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# Water purification using coagulant, flocculant and disinfectant

**Manasi Ghamande[1], Devrishi Koul[2] Kuwar Karan Kochhar[3], Romit Kamble[4], Pruthvesh Mandle[5], Rashad Ahmad[6], Hardik Birla[7], Siddhant Dhende[8], Tejas Bhagat[9], Sakshi Jadhav[10], Karthik Iyer[11]**

*[1]Department of Engineering, Sciences and Humanities (DESH),*
*Vishwakarma Institute of Technology, Savitribai Phule Pune University, India.*

**ABSTRACT**

*The basic idea of this project is to use the three stipulated processes to convert muddy water into potable water. All waters, especially surface waters, contain both dissolved and suspended particles. Coagulation and flocculation pro-cesses are used to separate the suspended solids portion from the water. The sus-pended particles vary considerably in source, composition charge, particle size, shape, and density. The small particles are stabilized (kept in suspension) by the action of physical forces on the particles themselves.*

*Most solids suspended in water possess a negative charge and, since they have the same type of surface charge, repel each other when they come close together. Therefore, they will remain in suspension rather than clump together and settle out of the water. The treatment efficiencies of coagulants have been compared for maximum removal of impurities under optimum pH and optimum dosage of coagulant. Disinfectant is used for killing all the viruses and bacteria present in water.*

***Keywords****-amorphous, coagulation, disinfection, flocculation, potable*

## I. INTRODUCTION

Access to potable drinking water is a major burden around the world. Each year diarrheal diseases related to unsafe drinking water, sanitation ad hygiene cause 1.8 million deaths around the world. The drinking water systems get affected by natural disasters, especially flooding, which can greatly increase the health threat from contamination of these systems from inadequate sanitation, industrial waste and by refuse dumps. In such situations, diarrheal diseases quickly can be major cause of morbidity and mortality, and providing portable water must be-come an immediate priority for emergency responders. For the emergency responder who immediately require portable water through this product can get quick access.

## II. LITERATURE REVIEW

We have surfed various websites and research papers for information on content of potable water and the various processes involved in purification of contaminated water. We found out that this was one of the most efficient ways of water purification and one of the quicker ways to get access to potable water. While doing the literature review, it was kept it mind that water must be made potable in such a way that it must be immediately available to the people who are in emergency and have faced various issues with drinking water.

## III. METHODOLOGY

3.1. Materials/Apparatus

1.Amorphous Ferrous Sulphate ($FeSO_4$) as a coagulant
2.High Molecular Weight Polymer as a Flocculant (Anionic)
3.Powdered Chlorine/Oxalic acid as a disinfectant
4.Filter paper/Membrane

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5.Muddy Water
6.Small plastic zip bag
7.Volumetric Flask

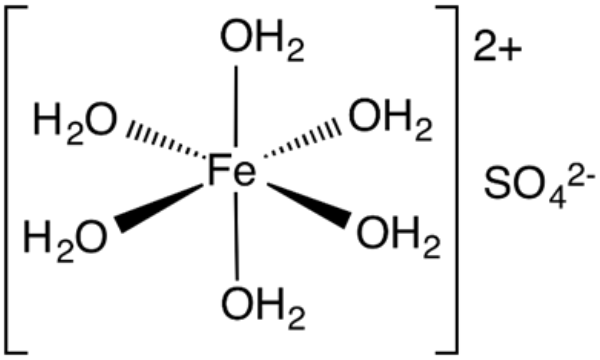


Fig.1. Amorphous Ferrous SulphateFig.2. Molecular Structure of Amorphous Ferrous Sulphate

Fig.3. Anionic Flocculant PowderFig.4. Powdered Chlorine

3.2 Method

At first, we collect muddy water infected with bacteria and other micro-organisms. The coagulant, flocculant and disinfectant is mixed together and collected in a small plastic zip bag. The ratio of the contents is 2:4:3 respectively. The volume of this water is noted down. After this, the water is filtered using filter paper which filters rock particles and other big particles. Now taking this solution in a volumetric flask, we add the mixture. At first the effect of coagulant commences i.e. amorphous Ferrous Sulphate (FeSO4). Since the coagulant contains positively charged metal ions (i.e. Fe2+), it at-tracts the negatively charged dirt particles in the solution(fig.2.). Thus, it coagulates the dirt particles. Now flocculant powder which is anionic in nature starts acting. Flocculant powder is basically a high molecular weight polymer. It has long chains which sur-round the positivelycharged coagulated particles and since their density be-comes greater than water, they settle down. Thus, all the dirt particles are present at the bottom of the volumetric flask and we are left with light brownish coloured water. Now the work of disinfectant comes into picture. After the settling down of dirt particles we are left with water containing bacteria and other microorganisms. Chlorine acts as a disinfectant killing all the microorganisms present in the solution and we are left with clean potable water. The above process is followed again but by using oxalic acid as a disinfectant.

3.3 Characterization and Testing.

After following the above-mentioned procedure, the amount of substances used is represented in a tabular format given below:

| Sr.no | Amount ofcoagulant used | Amount of flocculant used | Amount of Disinfectant used |
|---|---|---|---|
| 1. | 1.8gm | 3.7gm | Chlorine (2.7gm) |
| 2. | 2gm | 4gm | Oxalic acid (3gm) |

*Here the volume of solution is 240 ml for both cases.

## IV. RESULTS AND DISCUSSIONS

From the above process, we obtained potable water of about 150ml exempting the dirt containing solution. However, after comparing the effect of oxalic acid and chlorine, it was observed that chlorine was more superior in killing the microorganisms. Even oxalic acid is able to cleanse the solution, but chlorine does it in a better and efficient way. Also, the time taken by chlorine was much less than that of oxalic acid. It took about 30 minutes for the solution to become contaminant free upon addition of chlorine while it took 90 mins for oxalic acid considering the ratio of the components we have taken.

## V. LIMITATIONS

There are certain limitations of this product. Even though chlorine is superior to oxalic acid as a disinfectant, 100% removal of germs is not guaran-teed. Also, after adding the product to the solution it needs to be shaken well and should be allowed to settle for about 10-15 min (this time depends upon the area and locality from which the solution is obtained). While separation of suspended particles (which have settled down) from potable water, some particles might enter the po-table water from smaller gaps, hence extra care is to be taken while the pro-cess is being carried out.

## VI. FUTURE SCOPE

This product is quite convenient to carry and can be carried anywhere without any problems. As we know, there is an acute problem of potable water currently in the world, this problem can be resolved to a great extent through this mixture. People going on outdoor expedition can carry this product which can provide potable water quite easily. Also, it can be used in emergency situations like floods, where drinking water becomes con-taminated by dirt particles and other unwanted surrounding particles.

## VII. CONCLUSION

Thus, we conclude that by using the principles of coagulation, flocculation and disinfection, we can obtain clean and potable water conveniently. Also, chlorine is a strong and more efficient disinfectant that oxalic acid.

## VII. ACKNOWLEDGEMENT

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## REFERENCES

[1] X.P. Yang, S.H. Wang “Study on treatment of organ chlorine pesticide wastewater by flocculation” Environ-mental science and technology, 27(4) (2004), pp. 12-13

[2] B.Y. Li, G.W. Gu “Experimental research on flocculation treatment of mixed wastewater from chemistry industry” Sichuan Environment, 23(5) (2004), pp. 1-3

[3] Hindawi Publishing Corporation Journal of Chemistry Volume 2014, Article ID 969720, 10 pages http://dx.doi.org/10.1155/2014/979720
[4] David W. (2010) Hendricks Fundamentals of Water Treatment Unit Processes: Physical, Chemical, and Biological, IWA Publishing.
[5] Bratby J. (2006) Coagulation and Flocculation in Water and Wastewater Treatment. IWA Publishing, London, Seattle.
[6] Akers R.J. (1972) Flocculation Institute of Chemical Engineers, Lon-don.
[7] Dahling, P.V. Scarpino, M.Lucas, G. Berg and S.L. Chang, 1972. Destruction of viruses and bacteria in water by chlorine. Abstr. Ann. Meet. Am. Soc. Microbiol. Washington D.C. Abstr. No. E152, P.26
[8] Lothrop, T.L. and O.J. Sproul, 1969. High-level inactivation of virus-es in wastewater by chlorination. J. Water Pollut. Control Fed. 41:567-575. [PubMed]