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APPLICATION OF THE AQUATIC INDIGENOUS PLANT MATERIAL COAGULANTS FOR WASTE WATER TREATMENT

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ABSTRACT

Laboratory scale experiments were carried out to study the effectiveness of plant materials, viz. Polygonum sps, Typha sps, Limnophyton sps, Commelina sps and Ipomoea sps towards removal of hazardous components including certain important Physico-chemical parameters of contaminated Water. The polluted water when treated with the plants extracts selected for the study removed turbidity upto 97 % following Coagulation-flocculation process. Maximum turbidity from the polluted water was removed by Typha sps.The pH of water tends to be neutral, the most suitable pH for drinking water which was slightly acidic before treatment with plant extracts. The wastewater revealed better Conductivity results after the treatment. Simultaneously, amount of solid waste get decreased, making the water more potable. Aquatic plants thus act as the best natural coagulants, thereby reducing the level of contaminants from the polluted water. Also, other natural bodies which are used by the rural people for domestic purposes can be purified by implementing this cost effective and ecofriendly technology.

INTRODUCTION

Water resources all over the world are threatened not only by over exploitation and poor management but also by ecological degradation. According to a survey conducted by UNEP, 20% of world's population lacks access to safe drinking water and 50% of the world's population lacks access to safe sanitation (Rao, 2005).

Wastewater disposal is the major problem being faced by us. In developing countries, like India presently, only about 10% of the wastewater generated is treated; the rest is discharged as it is into our water bodies. The most commonly faced problem in disposal of wastewaters is their color and turbidity. Wastewaters from textile, food, cosmetics, paper and leather industries contain dyes which being recalcitrant in nature and are difficult to degrade. These dyes are highly colored compounds and leads to reduction of sunlight penetration in rivers, lakes or lagoons that in turn decrease photosynthetic activity and reduces the dissolved oxygen concentration. Such waters can be treated effectively using conventional treatment systems incorporating coagulation, flocculation, solid-liquid separation and disinfection. Coagulation or destabilization of colloidal suspensions results in aggregation of colloidal particles by physical and chemical processes. Flocculation results in the formation of larger and settleable structures by bridging them. The flocculent properties of different

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plant materials and their incorporation in polluted water are well documented by many researchers. (Ghebremichael, 2004; Kalibbala, 2008 and Marobhe, 2008). These natural coagulants which can be readily propagated and easily accessible to common persons would offer solution to our most plagued environmental issues and water pollution. Tannins, essential oils, sap or adhesive agents contained in plants are the active agents that bring about coagulation. Natural polymers such as starch, gums, glues, alginates, etc., function as bridging flocculants. The present study aimed at the development of water purification technology using natural coagulants which can be easily accessible to the rural people who regularly become the victims of contaminated drinking water.

MATERIALS AND METHODS

Turbid water samples of river Mahi were collected from different sites and analyzed for Turbidity, pH and Conductivity using standard methods (APHA-AWWA-AWPC, 1975 and Trivedy and Goel, 1984). For the assessment of coagulating flocculating efficacy of plant materials towards the removal of pollutants, extracts of Polygonum, Commelina, Typha, Ipomoea and Limnophyton, were prepared and the turbid water samples were treated for 30 minutes, 1 day, 2 days, 3 days and 4 days. A jar test method (Hans and Grayson, 1999) was used to check the flocculation. After each experimental period the samples were again analyzed to obtain the final values. The data was compared with drinking water quality standards.

RESULTS & DISCUSSION

Turbidity

Figure 1 represents the reduction in the turbidity after each experimental period. Polygonum reduces the turbidity by 92%, *Commelina* by 91%, *Typha* by 97%, Ipomoea by 93% and *Limnophyton* by 95%. The order of reduction was *Typha*> *Limnophyton*> *Ipomoea*> *Polygonum*> *Commelina*. All the plants efficiently removed turbidity of the waste water, the maximum efficacy shown by Typha.

The use of plant materials as natural coagulants to clarify turbidity of wastewaters is of common practice since ancient times (Folkard *et al*. 1995).The present research also reported reduction in the turbidity of river water samples. This reduction in turbidity is also comparable to those achieved by natural coagulant like *Moringa oleifera, M. drouhardii; M. stenopetala* and *M. peregrine* seeds (Jahn, 2001 and Gunaratna *et al*. 2007). Thus, the results of the present study confirmed that Polygonum, Typha, Limnophyton, Commelina and Ipomoea are natural coagulants and can be used as good clarifying agent and also unveil their potential as material for water clarification through coagulation and flocculation process. Typha is one of the best natural coagulants.

pH

All the plants studied did not reveal much change in the value of pH after treatment with the plant materials (Fig 2). The pH value on an average ranged from 6.4 to 7.4 showing neutral condition of the polluted water.

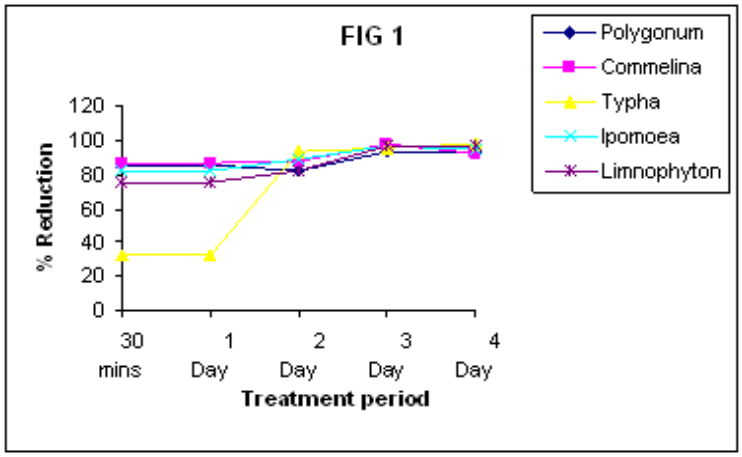
The current research did not report any alteration in pH values of the turbid waters of River Mahi after treating them with plant materials. Moreover, even after the treatment, the pH of water maintained its neutral condition.

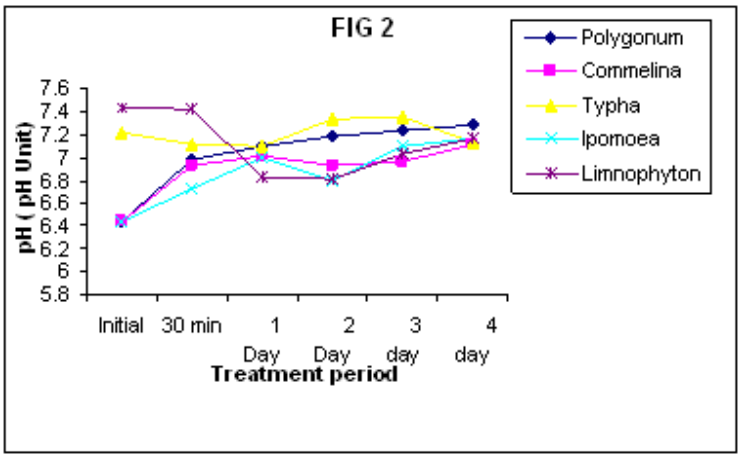
Okonko *et al*. 2007 investigated that the waste water collected from cassava processing unit, dyes and tie textile and Ogudu river discharging sites, when treated with latex of Calotropis procera showed significant reduction in alkaline pH indicating a decrease from alkaline pH to near neutral pH. Hence, the natural coagulants also would help in maintaining neutral pH of waste water which is one of the most promising parameter as far as the potability is concerned.

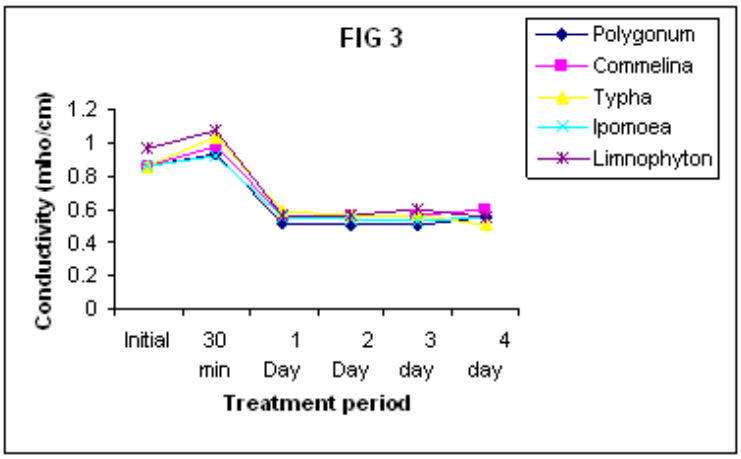
Conductivity

Fig 3 shows the results of conductivity of turbid water after the treatment with plant materials. In the first 30 minutes, a rise in the conductivity and thereafter a fall were reported at day 1. However, it did not reveal any change after 4 days treatment. But then no undesirable alteration in the value of conductivity was noticed.

The turbid river water quality did not vary much during the period of experiments except for 3o minutes experimental period where a slight rise in the conductivity was observed. Treatment with natural coagulants did not undesirably alter the conductivity and even after the treatment, its value fall within the drinking water quality standards (APHA-AWWA-AWPC, 1975). Similar results were obtained by Emelie *et al*. (2008) wherein Moringa oleifera seeds had no effect on the pH, alkalinity or conductivity of the treated water.







Therefore, effect of adding coagulation extracts derived from plant origin not only remove turbidity of river water but simultaneously revealed no change in water quality and characteristics. Thus, all experimental natural coagulants show a major advantage compared to aluminium sulphate which is the most conventionally used chemical for the removal of turbidity of water. Moreover, the natural coagulants affect neither pH nor conductivity whereas aluminum sulphate influences all of these.

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