COMPARATIVE STUDY ON EFFICIENCY OF NATURAL COAGULANTS CONSIDERING JET EFFECT

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Abstract : Surveys and Researches of various local plants used by ancient Indian peoples to purify water was found much more effective and harmless, in comparison with the existing water treating synthetic coagulants .
The findings indicated that from time immemorial, local people have used rich knowledge to treat their water. Plants identified were Moringaoleifera, Jatropha curcas, Citrussaurontifolia, Strynospotatorium. A review of the of the potentials of these plants coagulants with respect to turbidity removal and disinfection of water borne diseases were found far more ahead of chemical coagulants and disinfectants such as Alum and Chlorine. Studies have shown that Organic coagulants (biocoagulants) especially Moringaoleifera seeds are as efficient as Alum in purifying water and wastewater at low cost. The need to further develop biocoagulants as green treatment alternative for global water management considering growing global water crises is emphasized. As a contribution to the rich heritage of ancient Indian knowledge, and need to utilize the more efficient coagulants than the present one, we have undertaken this project.
In this project work we are using various natural coagulant specifically Cactus, Chickpea, Potato starch, Indian bean and for basis of comparison, MoringaOliefera, PAC and Alum. Tests for determining Turbidity, TS, pH will be performed on the turbid samples before adding coagulants. Same tests will be performed after addition of coagulants. Firstly the process of manufacturing the powdered form coagulants from the raw materials of respective organic species is done then are put to end use.

IndexTerms **- Natural coagulant ,Turbidity , Moringaolifera, Jatropha curcas ,citrus aurontifolia , strynospotatorium**

I. INTRODUCTION

There are many sources of water contamination, and also there are many ways to clean it up. New developments in environmental engineering are providing promising solutions to many water pollution problems. Chemicals can be added to toxic waste water to precipitate, immobilize, or solidify contaminants. Natural water is usually turbid to some extent. Coagulation and flocculation are commonly used methods for water turbidity removal, and are usually conducted by adding chemicals such as salts of aluminium and iron and polyelectrolytes. The first investigations about harmful influence of these chemicals on human health were published in the 60's of the 20th century. Those and later publications showed that the residues of aluminium salts in the water can cause Alzheimer's disease. Also, some studies indicate that some of synthetic organic polymers, such as acrylamide, have strong neurotoxic and carcinogenic effect.

All these studies indicate that, though science have done advancements in the field of the coagulants and water treatment process, still there are tremendous drawbacks and harmful effects which are imparted due to the synthetic coagulants.

In project, I am implementing and suggesting rarely used natural coagulants with their statistical, and comparative data.

II. LITERATURE SURVEY

The use of coagulant in removing suspended solids from semi-aerobic landfill leachate. – at, School of civilEngineering, Uni- SiansMalaysiaIn this paper the authors have accomplished the coagulation process by using synthetic coagulants. Suspended solids, color and COD, these are main pollutant in leachate, the efficiency of removing these pollutant by using fecl3,feSO4 and Alum as coagulant, is compared.Optimization of physical parameters of coagulation Flocculation in water treatment- At International congress on environmental research Uni- Mauritius. The main aim of carrying out this experiment by author is to verify the efficiency of the natural coagulant such as moringaoliefera, in various different physical conditions, used as coagulant, Optimized dosage is found out for coagulation, considering various Physical Parameters such as, Container Geometry , jar configuration, RMVG and SMVG.

III. Coagulant and method of manufacturing

Coagulation is an essential process in the treatment of both turbid surface and industrial wastewaters. Examples of chemical-based coagulants that are available commercially include lime, alum, ferric chloride and polyaluminium chloride. These coagulants affect the factors such as comparatively high costs, harmful effects on human health as well as the fact that they appreciably affect pH of treated waters. As such, it is desirable to substitute these chemical coagulants with cost-effective natural coagulants to offset the aforesaid disadvantages. Research on natural coagulants have been focused on Cactus powder,

Potato starch, Rajma seeds for the past 20 years and more researchers are studying applications of these natural coagulants such as long bean extract and cactus opuntia. It was determined, via two separate studies, that long bean extract was ineffective in removing turbidity while cactus opuntia exhibited high turbidity removal efficiency. Hence, the positive outcome of the latter study justifies further research on cactus opuntiaas a natural macromolecular coagulant.

Coagulation is an important wastewater treatment process used to reduce water turbidity and normally precedes the more complex secondary and tertiary water treatment processes. In this study, the effectiveness of a natural macromolecular coagulant derived from a Cactus species, Rajma powder, S. Potatorum for turbidity removal from estuarine and river waters were evaluated using jar test. Initial turbidity values measured at 499 PPM and 547 PPM for estuarine and river waters respectively were reduced by as much as 98% (estuarine) and 70% (river). Other parameters such as pH as well as alkalinity were also studied. It was indicated that the coagulant did not have a considerable effect on final pH of the waters. The amount of cactus added was well correlated with the final turbidity and alkalinity of the waters. High turbidity removal determined in this study indicates that cactus opuntia has the potential to be utilized for surface water treatment applications.

The natural coagulants used for coagulation process are:

1. Cactus opuntia
2. Chickpea
3. Rajma powder
4. Dolichos Lablab
5. StrychnosPotatorum

1. Cactus opuntia:

This coagulant is used to evaluate the efficiency and for turbidity removal from surface waters (estuarine and river) using jar test and determine the effect of dosage of cactus powder on turbidity, pH and alkalinity of the waters.

Cactus opuntia used in the study was collected and then is washed with tap water and subsequently sliced into small pieces to facilitate drying. The sliced cactus was then dried in oven for 8 hours at 80°C. The dried cactus was ground into fine powders using pestle and mortar and subsequently sieved to sizes 53 – 106 µm. Elemental analysis of the cactus powder to determine its carbon, hydrogen and nitrogen contents was carried out. The pH of cactus powder is determined by mixing the powder in distilled water at dosages of 13, 53, 213 and 853 mg/L and stirred at 130 rpm for 3 minutes prior to measurement.

It was presumed that the samples are contaminated with oil and grease that originated from spent diesel spilled from boats in addition to other turbid-causing substances such as silt within the estuary. River water samples are collected from a river. These samples are also turbid possibly due to high concentrations of silt along the river.

The test was conducted via jar test apparatus where raw water samples of 300 mL each were stirred at 130 rpm for 3 minutes in which cactus powder was added during this time. Cactus powder of dosages of 13, 53, 213 and 853 mg/L for each water samples were tested. This was the mixing stage. After 3 minutes, the coagulation stage commenced where the samples were stirred again at 80 rpm for 30 minutes. After the coagulation stage, the samples were allowed to stand for 30 minutes after which treatment was completed (settling stage). Turbidity, pH and alkalinity of samples before and after jar test are measured and tabulated. Turbidity values are determined via turbiditimeter while pH values via pH meter. Alkalinity values are determined by using titration.

2. Chickpea:

It is a legume belonging to the family Fabaceae reported that turbidity reduced up to 95.89% for highly turbid water which is almost as same as the reduction capacity of alum. Chickpea was also found to possess antimicrobial properties. It has been also reported that it has the ability to absorb heavy metals from water.

Chickpea: Cicer Arientinum

3. Rajma powder:

Suspended solids are the main contributor of turbidity to raw water. The normal source of suspended solid is clay particles resulting from the erosion of soil in that scrupulous area; potable water quality must the accepted drinking water standards of a society. The substantial characteristics of potable water that should meet the standard is turbidity. Within several cases this standard is as low as 1 PPM and in a few other cases is as high as 5 PPM as utmost acceptable.

The dominant mechanism in this regard is bridging between the colloidal particles. The usage of polymers for water treatment processes are adopted since 1980. Cationic polymers are used as primary coagulants, whereas nonionic and anionic polymers are used as coagulant The advantages of polymers over mineral coagulants are: more than 50% reduction in sludge volume, lower water content, better dewatering characteristic, no

effects on water pH, no increase in total dissolved solids of finished water, no dissolution of any substances in the treated water, which in the case of mineral coagulants the dissolution of Al and Fe happens and shorter settling time. The main objective of this research is surveying the application of Rajma powder in turbidity removal.

The results of this research are in accordance to turbidity removal by different dosage of Rajma powder used in Jar Test. Since the dosage of Rajma powder in this research was Moderate than other traditional chemicals application in turbidity removal with dosage of up to 10 mg/L in a water treatment plant, the efficiency in turbidity removal was also lower. With many advantages of Rajma Powder that is a natural coagulant for water treatment.

4. Dolichos Lablab:

This is also known as Hyacinth bean and belongs to the family reported that turbidity of water decreased from 500 PPM to 4.3 PPM when treated with Dolichos Lablab seed peels extract.

Dolichos Lablab: Indian Bean

5.Potato starch: Solanum Tuberosum

IV. METHODOLOGY OF PROJECT

In our project, we are considering 4 organic coagulants and comparison between them. We are considering jet effect on various parameters using these coagulants to determine pH, Color, Odour, Turbidity, Total solids, Dosage of coagulants. As we are providing larger contaners, the results obtained will be practically used in WTP.

METHODOLOGY FOR CHICKPEA:

Seeds are extracted from the plant fruits.

Seeds are dried up for upto 3 days.

Seeds are ground into fine powder. A mixture of water and ground seed material is prepared.

It is mixed for 5 to 10 minutes. The faster is stirred, the less time is required.

Finally after the sediments settle, the treated water is decanted and tested by measuring parameters like pH, turbidity and colour.

Procedure:-

250lit of turbid water is taken in the inlet tank

From inlet tank it is allowed to flow into the flocculation chamber, In this chamber metered dosage of coagulants are added, also it has jet for mixing them thoroughly

Processed water is allowed to flow into the sedimentation tank, for detention, samples are taken at different detention time to monitor the gradual settlement. Tests are conducted on the samples after 30, 60, 90 and 120 mins.

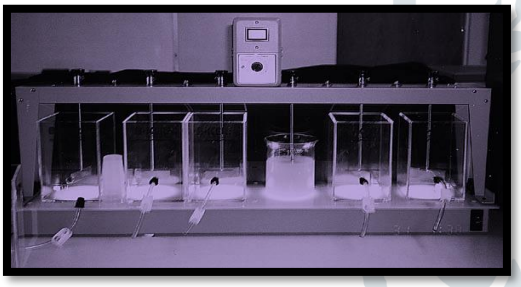
Results will be compared on mentioned parameters.

Experimental setup

Experimental setup comprises of three tanks of 250 litres capacity each. On the top, Intake tank is kept, it is connected from bottom to the flocculation chamber which is kept on lower level than the intake tank. Flocculation chamber is attached to the sedimentation tank from bottom. Flocculation tank will be provided with jet for proper mixing. In sedimentation tank, detention time will be available for floc to settle down. The dimensions of flocculation and sedimentation tanks are 0.8x0.8x0.9Mtrs.

Apparatus and Tests

1. **Jar test:**



2. Turbidity-meter (Jackson turbidity-meter):

It is more accurate in the range of turbidity between 100 and 1000 units.

3. pH meter:

The measurement of pH broadly indicates acidity, alkalinity or neutral character of a water solution and controlling a water treatment program.

4. Alkalinimeter (Titration):

Alkalinity is a measure of the capacity of water to neutralize acids. Alkalinity of water is due primarily to the presence of bicarbonate, carbonate, and hydroxide ions. An alkalinity titration defines the form of alkalinity as being bicarbonate, carbonate or hydrate alkalinity.

V. Conclusion

The project deals with suggesting the most efficient and harmless natural coagulant. The outcome will be excellent replacement to the currently used synthetic coagulants such as PAC, Alum etc. which already have tremendous drawbacks with efficiency, cost effectiveness and residual threats. By the end we will be able to compare the statistics of synthetic coagulants with scarcely used natural coagulants and most probably insisting them as replacement to conventional coagulants

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