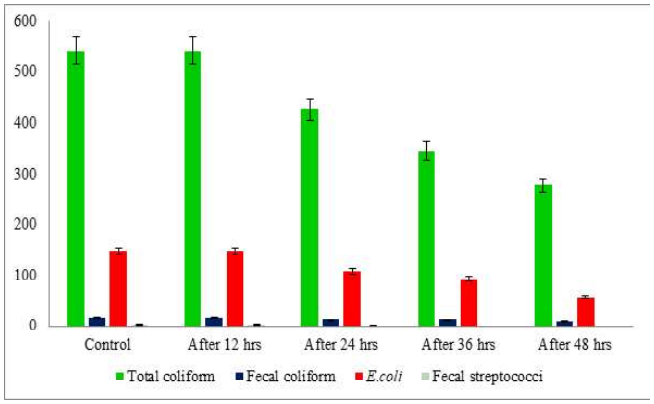
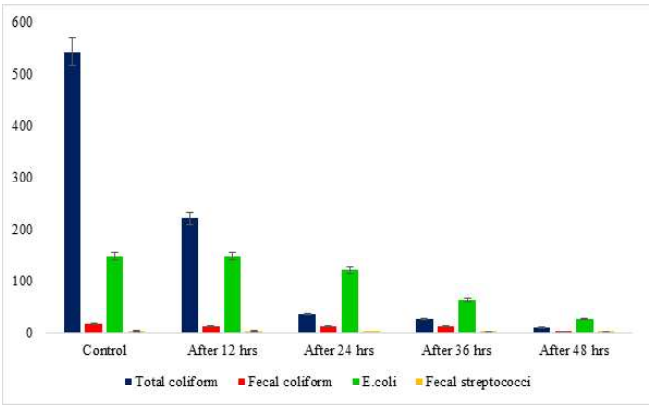


Chart showing reduction of coliform bacterial count after treatment with *Calendula officinalis*



DISCUSSION

The results obtained clearly that the low time period of treatment i.e. 12 hours had no significant impact on all four parameters i.e. total Coliform, fecal Coliform, *E.coli* and fecal *streptococci.*

A minor reduction was recorded in the case of total Coliform, fecal Coliform *E.coli* when the treatment was enhanced to 24 hours, but the reduction in fecal *streptococci* population was most significant & was more than 50% after increasing the time period of treatment up to 36 hours once again not so encouraging result was obtained with respect to total Coliforms & fecal *E.coli*. The value for this parameter was around 20 to 40% but the most notable reduction was found with respect to fecal *streptococci* which reduced up to 87.5% further reduction was not observed when the treatment period was enhanced to 48 hours. This indicates that 36 hours is the most significant treatment period. So far fecal *streptococci* are concerned a very minor reduction in the population of total Coliform and fecal Coliform was noticed even after 48 hours. It can be concluded after analyzing the data observed with *Azadirachta indica* that it is highly effective for fecal *streptococci* only. So far impact on total Coliform fecal, Coliform & *E.coli* is concerned the results were not so encouraging.

When the efficacy of *Calendula officinalis* was taken into consideration total Coliform bacterial population &

fecal Coliform bacterial population were reduced by 59.29 % & respectively after 12 hours no remarkable reduction was noticed with respect to *E.coli* & fecal *streptococci*. A highly encouraging result was obtained so far regarding the total Coliform bacteria Concerned even after the treatment period of 24 hours, the population reduced by nearly 94% to 98%. The most significant reduction in the fecal Coliform bacterial population and *E.coli* bacterial population was observed when the treatment period was 48 hours. Reduction in the population of fecal *streptococci* was significant even after treatment of 24 hours and it was found mentioned when a further increase in treatment period was done. It was observed from the above discussion that *Calendula officinalis* was much more effective as compared to *Azadirachta indica*, even a low treatment period with *Calendula officinalis* was much more effective.

As for *Azadirachta indica* was concerned it was not much effective in reducing the population of total Coliform fecal Coliform, & *E.coli*, but it was highly effective. So far reduction of fecal *streptococci* is concerned, hence water having a high population of fecal *streptococci* can easily be treated using *Azadirachta indica*. *Calendula officinalis* on the other hand can be used for all the form-reported parameters.

REFERENCES

1. **Garg S. K. 1999**. water supply engineering, *Khanna publishers.* **11:**759.
2. **Mishra A. K., Mishra A., Pragya Chattopadhyay P. 2018.** Screening of acute and sub-chronic dermal toxicity of *Calendula officinalis* L. essential oil. *Regul. Toxicol. Pharmacol*, **98:**184-189
3. **Radulescu V., Doneana C. and Loioiu T. C. G. 2000.** Investigation of chemical composition of *Calendula officinalis*. *Revue Roumaine de chimie.* **45(3):**271-275
4. **Chitrakar B., Zhang M., Bhandari B. 2019.** Edible flowers with the common name "Marigold": Their therapeutic values and processing, *Trends Food Sci. Technol*, **89:** 76-875.
5. **Hamburger M., Adler S., Baumann D., Förg A., Weinreich B. 2003.** Preparative purification of the major anti-inflammatory triterpenoid esters from Marigold (*Calendula officinalis*). *Fitoterapia*, **74:** 328–338.
6. **Neukirch H., D'Ambrosio M., Via J. D., Guerriero A. 2004.** Simultaneous quantitative determination of eight triterpenoid monoesters from flowers of 10 varieties of *Calendula officinalis* L. and characterization of a new triterpenoid monoester. *Phytochem. Anal.* **15:** 30–35.
7. **Ohmiya. 2011** A. Diversity of carotenoid composition in flower petals. *Jarq-Jpn. Ag. Res. Q.* **45:** 163–171
8. **Petroviæ L., Lepojevic Z., Sovilj V., Adamoviæ D., Teševiæ V. 2007.** An investigation of CO_2 extraction of marigold (*Calendula officinali*s L.). *J. Serb. Chem. Soc.* **72:** 407–413.
9. **Vinodhini V., Das N. 2010.** Packed bed column studies on Cr (VI) removal from tannery wastewater by neem sawdust. *Desalination*. **264(1–2):** 9–14
10. **Manna S., Saha P., Roy D., Adhikari B., Das P. 2018.** Fixed bed column study for water defluoridation using neem oil-phenolic resin treated plant bio-sorbent, *Journal of Environ Manag.* **212:** 424–432
11. **APHA. 2005.** Standard Methods for the Examination of Water and Waste Water

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