IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 2 Issue 5, May 2015.
www.ijiset.com
ISSN 2348 – 7968

Application of Zia Mays, Cucorbita Pepo, Carica Papaya as Natural Coagulants for Purification of River Water

Dr. Shweta Verma[1*], Isma Mehraj[2], Anshul Jain [3], Anil Prasad Ray[4]

[1]Assistant Professor, D.Y. Patil College of Engineering, Akurdi, Pune, Maharashtra ,India,

[2, 3, 4,] B.E. Students, Department of Civil Engineering, D.Y. Patil College of Engineering, Akurdi, Pune, Maharashtra, 411044, India

Abstract

Quality of water and its treatment has becoming an increasing concern in developing nations like in India, where the quality is poor, proper treatment is lacking. The high cost of treated water makes most people in rural communities to resort to readily available sources which are normally of low quality exposing them to water borne diseases. Safety and health are primary considerations for water purification. Access to save water is a serious issue affecting people of all ages for those living in remote communities and far flung areas where availability of improved water sources is limited; it is a great challenge to impact quality of life in significant ways. This research is carried out to confront the effectiveness of powder extracted from matured dried Zia Mays, Cucorbita Pepo, Carica Papaya as active coagulant in water, which is readily available and commonly recognizable in most urban and rural communities of India. The present research work which was carried on three natural seeds i.e. Zia Mays, Cucurbita Pepo, Carica Papaya in treatment of River water that act as natural coagulants. It was observed out of the above seeds, Zia Mays showed the best results. It reduced the total pH, Turbidity, Alkalinity, Hardness upto significant limits.

Keywords: *Natural coagulants, River water, Seeds, Purification*

1. Introduction

Chemical coagulants like aluminium sulphate (alum), $FeCl_2$ are used in waste water treatment plant. The excess use of chemical coagulants used can effect human health, aluminium causes neurological diseases such as presenile dementia [1]. Coagulation and flocculation helps in removal of colloidal particles, available coagulants like aluminium sulphate and poly aluminium chloride. They are cheap, effective and esay to handle. Aluminium can be overdosed for efficient coagulation but overdose of aluminium salt increases the alum concentration and causes turbidity. Excess intake of aluminium causes alzheimers disease[4].

In developing countries like India, people live in extreme poverty have been drinking highly turbid and micro biologically contaminated water as they lake knowledge of proper treated water, they do not afford to use high cost of treatment methods using chemical coagulants. There are few problems that cause large seasonal variations in raw water and increase its turbidity [4,5].

Natural coagulants have been used for domestic purposes since traditional time in tropical rural areas[6,7]. Few analysis have been described for using of natural coagulants like Moringa Oleifera seeds, Cactus Latifaria, Mesquite Bean, Nirmali seeds[10]. The main advantage of using natural plant based coagulants are cost effective, less production of pH and biodegradability. The naturally occurring coagulants are presumed safe for human health[8]. The main objective of this study is to investigate the potential of Zia Mays, Cucorbita Pepo, Carica Papaya seeds, in coagulation of turbid water.

2. Materials and Method

2.1 Collection of Water Sample

The water sample used for study was aseptically collected from Pawna dam river (Ravet), Pune, India.

2.2 Collection and Identification of Seeds

Seeds used in this study i.e. Zia Mays, Cucorbita Pepo, Carica Papaya were collected from seed market located nearby.

2.3 Preparation of Seed Powder

The seeds were dried at ambient temperatue 23-25 ^oC for a period of 5 days before crushing. The seeds were made into fine powder and was sieved through 1.18mm standard sieve size. The powder was collected in sterile bottle with air tight cap.

ISSN 2348 – 7968

2.4 Preparation of Seed Solution

Different concentrations of seeds Zia Mays, Cucorbita Pepo, Carica Papaya were made by dissolving 1gm, 2gm and 3gm in 100ml of distilled water each contain in a conical flask to obtain 1%, 2% and 3% of solution respectively. The solution was shaken properly for 1 minute for activation and extraction of coagulant and anti microbial proteins in the seed powder. Each of the concentration was poured into 1 litre of the raw water contained in a beaker and water was stirred for 1 minute and was kept for magnetic stirring for 0.5 hour, 1 hour, 2 hours respectively. The treated water was then allowed to stand undisturbed for 6 hours. Later, top layer of 100 ml was collected and subjected to post treatment analysis.

2.5 Method Used for Physiological Study of Water

For water sample, physiochemical parameters were determined prior and after treatment with seed solutions of Zia Mays, Cucorbita Pepo, Carica Papaya using specific methods. The parameters determined were pH, Turbidity, Alkalinity, Hardness.

3. Result and Discussion

pH: With the present study treatment of Zia Mays, Cucorbita Pepo, Carica Papaya seed powder that was given to the raw water samples in different doses. During the analysis, it was observed that after treatment with Zia Mays powder ; pH of sample was decreased from 8.5 to 7.2, 7.0, 7.5 for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table1, Fig1]. After treatment the range of pH was within the limit. Similarly, it was observed for Cucorbita Pepo ; pH of sample was decreased from 8.5 to 7.0, 7.0, 7.2 for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table2]. For Carica Papaya seed powder; it was observed that pH of the sample was decreased from 7.8 to 7.2, 7.5, 7.6 for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table3].

Turbidity: The initial turbidity for the Raw water sample taken for Zia Mays was 31 NTU which was beyond the limits of BIS/GOI/WHO standards. It was observed after treatment the turbidity got reduced from 31 NTU to 5.6, 3.8, 2.7 NTU for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table1, Fig2]. Similarly after treatment with Cucorbita Pepo the turbidity got reduced from 27 NTU to 5.7 ,4.9 ,4.0 for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table2] and for treatment with Carica Papaya seeds the turbidity from 32 NTU got reduced to 6.8 , 5.0 ,3.2 NTU for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table3]. The turbidity reduced below 5 NTU. Due to this treatment there was an improvement in the flock size and flock settled rapidly. These analysis shows that with increase in dose of coagulants the turbidity got reduced to a good extent.

Alkalinity: Alkalinity during the research work was observed to be 320 mg/litre for raw water but after treatment with Zia Mays seeds alkalinity got reduced to 172, 140 ,120 mg/litre for for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table1, Fig3]. Similarly with the use Cucurbita Pepo the initial alkalinity of the water sample was 190 mg/litre but after treatment the values for different doses were 105, 92, 83.0 mg/litre for for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table2] and for treatment with Carica Papaya with the initial alkalinity of raw water 140mg/litre was reduced to 90,100,100 mg/litre for 1gm/lit, 2gm/lit, 3gm/lit dose respectively[Table3]. The alkalinity present was within the range of BIS/WHO/GOI standards. It was observed the seeds had the natural buffering capacity.The flocks were light however it confined the reduction of alkalinity.

Hardness: Hardness was 204 mg/lit for raw water after treatment with Zia Mays the hardness got reduced to 190, 144, 96 mg/litre for 1gm/lit, 2gm/lit, 3gm/lit dose respectively.Similarly Cucurbita Pepo with initial Hardness of the water sample 210 mg/litre but after treatment the values were 170, 150, 127 mg/litre for 1gm/lit, 2gm/lit, 3gm/lit dose respectively and for treatment with Carica Papaya with the initial Hardness of raw water was 200mg/litre was reduced to 150,110,100 mg/litre for 1gm/lit, 2gm/lit, 3gm/lit dose respectively.It was observed that hardness of water is decreased with increase in dose of coagulants used. Hardness in raw water is due to the presence of calcium,magnesium and other hardness causing substances that means if hardness increases, the required dosage of seed powder increases.

Colour : The initial brown colour of raw water sample was completely removed after treatment with Zia Mays, Cucorbita Pepo and Carica Papaya. The seeds show absorbent Properties.

ISSN 2348 – 7968

Table 1: Parameters studied before and after treatment of waste water for Zea Mays seed powder.

Sr. No.	*Parameters*	*Before Treat-ment*	*After Treatment* (gm/lit)			*BIS Std.*
			1	2	3	
1	pH	8.5	7.2	7	7.5	6.5-8.5
2	Turbidity(NTU)	31	5.6	3.8	2.7	5-10
3	Alkalinity(mg/lit)	320	172	140	120	200-600
4	Hardness(mg/lit)	204	190	144	96	500
5	Colour	Brown	Colourless			Colour -less

Table2: Parameters studied before and after treatment of waste water for Cucurbita.

Sr. No.	*Parameters*	*Before Treat-ment*	*After Treatment* (gm/lit)			*BIS Std.*
			1	2	3	
1	pH	8.5	7	7	7.2	6.5-8.5
2	Turbidity(NTU)	27	5.7	4.9	4.0	5-10
3	Alkalinity(mg/lit)	190	105	92	83	200-600
4	Hardness(mg/lit)	210	170	150	127	500
5	Colour	Brown	Colourless			Colour-less

Table 3: Parameters studied before and after treatment of waste water Papaya.

Sr. No.	*Parameters*	*Before Treat-ment*	*After Treatment* (gm/lit)			*BIS Std.*
			1	2	3	
1	pH	7.8	7.2	7.5	7.6	6.5-8.5
2	Turbidity(NTU)	32	6.8	5.0	3.2	5-10
3	Alkalinity(mg/lit)	140	90	100	100	200-600
4	Hardness(mg/lit)	200	150	110	100	500
5	Colour	Mud Brown	Colourless			Colour-less

The results obtained from seed powder Zia Mays [Table 1], a significant change in parameters as compared to Cucurbita Pepo, Carica Papaya was observed. The graphical presentation for Zia Mays, showing change in various parameters is as follows:

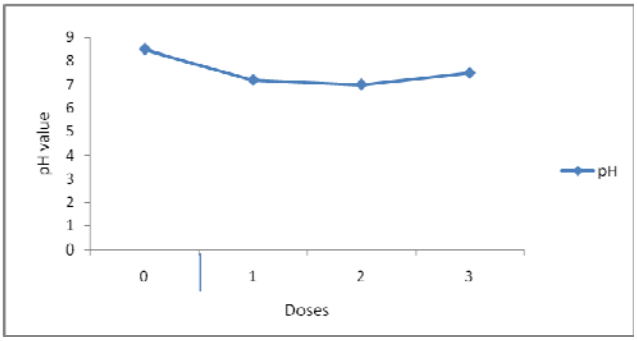

Figure 1 : pH of water before and after treatment of Zia Mays seed powder.

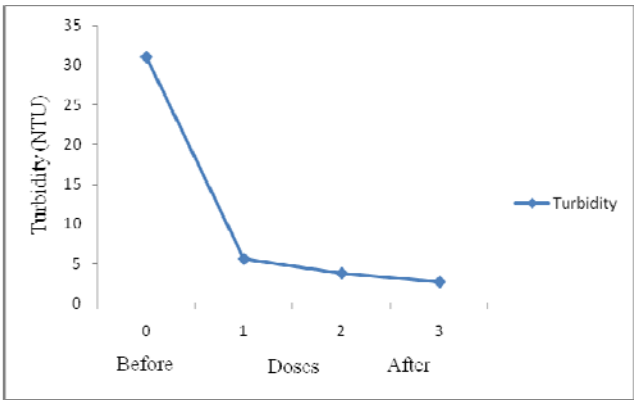

Figure 2 : Turbidity of water before and after treatment of Zia Mays seed powder.

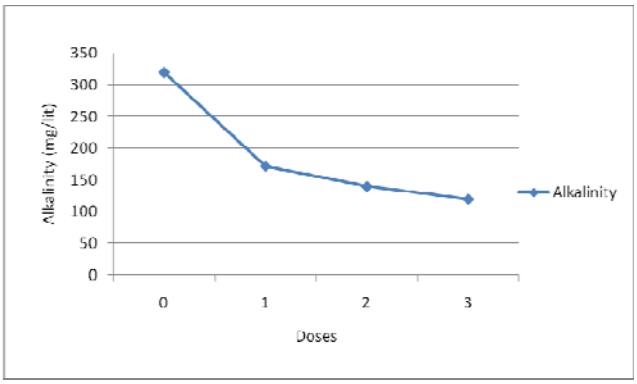

Figure 3: Alkalinity of water before and after treatment of Zia Mays seed powder.

ISSN 2348 – 7968

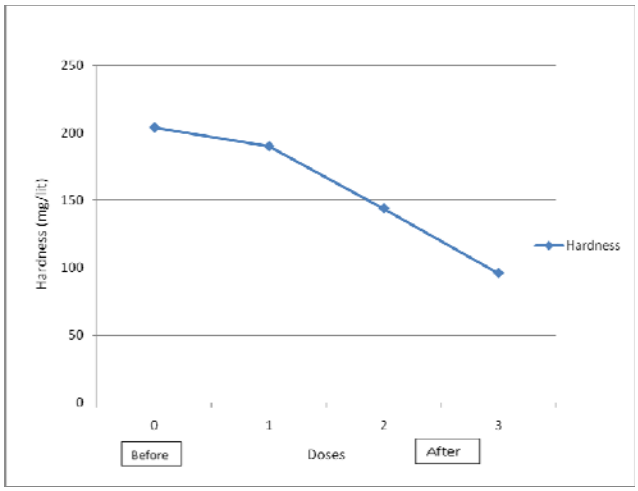

Figure 4 : Hardness of water before and after treatment of Zia Mays seed powder.

4. Conclusions

The present research work which was carried on three natural seeds i.e. Zia Mays, Cucurbita Pepo, Carica Papaya in treatment of River water that act as natural coagulants. It was observed out of the above seeds, Zia Mays showed the best results. It reduced the total pH, Turbidity, Alkalinity, Hardness upto significant limits. The seeds used are not giving any toxic effect. Its eco-friendly and cheaper method of water treatment. These seeds can be used in rural areas where no facilities are available for the water treatment also the sludge settled can be used as bio fertilizer advantage for rural villages.It may be noted the treatment wont be much suitable for drinking purpose but can be used in household work and washing irrigation purpose in villages.

5. References

[1] Francis kweku Amagloh, Amos Benang, Effectiveness of Moringa Oleifera Seed as Coagulant for water purification; University for development Studies, Faculty of Applied Sciences,Department of Applied Chemistry and BioChemistry 2009;4(1) 119-123.

[2] A H Birima, H A Hammad, MNM Desa, ZC Muda , Extraction of Natural Coagulant from Peanut Seeds for Treatment of Turbid water; Centre of storm water and Geohazard Management,University Tenaga, Malaysia 2013;(16)1-4.

[3] M.N.Alo ,C Anyim, Coagulation and Anti Microbial Activities of Moringa Oliefera seeds;Department of Medical laboratory,Ebonye State University,Nigeria 2012;3(2) 887:894.

[4] B. Bina, M. H. Mehdinejad, M. Nikaeen, H. Movahedian Attar ,Effectiveness of chitosan as natural coagulant aid in treating turbid waters; Department of Environmental Health Engineering, School of Public Health,Isfahan, Iran; 2009, Vol. 6, No. 4, 247-252.

[5] Md. Asrafuzzaman,A. N. M. Fakhruddin andMd. Alamgir Hossain,Reduction of Turbidity ofWater Using Locally available Natural Coagulants1Department of Environmental Sciences, Jahangirnagar University, Savar, Bangladesh 2011; Article ID 632189, 1-6.

[6] Chitteti Ramamurthy, Malige Uma Maheswari, Natarajan Selvaganabathy,Evaluation of eco-friendly coagulant from Trigonella foenum-graecum seed;Department of Biochemistry and Molecular Biology, School of Life Sciences, Pondicherry University, India 2012; 2, 58-63.

[7] John bratby,coagulation nd flocculation,With an emphasis on water and wastewater treatment,Uplands Press ltd,Publishers of "filtration & separation " magazine,Croydon England;1980 1-334.

[8] Kenneth Yongabi, David Lewis and Paul Harris, Natural Materials for Sustainable,Water Pollution Management,School of Chemical Engineering, The University of Adelaide South Australia 1980;154-188.

[9] Orhue, E. R.1 and Osaigbovo, The effect of rubber effluent on some chemical properties of Soil and early growth of maize (zea mays), Department of Soil Science, Faculty of Agriculture, University of Benin, PMB 1154, Benin City, Nigeria 2013;6(1) 164-168.

[10] N.B.Prakash, Vimala Sockan, P.Jayakaran,Waste Water Treatment by Coagulation and Flocculation Faculty, Salalah College of Technology, Salalah, Sultanate of Oman;March 2014, 480- 484.