

PERFORMANCE EVALUATION OF NATURAL HERBS FOR ANTIBACTERIAL ACTIVITY IN WATER PURIFICATION

SUNIL B. SOMANI

Faculty & Dean Academic, Shri Sant Gajanan Maharaj College of Engineering,

Shegaon – 444 203, Maharashtra, India

(E-mail: somanisb@rediffmail.com)

NITIN W. INGOLE

Principal, IBSS College of Engineering, Ghatkhed, Amravati 444 602

SHRIKANT S. PATIL

Department of Chemical Technology, S G B Amravati University, Amravati – 444 602

Abstract:

The aim of this study was to evaluate the effectiveness of natural herbs for antibacterial activity in water purification. The antimicrobial activity of Tulsi (*Ocimum Sanctum*), Neem (*Azadirachta indica*), Wheatgrass (*Triticum Aestivum*), Amla (*Phyllanthus Emblica*) and Katakphala (*Strychnos Potatorum*) were tested by Disc Diffusion Method (Kirby –Bauer Method) after extracting the dried material powder of natural herbs in 50% alcohol (ethanol). An antibacterial activity was observed in all herbs used. Most effective an antibacterial activity were observed in Tulsi, Neem and Wheat. In all herbs maximum removal of *E.coli* was found at 30 minutes contact time onwards. The percentage removal of *E.coli* were found 82.05% , 71.79% , 64.1% , 41.03% & 28.20% by using Tulsi, Neem , Wheatgrass , Amla and Katakphala herbs extract respectively, at 30 minute optimum contact time. The optimum removal of *E.coli* was observed at 1% concentration of extract of different herbs used.

Key Words: *Antibacterial activity, Herbs, Extract*

Introduction:

Water is a reactant, a reaction and transport medium, a temperature regulator and an important mechanical support for life processes as we know them. As human population densities increase, it becomes more and more difficult to provide supply of high-quality potable water from surface and ground water stocks, and removal of harmful microorganisms, such as bacteria, viruses and protozoa, assumes greater significance. The standard methods of disinfection include initial filtration of various sorts, and ultraviolet treatment is sometimes employed in special situations; but reliance is mainly placed on chemical treatment species such as chlorine, chlorine dioxide and ozone [White, (1992); Gagnon et al., (2005); Chand et al., (2007)]. Chlorine is the most widely used.

It is a well known fact that most of the chemical disinfectants used for antibacterial activity generate various unwanted chemicals known as disinfection by products (DBPs) in water. These DBPs are associated with harmful effects on humans such as hemolytic anemia cancer risk, nervous system effect and liver effects. Chlorine, which is applied to water at various points in a water treatment for disinfection, combined with naturally occurring organic matter (NOM) to generate DBPs in general and halogenated DBPs is

particular [Clark et al., (1998)]. So, there is need to find alternative method for antibacterial activity [Schoenen, (2002)].

In India, the majority population still lives in village and small towns. These rural / tribal communities do not have access to public water supplies. This population obtains their water supply from unprotected sources such as open dug wells or small streams and ponds which are polluted. The disinfection of water in these rural / tribal areas has a unique problem. Therefore, there is an urgent need for development and widespread promotion of simple disinfection techniques for rural /tribal areas.

Materials and Methods:

Collection of Plant Material: The plant Tulsi (*Ocimum Sanctum*), Neem (*Azadirachta indica*), Wheatgrass (*Triticum Aestivum*), Amla (*Phyllanthus Emblica*) and Katakphala (*Strychnos Potatorum*) materials (leaves /fruits) [Joshi et al., (2009); Biswas et al., (2002); Shirude A.A., (2011); Bole et al., (2010); Mallikharjuna et al., (2009)] were collected shaded dried in drying oven at the temperature 105⁰ C to 110⁰ C for at least 12 hours. The materials of different herbs used were converted into powdered form by using grinding machine and then stored at room temperature.

Preparation of the Extracts: The powders were subjected to successive extraction with organic solvent 50% ethanol by Soxhlet method (Fig.1). The extracts were collected and distilled off on a water bath at atmospheric pressure and the last trace of the solvent was removed in vacuo. Extracts were stored in refrigerator for antimicrobial studies. Stock solution was 20% (w/v) of dried plant materials in solvent. [Gunaselvi et al., (2010)]



Fig.1: Soxhlet Apparatus Used for Extraction

Kirby –Bauer Method: It is used to check the antimicrobial activity of an agent. The effectiveness of an antimicrobial in sensitivity testing is based on the size of the zone of inhibition that surrounds a disk that has been impregnated with a specific concentration of the agent. The zone of inhibition, however, varies with the diffusibility of the agent, the size of the inoculums, the type of medium. It is a standardized system that takes all variables into consideration. It is standard laboratory method [Benson, (2001)] used to check the antimicrobial activity of the herbs used in study.

MPN Test: This test is used to determine the most probable number (MPN) of coliforms (*E. coli*) present per 100 ml of water. In this test a series of nine tubes of lactose broth are inoculated with measured amounts of

water to see if the water contains any lactose –fermenting bacteria that produce gas. If, after incubation gas is seen in any of the lactose broths, it is presumed that coliforms are present in the water sample. In this MPN test, set up used was consist of three double strength lactose broth (DSLБ) tubes and six single strength lactose broth (SSLB) tubes as per the quantities given in the table – 1

Table-1: Test set up

Set	No. of Tubes	Strength	ml of Media	ml of Sample
1	3	DSLБ	10 ml	10ml
2	3	SSLB	5ml	1ml
3	3	SSLB	5ml	0.1 ml

After test set up, incubate the tubes at 35⁰C for 24 hours and examine the tubes to record the number of tubes in each set have 10% gas or more to determine MPN by using Multiple Tube Test standard table [Benson, (2001)].

Results and Discussion:

The extracts of natural herbs Tulsi (*Ocimum Sanctum*), Neem (*Azadirachta indica*), Wheatgrass (*Triticum Aestivum*), Amla (*Phyllanthus Emblica*) and Katakphala (*Strychnos Potatorum*) were tested at different contact time and concentration against *E.coli*. The effect of contact time on removal of *E.coli* was found maximum 30 minutes onwards for all the herbs extract. 30 minutes contact time was found to be optimum for all herbs used in this study (Fig. 2, 3, 4, 5 & 6).

Also the effect of different concentrations of herbs extract used in this study was found maximum 1% onwards for the removal of *E.coli* 1% concentration was found to be optimum concentration for all herbs used in this study (Fig.7, 8, 9, 10 & 11).

The percentage removal of *E.coli* were found 82.05% , 71.79% , 64.1% , 41.03% & 28.20% by using Tulsi, Neem , Wheatgrass, Amla and Katakphala herbs extract respectively, at 30 minute optimum contact time.

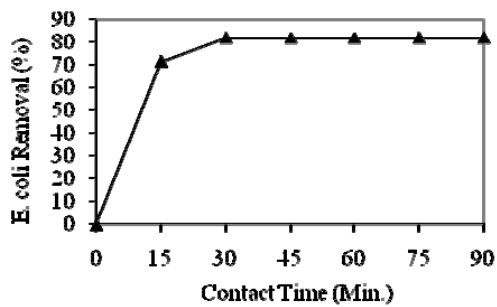


Fig.2: Effect of Contact time on E. coli %age Removal (Tulsi)

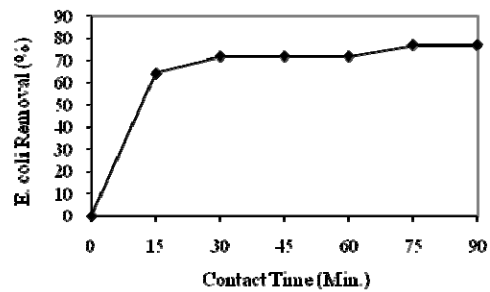


Fig. 3: Effect of Contact time on E. coli %age Removal (Neem)

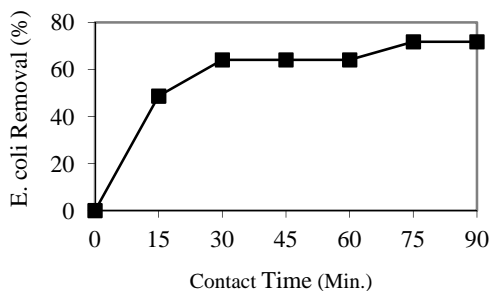


Fig. 4: Effect of Contact time on E. coli %age Removal (Wheatgrass)

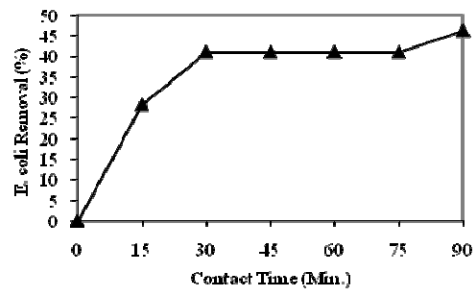


Fig. 5: Effect of Contact time on E. coli %age Removal (Amla)

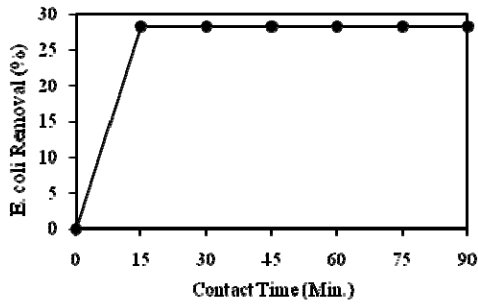


Fig. 6 : Effect of Contact time on E. coli %age Removal (Katakphala)

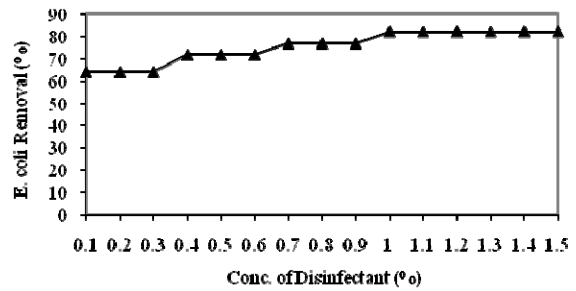


Fig. 7 : Effect of concentration on E. coli %age Removal (Tulsi)

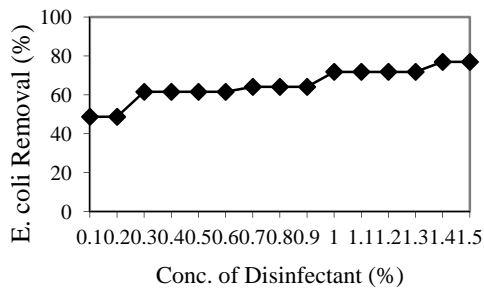


Fig. 8 : Effect of concentration on E. coli %age Removal (Neem)

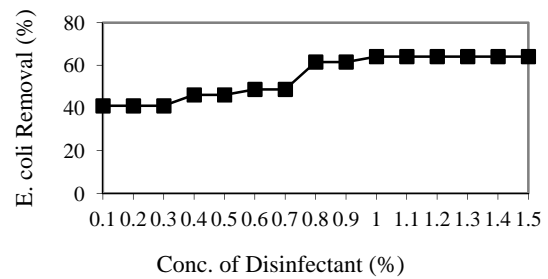


Fig. 9 : Effect of concentration on E. coli %age Removal (Wheatgrass)

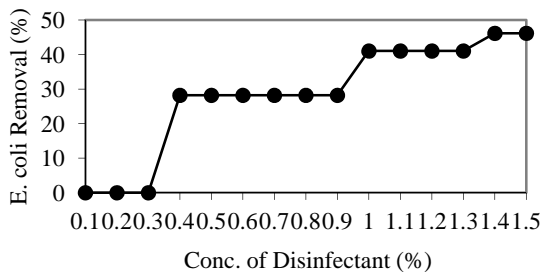


Fig.10: Effect of concentration on E. coli %age Removal (Amla)

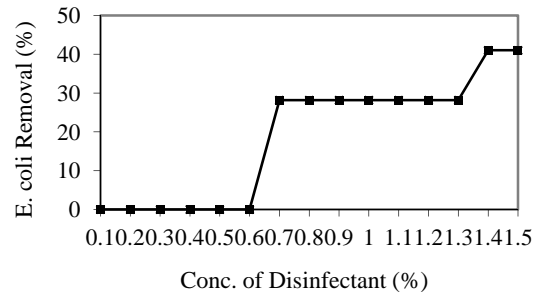


Fig. 11: Effect of concentration on E. coli %age Removal (Katakphala)

Conclusion:

In rural/tribal area, the peoples are using the water from well or any other sources of water without any treatment. They are also reluctant to use chemicals as a disinfectant. These natural herbs used in this study can be effectively use as a disinfectant. Using these disinfectants, pathogenic bacteria from the water can be killed and made water safe for the user. The major population of our country is living in rural/tribal area, where these natural herbs are easily available. Especially Tulsi, Neem and Wheatgrass were found most effective for antibacterial activity in water purification. Disinfection of water by using natural herbs can also help to generate employment facility for the peoples living in this area.

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