

Influence on Effluent Characteristics under Electromagnetic Field (EMF)

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Abstract: Electromagnetic Field (EMF) for the water and wastewater treatment show good potentials and is safe, effective and environmentally friendly. The EMF has no harm full effect on the human health and the operating cost is also less as compared to the conventional method for water and wastewater treatments. In addition to this, the EMF have antimicrobial and antibacterial effect on the wastewater. EMF's have special properties which are useful for the treatment processes such as; it helps in modifying the physical and chemical properties of the water molecules, helps in scale prevention in the pipes in the treatment facilities, organic and phosphorous compound removal, sludge precipitation are some of them. The present study heighlights the effect of EMF on COD,SS and TS of the industrial effluent. In addition to this, the construction of the assembly for introducing the electromagnetic field in the effluent is also the part of the study.

Keywords: Electromagnetic field, Magnetic treatment, waste water treatment

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Introduction:

Water is the major resource for the world to work and is very important for its sustenance. With increasing in the developmental activities all over the world there is increase in rate of negative exploitation of this very major resource. Due to increase in the industrial activities the ground water and surface waters are getting polluted to the extent that it cannot be used for the domestic purpose without treatment.

In case of water treatment biological, chemical and physical methods are commonly adopted. Here the waste water of dye and dye intermediate is studied with the COD ranging from 5000mg/l and high suspended solids with dark color, this wastewater is considered to be the high strength waste water and is the significant source of environmental pollution. The high suspended solids content and dark color of the waste water adds to the turbidity of the effluent. The conventional method for dealing with this type of water consists of various biological, chemical and physical methods. However, because of the variability of the composition of this type of wastewater these traditional

methods are becoming inadequate and the cost of the treatment of this kind of waste is also going high day by day.

Magnetic technology is a method for the magnetization of the matter with the help of the magnetic field. This technology is used in the treatment of the wastewater and its effects have been studied by various authors (Ali Yadollahpour, 2014) (Kronenbergf, 1985), these studies are mainly focused on the aspects such as the effects of the magnetic field on the pollutant degradation (M. Krzemieniewski, 2004) and the effect of the magnetic field on the microbial growth and its activity.

The aim of the study is to investigate the influence of magnetic field and the exposure time on the physical properties in terms of the SS reduction, TS (Total solids) reduction and the reduction of the COD of the effluent. This study is focused on the experimental work been carried out in the environmental laboratory, faculty of environment engineering, LD college of engineering, Ahmedabad.

Material and Method:

Study area:

The industry of study is situated in Ahmedabad, Gujarat. It is a dye and dye intermediate industry dealing with a dye wastewater which needs a lot of physical, chemical and biological treatment. Normal treatment methods are not economical.

Experimental assembly:

Electromagnetic Treatment: The water sample was collected from Dye and Dye Intermediate industry, Ahmedabad, India. The initial characteristics of the effluent is

Parameter	Industrial water
COD	5616mg/l
SS	5372mg/l
TS	32292mg/l
Color	Violet
pH	9

The arrangement of the experiment is as shown in the figure 1, it consists of a solenoid made up of copper wire having 1400 turns (25Ω resistance) 10 A current is driven by the assembly.

The waste water total volume fed to the reactor is 500ml and the total volume of the reactor is 1L. The reactor is placed in a vertical position as to enable all the magnetic field lines to pass through the air and water phase and thus the EMF can be introduced without any losses.

To induce the EMF steel filings are introduced within the reactor and thus the permeability of the waste water is increased.

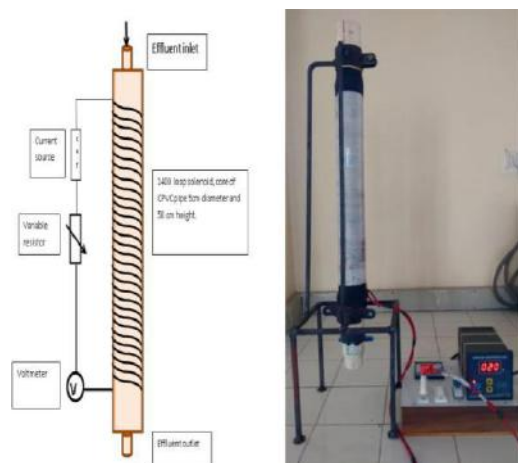


Figure 1: Experimental Assembly

Physical and chemical analysis of the water:

The COD of the samples was determined by the standard dichromate reflux method. Hardness was determined by titration methods. Suspended solid in sample is carried out by filtering the wastewater through a 0.45 mm membrane filter (or a fiber pad filter) and then measuring the dry weight (obtained by drying the filter and its content at 103-105 °C) of the material so collected (M. Srinivasa Rao1, 2014). pH measurements were done using a combined electrode (LL-Aquatrode, Metrohm) adapted for pure water. The electrode was calibrated using a test kit buffer (M. Srinivasa Rao1, 2014). The total solids were measured by measuring the initial and final weight of the beaker before and after putting it into the oven for 24 hr at 103 degree temperature.

Results and discussion:

The experiment is carried out in batches and at 25 degree ambient temperature.

With varying power (watt):14, 16, 18, 20 respectively.

The water was introduced to the electromagnetic field for two different time intervals 3, 6 hours'; the total volume of the sample exposed to the field was 500ml.

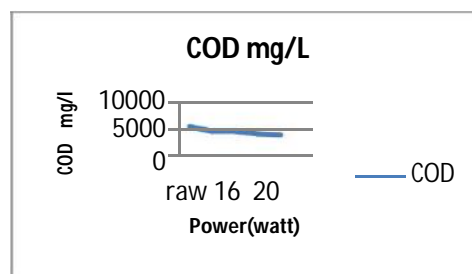


Figure 1: Changes in COD at different power for 3 hr.

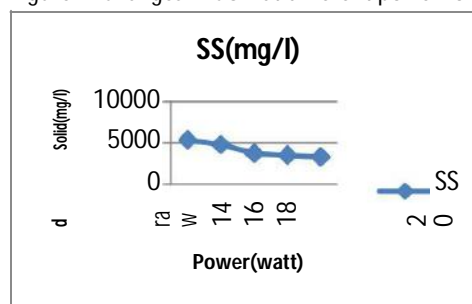


Figure 2: Changes in SS(Suspended solids at different power for 3 hr

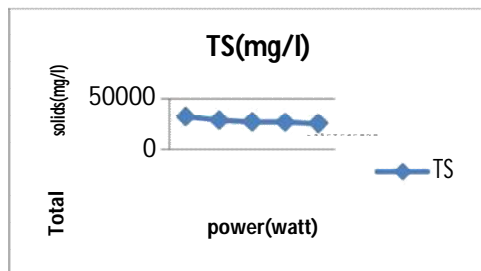


Figure 3: Changes in TS (Total solids) at different power 3 hr.

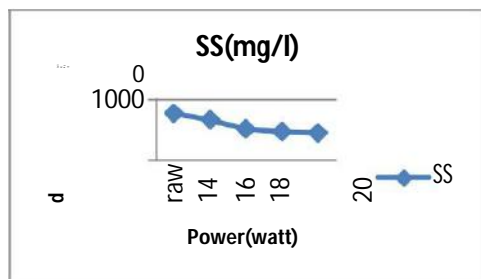


Figure 4: Changes of suspended solids at different power for 6hr

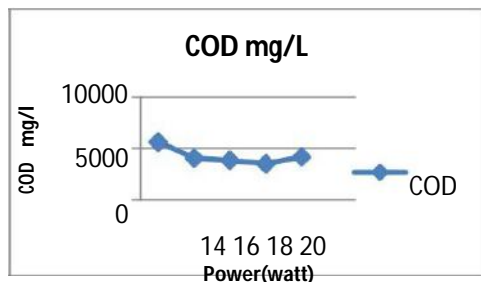


Figure 5: Changes of COD at different power for 6hr

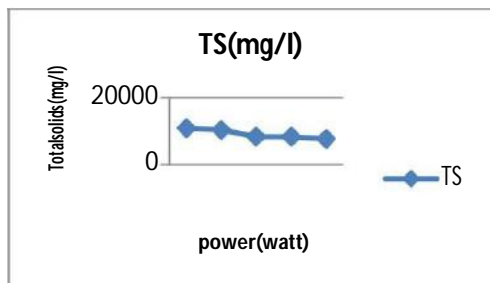


Figure 6: Changes of TS (total solids) at different power for 6 hr.

Conclusion:

- The metal packing in a technological system improves pollutant removal from wastewater.
- Phenomena caused by electromagnetic field favorably influence the wastewater treatment.
- The best strategy of the treatment would be introduction of both the chemical and magnetic treatment together. This would give a better treatment output.
- Magnetic treatment when used properly can lead to the reduction of the scale forming in the pipes and the transport systems.
- Magnetic/electromagnetic treatment can increase the biodegradability of organic compounds present in the wastewater.

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