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# Application micro particles of magnetite in removal of high turbidity of water and its dependance on pH

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## ABSTRACT

High turbidity in water is a good indicative of undrinkable water quality and suggests contamination of water having suspended particles of heavy metals in it.Water treatment plants also fails to treat contaminated water associated with turbidity in it. The main objective of this study is to treat high turbidity water by Magnetite particles in the effect of a magnetic field,which enhances the rate of removal of turbidity from water.After magnetization magnetite particles can remove turbidity from 9600 NTU to 20 NTU. The use of magnetite particles are also $p^H$ friendly because they are more effective up to $p^H$ OF 6.0 to9.0. It has also been investigated that recycle of magnetite particles and their reuse is also recommendable. Cetyltrimethyl ammoniumbromide (CTAB) and other similar tri derivatives are found useful in regeneration of magnetite particles.

**Key words**: Adsorption, Magnetite, CTAB, Heavy metals, removal.

## INTRODUCTION

Water treatment plants are facing much problems in treating water having turbidity in it. During the rainstrom period ,water is mixed with enormous amont of mud ,dust and other particles.This results in increase in turbidity in water and conventional method of water treatment plants normally fail in this stage.Coaggulants added during water treatment acts on the following mechanism (a)sweep flocculation (b) adsorption and bridging (c)double layer compression and (d) charge distribution.Generaly water treatment plants fail because coagulants have low diffusion rate as a result coagulant hydrolysate are easily attracted by turbid particles and they flocks,hence affect near the injection area only.Magnetic separation property of magnetite($Fe_3O_4$) has enabled it in removing suspended particles, nanoparticles, oil wastes, heavy metals and organics.In this study Jar test experiment is conducted to replace coagulants by magnetite particles which are easily regenerated from sedimentation sludge by cationic surfactant.The main aim of this study is to determine proper dose of magnetite, magnetization effect,solution pH etc.

## MATERIAL AND METHODS

Many amounts of $FeCl_2$, $D4H_2O$ and $FeCl_3$, $D6H_2O$ having molar ratio of 2:3were dissolved in deionised water.Then NaOH (0.1M)was added in to the solution at a rpm of 300 for15 minutes. The synthesized magnetite particles were washed several times using deionised water and were magnetized in a strong magnetic field for an hour. At the next moment turbid water was prepared by mixing bottom sludge of Tamas River with deionised water. CTAB was obtained by Colligen manufacturer of fine chemicals.Many amounts of magnetite particles were added in one lit of water and the $p^H$ was adjusted by adding 1M NaOH and 1M HCl buffer.After this magnetite particles were added in turbid water and mixed homogeneously.Then after a strong magnetic field was applied which enhances the sedimentation. The sludge was collected from the mid point of the jar and its turbidity was measured by turbidity meter.

Regeneration of magnetite particles are done by cationic surfactant in which the sludge is mixed with100ml deionised water and different concentrations of CTAB and agitated at 300 rpm for 20 minutes and washed several times by deionised water.Total organic carbon (TOC) is employed as an indicator of the concentration of surfactant in which CTAB concentration is obtained by linear regression equation.

## RESULTS AND DISCUSSIONS

Due to smaller size (350nm) of magnetite particles they disperse easily in water and collide with turbid materials to form flocs of high density. Graphical representation[1] assigned here with , expresses different dosages of magnetite and residual turbidity showing reduction in turbidity from 134 NTU to 20 NTU with an increase in magnetite dose from 3gm/L to3.5 gm/L.It reveals that removal of suspended particles is not easier.It can also be seen that turbidity can be reduced even up to 12 NTU. Graphical representation[2] explains magnetization strength of magnetite particles against applied magnetic field. It suggests that at 1000Gauses magnetization is increased properly and after 2000Gauses it becomes of minor significance. It can also be seen that magnetization becomes passive due to coating of turbid substances on magnetite particles. Graphical representation[3] reveals effect of p$^H$ on removal of turbidity and shows that it is maximum at p$^H$ 6.5. It might be due to maximum surface (+ve) charge of magnetite particles at this p$^H$ value. The hydrophobic group of CTAB is responsible for gathering hydrocarbon chains and making them denser to settle easily.

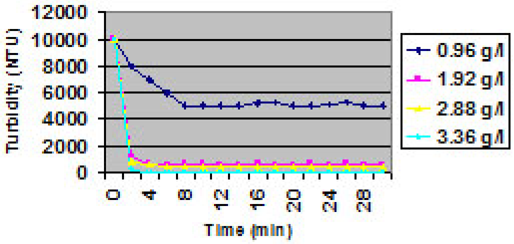


**Fig. 1: Effect of different dosage magnetite particles**

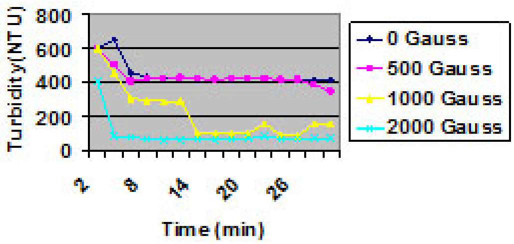


**Fig. 2: Effect of magnetisation strength of magnetite particles**

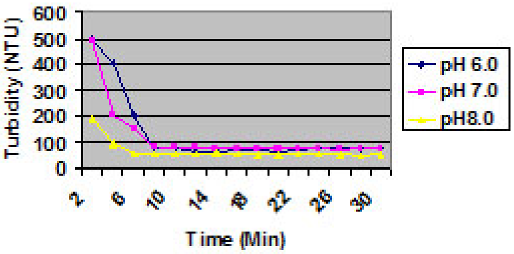


**Fig. 3: Effect of pH**

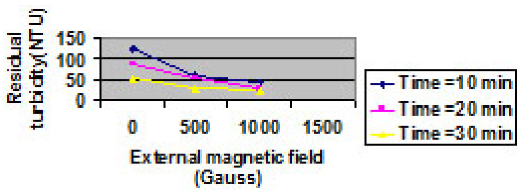


**Fig. 4: The relatioship between residual turbidity and external magnetic field at different time intervals**

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