International Journal of Research in Advent Technology, Vol.6, No.11, November 2018
E-ISSN: 2321-9637
Available online at www.ijrat.org

Comparative Analysis of Removal of Total Dissolved Solids with the Use of Poly Aluminium Chlorides Coagulant from Three Reactive Cold Dye Waste Waters

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Abstract- Around the world, control of water pollution is of primal importance. In the era of water scarcity, the production units consume much amount of water that can otherwise be used for agriculture and other regular human activities. These factories are increasing in number every year, thus ending up consuming precious water. Industrialisation is necessary but the point of concern here is; not only the natural resources they use, but also the waste they generate, which ends up polluting the environment. One of major polluter of water is dye and dyestuff industries. The waste water generated after the production has huge amount of total dissolved solids, which is holding the dye molecules and other materials used in production process. If this water is released in environment without proper treatment, it highly pollutes water bodies, in addition to destroying the aesthetic value of it. In this research article we have concentrated on three cold reactive dyes namely Red M5B, Yellow M8G and Magenta MB and how commercially available polyelectrolyte solutions i.e. coagulants reduce the total dissolved solids from the waste water. From the selected samples Red M5B showed maximum removal of 86% followed by Yellow M8G with 64% and Magenta MB with 34%.

Keywords: Reactive dyes, Red M5B, Magenta MB, Yellow M8G, TDS removal, Aluminium Chloride Coagulant

1. INTRODUCTION

The world comprises of different types of things. Whether the things are natural or man-made, colour gives unique factor to them. For man-made materials, we need a colouring agent, which is widely known as dyes or pigments. In developing countries, there is a huge segment of industry, producing or consuming dyes & dyestuff and most noteworthy is the textile industry, which utilizes the majority of them [1]. Not only textile, but also pharmaceuticals, cosmetics, printing, leather, food industries etc. consumes dyes [2]. Large scale production and extensive application of reactive dyes have affected the environment considerably. Legislation for environmental protection holds the hand of industrialists and imposes them to scavenge for economic and eco-friendly technologies to reduce the dye portions in waste water [3]. Reactive dyes are very complex molecules; structured to resist chemical reactions, photolysis and are highly unwavering in natural environments. If dyes are present in released waste water, it alters the colour in water bodies which is aesthetically distasteful and diminishes the pace of photosynthesis of aquatic plants. Releasing such water to soil may put a hazard to the food web [4]. These dyes require salting process, which in turn increase the total solids in discharge water [5]. If plants consume the dye containing effluent, the lethal dye particles get transferred to the whole food chain and put a threat of biomagnification in organisms. If such dye waste waters are released in environment, it creates saturation in discharged plains [6]. Dyes are one of the main industrial wastewater pollutants, which right away require viable solutions. The objective of this article is to compare the outcomes of total dissolved solids in different dye waste waters after addition of Poly Aluminium Chlorides Coagulant.

2. MATERIALS AND METHODS

2.1 *Chemicals and apparatus:*

Filter - Any one of the following may be used, Glass fibre filter disc - (Whatman GF/C)1 to 5. 5cm in diameter, pore size 1. 2µm, Paper- Acid washed, ash less hard filter finish; filter paper sufficiently retentive for fine particles (Pore size 2-2. 5 µm equivalent to Whatman filter No. 542, Gooch crucible- 30 mL capacity with 2. 1 or 2. 4 cm diameter glass fibre filter disc. (Whatman), Sintered disc- G-5 or its equivalent with pore size 1 to 2 µm, Membrane filter- 0. 45 µm membrane, Filtering Assembly- Depending upon the type of filter selected, Drying Oven- With thermostatic control for marinating temperature up to 180ºC, Desiccator- Provided with a colour indicating desiccant, Analytical Balance- 200 g capacity and capable of weighing to nearest 0. 1 mg, Magnetic stirrer with Teflon coated stirring bars, commercially available poly aluminium chlorides coagulant, mother liqueur (Dye waste water) of reactive cold dyes Magenta MB, Yellow M8G and Red M5B collected from dye production houses of Vatva Industrial estate: Shri udhyog, Space industries and Gunjan Industries respectively.

2.2 *Methodology*

The clean evaporating dishes were heated to 180ºC for 1 hour, cooled, weighed and stored in the desiccator until ready for use. For each dye waste water six different evaporating dishes were taken. A 100 mg sample of Red M5B, yellow M8G and Magenta MB waste water were filtered through Whatman filter no.542 to obtain a measurable reside and successive aliquots of filtered sample were added to the dish. Volume of sample was stirred with a magnetic stirrer. This volume was pipetted to a weighed evaporating dish placed in a drying oven at 98ºC. In every dish, waste water is taken after filtration and except a raw sample, each evaporating dish had ascending amount of coagulant starting from 1ml to 5ml. After complete evaporation of water from the residue, dishes were transferred to an oven at 179-181ºC and dry to constant mass, that is, till the difference in the successive weighing is less than 0. 5 mg. Drying was done for a long duration (usually 1 to 2 hours) to determine constant mass. The dishes were weighed as soon they got cooled, in order to elude residue to stay for long period as some residues are hygroscopic and might absorb water from the surroundings.

Calculation: - Calculate the filterable residue from the following equation:

Filterable residue, mg/L = 1000M/V (1)

where; M = mass in mg of non-filterable residue, and V = volume in mL of the sample.

3. RESULTS AND DISCUSSION

Table:1 TDS removal of Red M5B dye waste water at different concentration of coagulant

Sr. no.	Amount of Coagulant added	TDS of Red M5B waste water
1	Raw waste water	375000
2	1ml	57242
3	2ml	56885
4	3ml	56894
5	4ml	55524
6	5ml	53984

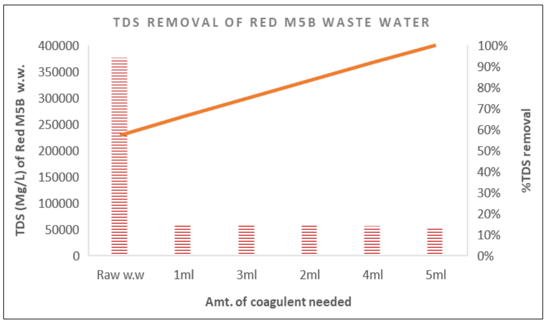

Fig:1 Percentage TDS removal from Red M5B waste water

Table:2 TDS removal of Yellow M8G dye waste water at different concentration of coagulant

Sr. no.	Amount of Coagulant added	TDS of Yellow M8G waste water
1	Raw waste water	296036
2	1ml	159060
3	2ml	118876
4	3ml	120355
5	4ml	122950
6	5ml	107875

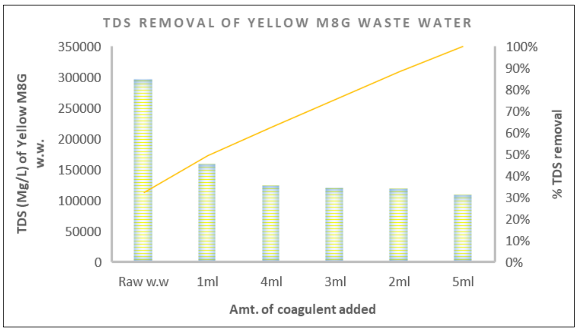

Fig:2 Percentage TDS removal from Yellow M8G waste water

Table: 3 TDS removal of Magenta MB dye waste water at different concentration of coagulant

Sr. no.	Amount of Coagulant added	TDS(mg/L) of Magenta MB waste water
1	Raw waste water	310000
2	1ml	235990
3	2ml	229480
4	3ml	217807
5	4ml	203242
6	5ml	210640

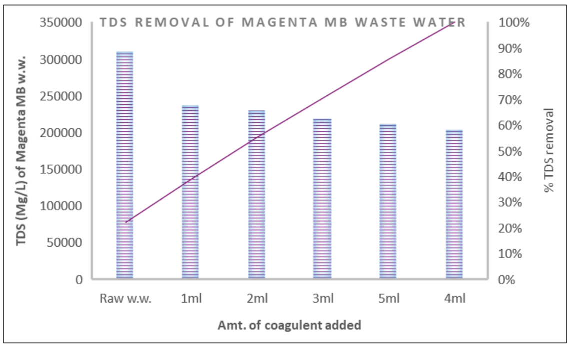

Fig:3 Percentage TDS removal from Magenta MB waste water

The samples taken in testing, were all from same group of dyes. The production method is more or less similar and so are the reactive groups. The process needs very low temperature around 4-5ºC and almost 20% salting to precipitate out the dye molecules. The salting process is prime contributor to the high level of TDS in cold dye waste waters. Also other factors like lower recovering capacity of plant or fault in machineries like filter press, that may cause the release of dye molecules in waste stream.

4. CONCLUSION

Different dye waste waters reacted differently to the commercially available coagulant [7]. As the amount of coagulant increases, the removal of TDS from dye waste water gets better. On an ideal scenario, coagulant was added in maximum 5% of the volume to the waste water. Red M5B showed excellent results from all the taken samples, followed by Yellow M8G and Maganta MB. Among all the three dye waste waters Red M5B got reduced to 86% while Yellow M8G showed TDS removal of 64% and Magenta MB has removal of 34%. The removal of TDS varies due to factors like different amount of salt addition, dye structures, apparatus handling and human error. Waste water of Red M5B shows continuous drift in results while yellow M8G and Magenta MB have some deviations from customary outcome.

ACKNOWLEDGEMENT

This research was funded by Gujarat Pollution Control Board under its Research and development scheme. We are thankful to Mr. Sushil Vegda, Mr. K.B.Vaghela for constant support and guidance.

REFERENCES:

[1] Mishra A., Srinivasan R., Dubey R. “Flocculation of Textile Wastewater by Plantago psyllium Mucilage”. Macromolecular materials and engineering, Volume287, (9) pp 592-596, 2002.

[2] Gupta V.K., Suhas. “Application of low-cost adsorbents for dye removal – A review”. Journal of Environmental Management, Volume 90 (8), pp.2313-2342, 2009.

[3] Anastasakis K., Kalderis D., Diamadopoulos E. “Flocculation behavior of mallow and okra mucilage in treating wastewater”. Desalination, Volume 249 (2), pp 786-791, 2009.

[4] Raghu S., Ahmed basha C. “Chemical or electrochemical techniques, followed by ion exchange, for recycle of textile dye wastewater”. Journal of Hazardous Materials, Volume 149 (2), pp. 324-330, 2007.

[5] Yadav A., Singh L., Mohanty A., Satya S., Sreekrishnan T.R. “Removal of various pollutants from wastewater by electrocoagulation using iron and aluminium electrode” pp. 352-358, 2012.

[6] Adak A., Bandopadhyay M., Pal A. “Removal of crystal violet dye from wastewater by surfactant-modified alumina”. Seperation and Purification Technology Volume 44 (2), pp. 139-144, 2005.

[7] Namasivayam C., Thamilarasi M.V. “Removal of chromium(VI) from water and wastewater using surfactant modified coconut coir pith as a biosorbent”. Bioresource Technology, Volume 99,(7) pp 2218-2225, 2008