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Investigation of Oil Spill Removal from Water Using Stearic acid and Oleic acid based Nanocomposites

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Abstract: The removal of oil spill using an iron nanoparticle with Stearic acid and Oleic acid based composites. The prepared composite were simple and convenient method. The prepared composite were characterized by FT-IR, XRD and TEM method. Additionally, the oil spill could be removed at different parameters such as pH, contact time and dosage. The experiment results of oil spills has removed that the magnetic nanoparticles were effective for oil spill removal. The maximum removal were (70%) of oil spills from waste water. This kind of reaction might be explained basic facts, small size nano (100nm). Hence, this kind of promising material used for the removal of oil spills from aqueous and industrial waste water in environmental cleaning process application.
Keywords: Magnetic nanoparticles, Stearic acid, pH, Oleic acid, Removal of oil spill

I. INTRODUCTION

Iron oxide magnetic nanoparticles (MNPs) have numerous favorable circumstances that can be utilizing an external magnetic field. MNPs among materials with attractive properties, because of their demonstrated biocompatibility are most reasonable for biomedical and natural applications [1], [2].The clinical utilization of magnetite as a result of their characteristic properties and biocompatibility as they naturally occurred in the human heart, spleen and liver [3]. These materials demonstrated antimicrobial action when they interrelate with microbial cells as little size to destroy the microbial cell without poising of human body [4], [5] . Researchers valorized the capability of magnetite nanoparticles in the hindrance of microbial development and bio-film arrangement of numerous pathogenic species. For example: fungi, yeasts and microscopic organisms this besides treating explicit irresistible sicknesses [6], [7].The magnetite nanosystems has displayed antimicrobial movement against planktonic, just as disciple microbial cells [7].

There are numerous constraints emerge from arrangement of magnetite, for example: molecule agglomerations, dispersability and solidness in watery framework. Distinctive sorts of settling specialists were acquainted with control the steadiness of attractive nanoparticles. The majority of these materials prompt expanded cytotoxicity. New techniques were utilized to enhance the antimicrobial movement of MNPs utilizing oils and microwave presentation [8]. Iron oxide nanoparticles (Fe_3O_4) are regular ferrite display special attractive properties because of the electrons exchange in the range of Fe_{2+} and Fe_{3+} in the octahedral destinations which has a cubic backwards spinal structure [3]. Readiness of Fe_3O_4 nanoparticles has been pulled in extraordinary intrigue on account of their gigantic value in various spaces, particularly as Ferro-liquids at sizes of 100 nm due to their high reactivity and extensive surface-to-volume proportion.

Iodine frames hypoiodite (IO_-) and iodate (IO_{3-}) has been accounted for that the adsorption of iodate anion on iron oxide impacted the gem development of magnetite and generate more hydroxyl gathering [3]. The development of hydroxyl bunches on the outside of iron oxide nanoparticles can improve the topping of the molecule with unsaturated fat. These gatherings can frame covalent securities with carboxylic utilitarian gatherings of unsaturated fats to dodge their agglomeration [9].The convergences of unsaturated fats play a vital role in topping of magnetite. It is outstanding that when the grouping of unsaturated fats surpasses the basic micelle fixation, micelle development will happen. This will diminish the measure of unsaturated fats accessible for particles adjustment [10]. The present investigation is to blend iron oxide attractive nanoparticles (magnetite) by straightforward substance co-precipitation strategy utilizing one iron salt at room temperature. The impediment of co-precipitation technique to round shape restrains the properties and pertinence of the readied particles. In addition, the creation of high return and diverse states of biocompatible magnetite covered nanoparticles. The assessment of antibacterial movement subsequent to treating with various kinds of unsaturated fats is not so far announced in the before writing. The utilization of the formulated magnetite nanoparticles to gather the oil slick utilizing attractive field is examined.

II. EXPERIMENTAL METHODS

A. Materials

Anhydrous ferric chloride, potassium iodide and watery (25%) ammonium hydroxide arrangement utilized as reagents for planning of magnetite were acquired from Galaxy chemicals Vellore. Oleic Acid (OA) and Stearic Acid (SA) were utilized as unsaturated fats. Petroleum, lamp oil and oils were utilized as wellspring of oil spill. Throughout the preparation distilled water was used for conducting experiment.

B. Preparation Technique

First dissolvability of unsaturated fats (stearic acid and oleic acid) was tried utilizing ethanol, chloroform, and Isopropyl Liquor. The topped magnetite nanoparticles with unsaturated fatty acid can be set up by responding an answer of anhydrous $FeCl_3$ (4000 mgs; in 300 ml of water) with KI (13200 mgs, in 50 ml water) at room temperature. The reaction combo was mixed for one hour until iodine was precipitated. Distinctive measures of SA and OA solubilized in ethanol-water dissolvable (100 ml, 4:1 vol%) and 25% alkali arrangement (200 ml) were added drop wise at the opportunity to the warmed response blend at 55^{o}C. The reaction mixture kept at this temperature for 4 hours until complete precipitation of dark magnetite was accomplished. The precipitate was then left to settle down, sifted, washed with refined water, ethanol, dried under vacuum at 30°C and gauged.

C. Feed Composition

The evacuation proficiency of attractive powder towards oil slick was assessed concurring past revealed technique. The volume of oil expelled utilizing this tidy up method to the volume of the first oil slick and measured in a variable called "productivity" which can be determined as; Table 1.

$$\text{Efficiency} = (\text{volume of removed oil/ volume of original spill}) * 100\% \quad \text{---------------------} \quad 1$$

I. TABLE
Preparation Of Nanoparticle In Different Combination

S.No:	Ferric Chloride (mg)	Potassium Iodide (mg)	Stearic Acid (mg)	Oleic Acid (mg)
SO1	5	2	1.5	3580
SO2	5	2	2	4475
SO3	5	2	3	5370
SO4	5	2	4	6265
SO5	5	2	5	7160

D. Experiment

Batch adsorption technique was adopted for adsorption studies. Dissolvability of stearic acid, oleic acid was tried and ethanol was found as best dissolvable. An adsorption studies was carried out with various parameters such as contact time, PH, and dosage water. About 14ml of water (refined water, faucet water and ocean water) was taken and 2ml of (oil, lamp oil, vegetable oil) was added to make oil slick. The adsorbent was included the oil slick at various focus, time and measurements the spill was evacuated utilizing high effectiveness neodymium magnet. The rest of the spill was estimated utilizing estimating barrel.

III. RESULT DISCUSSION

A. Effect OF pH

As the pH was been expanded from 3 to 12 viability begun to increment and lessening at pH 12 as appeared in figure1. Ideal pH was found to be7and 9. The other trial was done at pH 7 and the above pH 9 the adsorbent begins to break up it leads to decrease adsorption of oil.

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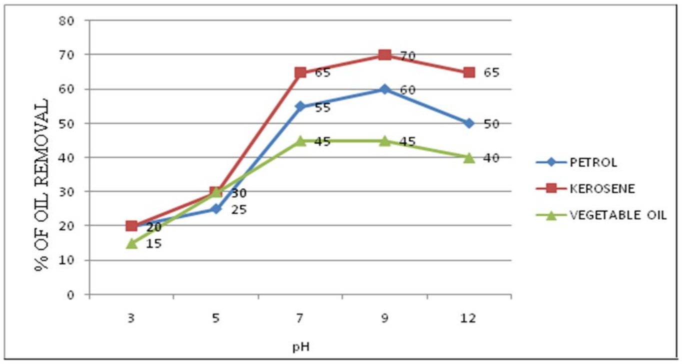
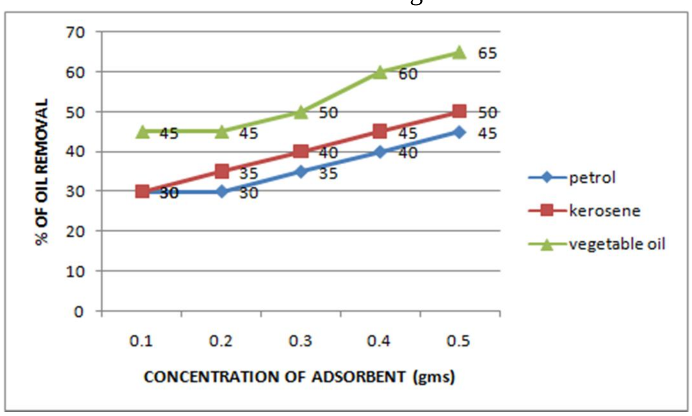
Figure1
Effect of ph on removal of oil spill



B. Effect Of Dosage

An adsorbent portion expands keeping the different parameters at unfaltering regard departure adequacy increments. At the point when measurement of adsorbent expands expulsion additionally increments. Figure 2 indicates level of evacuation relies upon measurements.

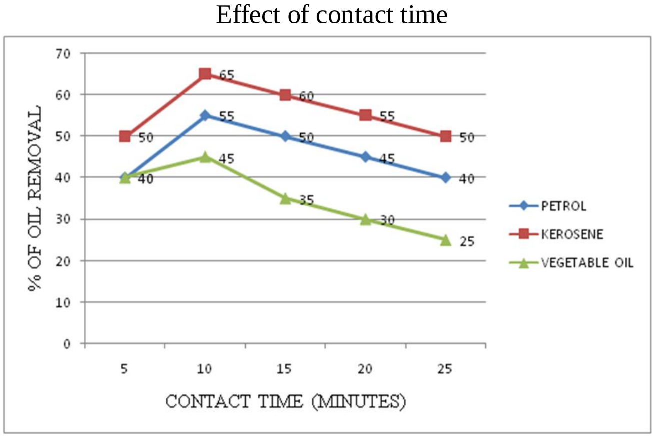
Figure 2
Effect of dosage



C. Effect Of Contact Time

As the season of adsorption is expanded from 5 to 25 minutes viability diminished somewhat. Since the adsorbent begins to break down and diminishes the effectiveness of adsorbent which is appeared in figure 3.When the contact time increases removal tendency also decreases.

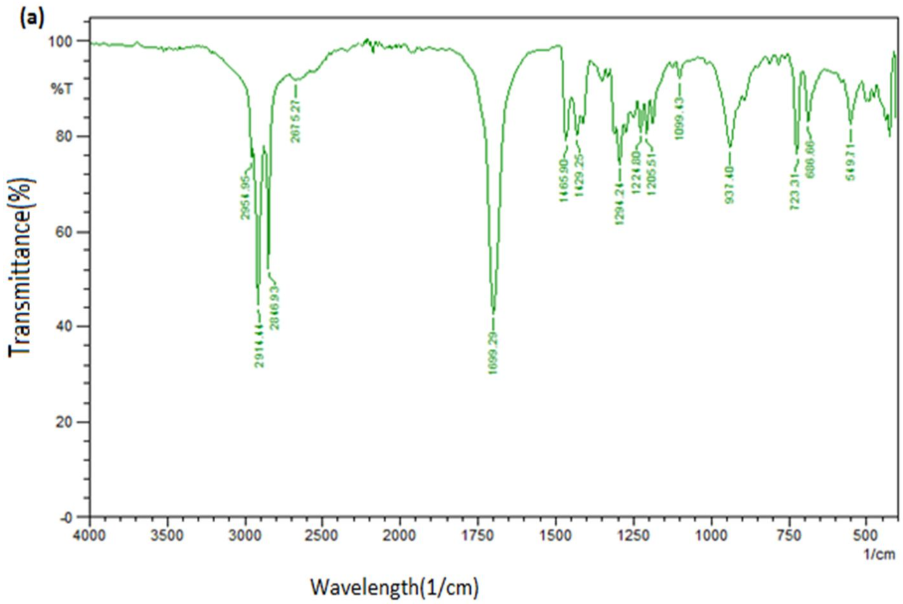
Figure 3
Effect of contact time



D. FT-IR Spectral Studies

In order to identify possible interaction and functional groups present on the surface of Iron nanoparticle FT-IR studies were performed extensively used for quantitative as well as for qualitative analysis in almost all fields of science. The FT-IR spectra of (Stearic acid and Oleic acid) SO5 adsorbent has shown in figure.4. The peaks of SO5 has been observed at 2675.27cm^{-1} (Methylene sym.stretch), 1699.29cm^{-1} (C=O amide). In the SO/SA/OA composite a peak at 2675.27cm^{-1} due to methylene stretch of SO is observed which indicates the SO has been introduced into the composite. The change of alkyl halide C-F at 1224.80, 1205.51, 1099.43, 937.40 and 723.31cm^{-1} shown has the incorporation of SA/OA in SO.

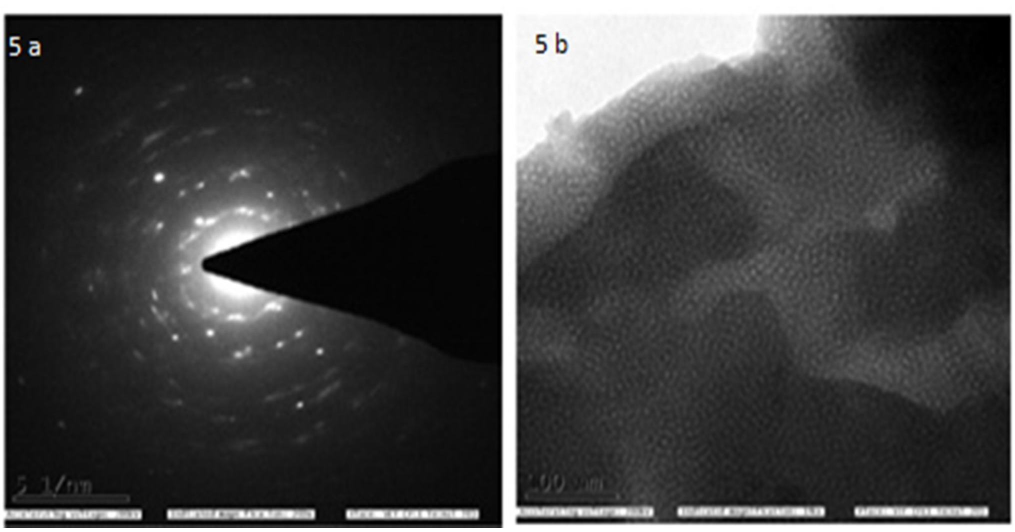
Figure4
Ft-ir spectra of sa/oa/magnetic nanoparticles adsorbent



E. Tem Studies

The scattering of Iron nanoparticles has been studied by TEM Figure.5a-b shows the TEM images of SO/iron nanoparticles. According to these images the Iron nanoparticles in adsorbent have rod like structure and size of nanoparticle got were 100nm.

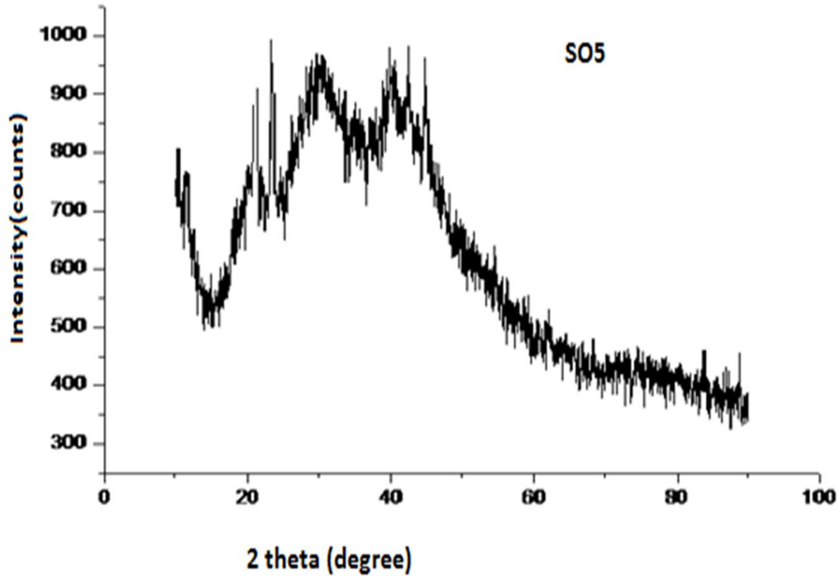
Figure 5 a - b
Tem image of prepared adsorbent using sa/oa/nanoparticles



F. XRD Analysis

The powder XRD patterns of SA and OA has shown in figure.6. The XRD results revealed the distraction peaks which are characterization of the $Fecl_2$, Peaks of 2ϴ at 31.3°, 42.3°, 44.5° were concerning plans reflection of the crystal standard of magnetite (220), (311) and (400) respectively. The KI and $Fecl_2$ compound has well been supported the XRD data. Further the XRD patterns of peaks 2ϴ indicated the amorphous nature of the SO. This result indicates the $Fecl_2$/KI loaded XRD peaks were well supported.

Figure 6
XRD OF Adsorbent SO



IV. CONCLUSION

In this present study oil spill were removed by adsorption method. To synthesis iron nanoparticles based on stearic acid and oleic acid composites. The prepared SO magnetic composites were well characterized by FT-IR, TEM and XRD analysis. The nano composite image 100nm has been observed by TEM analysis. FT-IR studies, XRD well supported the SO/magnetic nano composite. An adsorption studies has also been done at various parameters such as pH, contact time and dosage. Hence, the results indicates maximum amount of oil spill 70% were removed by SO/magnetic composite. Therefore this kind of composite was well application in industrial application such as waste water treatment and oil industry.

V. ACKNOWLEDGEMENT

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