Extraction of Sodium Sulphate in Agitated Thin Film Dryer Salt and Reuse of Glauber Salt in Dyeing Processing

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ABSTRACT

Generally, textile dyeing industries are using sodium sulphate & sodium chloride salts in wet processing system. Sodium sulphate salts are generated in centrifuge system in CETP units, salts are generated increasing gravity in forced film evaporation mechanism, FFE reject water carried out to the crystallization process. Crystallization using high pressure steam converts into solid phase salt product. Its either been chloride 0r sulphate, depends upon the dosing and composition of salts using dyes effluent in treatment mechanism. The reject water accumulate in ATFD system. In this system generating 2% mixed salts from the day of production. ATFD salts presence of chloride and sulphate nature at the 60-70% of total composition. in the Mixed salts extraction in the specified sulphate compound to the solid – liquid extraction method using as a catalyst of acetonitrile-water solvent compound formed as a elution. Eluted products separation occurs to the Gas Chromatography mechanism. Additional solvent to the mobile phase as a sodium chloride as a miscible solvents in separation from organic solvents. Organic solvent layer drying process occurs using a helium or argon gas. Magnetic nuclear resonance spectroscopy for the composition of the phase resulting from settling out and compare the effectiveness of sodium sulphate as a drying agent.

Keyword: ssodium sulphate, forced film evaporation, agitated thin film dryer, elution, spectroscopy, drying agent.

I. INTRODUCTION

Rapid growth of industries has not only enhanced the productivity but also resulted in release of toxic substances into the environment, creating health hazards. It has seriously affected normal operations of ecosystems, In recent years, considerable attention has been paid to the industrial wastes, which are usually discharged on land or into different water bodies. This is likely to result in the degradation of environment.

Various techniques have been studied for their applicability in treatment of wastewaters. These mainly based upon the ZLD process system.

Textile is the process industrialization is the main parameter for the economic growth of a nation and modernization of life, cotton, wooden, synthetic, fibres, synthetic dyes, chemical, and process water are among the major impute raw materials in this industry and these inputs diversified the economic importance of the textile industry, based upon fiber production, textile industries categorized into two major processes such as dry and wet are mainly generated in wet processing steps.

Discharging of wastewater from the textile industry contains toxic pollutant such as dyes, chrome, NAOH, starch, acid, etc. an average textile industry consumes process potable water about two hundred liters per kg product. The estimation of world bank dyeing and finishing section is near to 17-20% of industrial waste water generate. At present dyes are mainly aromatic compounds and heterocyclic structures with polar and color- display groups. The structure of dyes is more complicated wit stable. Then the difficult to decompose. In this review work. Evaluation of different wet processing system such as bio-degradiation technologies and physiochemical methods of remove pollutant in textile effluents.

In wet process, during the sizing of fibers, several chemical are consumed such as starch, enzyme, waxes, and ammonia. The occurrence of starch hampers the diffusion of the dye molecule into the yarn/fabric. Which needs the removal of starch proceeding to dyeing and then printing, removing sizing chemicals from fiber commonly used enzymatic or dilute mineral acid hydrolysis the effluent from desizing and sizing unit processes has highly dominant biological oxygen demand in the range of 300 – 500 ppm and a solution of ph that is 4-5.

II. LITERATURE

Dyeing industry are used sodium chloride(vacuum salt) and sodium sulphate(gluber salt) for dyeing purpose. However this was found problematic as crystallization of sodium chloride salt produced as a concentration include color and hardness causing salts. Therefore the separate crystallization strategies was required for sulphate and chloride salt. This was a achieved by concentrating the bring up in the brine 250 – 300 gpl using a conventional MEE and after chilling the brine and at least than 10 degree Celsius using a adiabatic chiller to recover to high purity sodium sulphate as gluber salt.

The crystal sulphate salt were dewatering in a pushed centrifuge. The mother liquor from the centrifuge after recovery of sodium sulphate, still containing mixed salts which was

again fed through a forced circulation (FCE) type evaporators to crystallized mixed salt with color and hardness and other contaminants which is disposal issue. The mixed salts is being stored in HDPE bags at storage house.

III. METHODOLOGY

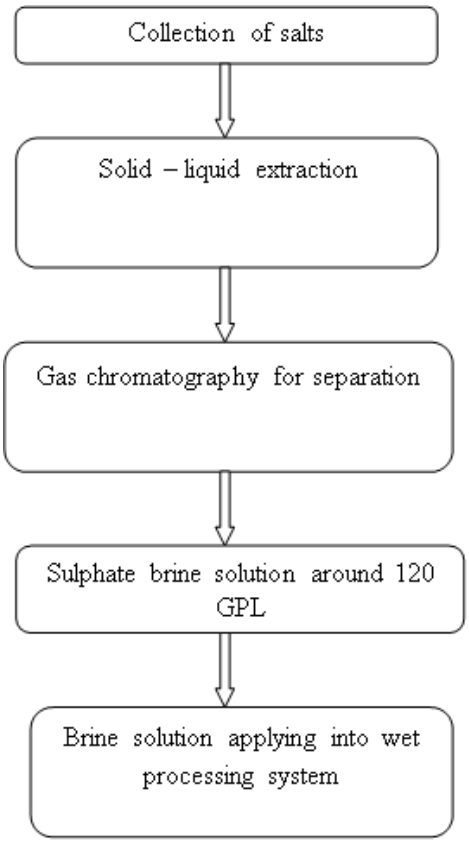

FIGURE 1
METHODOLOGY

IV. SOURCES OF WATER AND SALT WASTE WATER CHARTERSTICS

SALT SOLUTION AND BRINE PREPRATION:

1 mole of salt solution to added on 1 mole of acetonitrile-acetone miscible solution to extract the sulphate content using as sohklet solid-liquid extraction mechanism. The extracted product as a liquid form of solution to prepare a brine solvent as a sulphate content. In a liquid presence of exhaust color will fade out and mixed shade presence in wet processing system, so the color value must be reduced using a sodium hypochlorite agent as a color removal and reducing the oxidizing agent of chlorine added sodium meta bi sulphate as 1:3 ppm ratio.

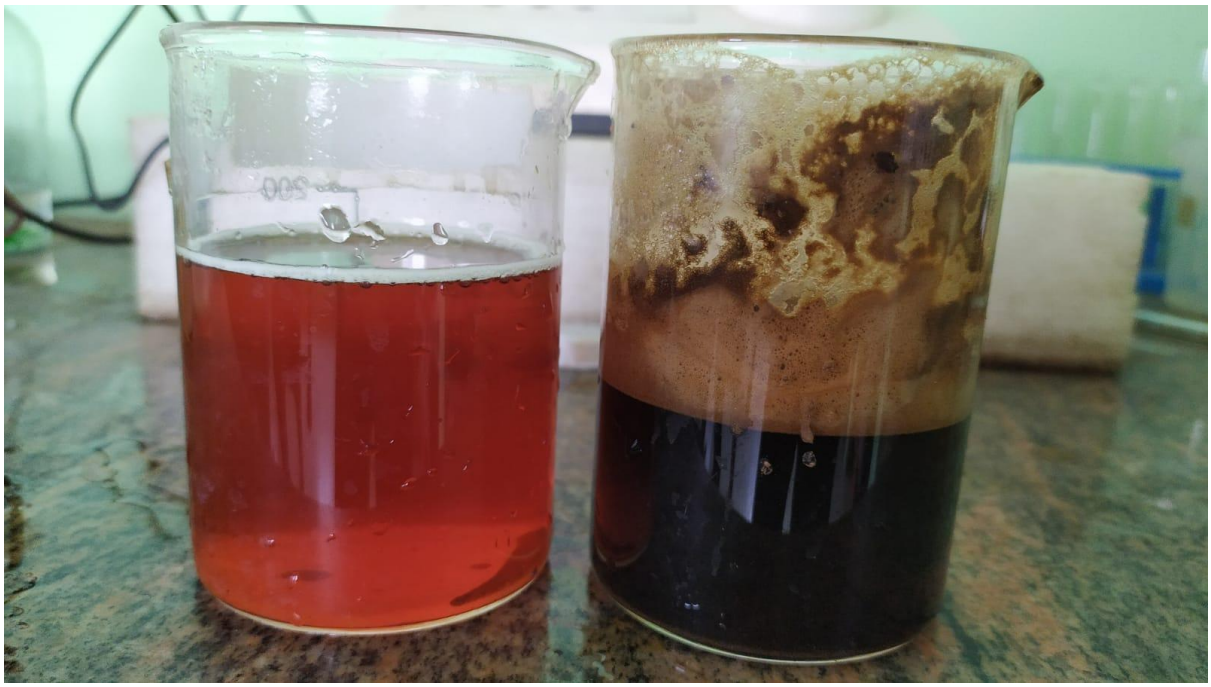

FIGURE 2
BRINE PREPRATION

INITIAL CHARACTERISTICS OF SALT WATER

TABLE 1
SALT DILUTION CHARACTERISTICS

S.NO	PARAMETERS	VALUE OF SAMPLE 1	VALUE OF SAMPLE 2
1.	pH	9.5	8.7
2.	Total Suspended Solids	150 mg/l	175 mg/l
3.	Total Dissolved Solids	2,20,000 mg/l	1.75,000 mg/l
4.	Sulphate	2800 mg/l	5600 mg/l
5.	chloride	1800 mg/l	3500 mg/l

EFFECT OF EXTRACTION IN MISCIBLE SOLVENT

Reaction mechanism

Here the extraction process occurs on the feed solution of adding the salt concentration diluted in acid content for getting more volatile and dissolved impurity organic residual compound. Top up the solvent as a acetone with a hydrolysis nature mixing paddles in rapid motion the separation process occurs the spent of solid in residual compound and

bottom of the Colum in sokhlet extraction as a more elegant eluted compound in presence of water.

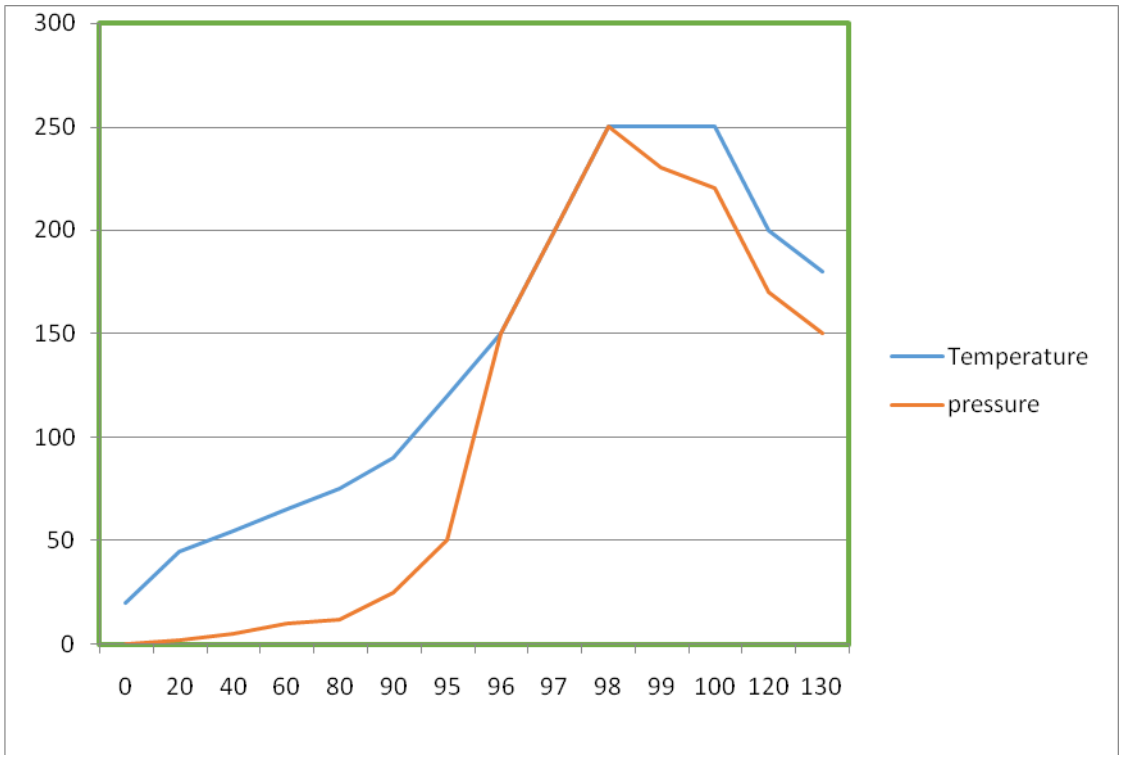

FIGURE 3
TEMPERATURE VS PRESSURE CHARACTERISTICS RANGES IN WET PROCESSING SYSTEM

SEPARATION MECHANISM IN THE GAS CHROMATOGRAPHY

The sample of acetonitrile – water organic eluant inject the packed bed type column with a temperature of 20-30 degree Celsius. It is allowed to the rapid volatilization of the sample. The column temperature maintain about 150 – 300 degree Celsius. Separation occurs interaction of molecules in mobile phase and stationary phase. The light weight compounds moved slowly in stationary phase side. High volatile compounds moves in mobile phase to the column. Once the separation will completes the flame ionization detectors detects the values. Detector contains both hydrogen and oxygen to produce flame. The sample molecules each has positive and negative charges. Both oxygen and nitrogen contains the flame, from the sample molecules to reach the flame via column the oxygen and nitrogen ionized electron are released and ignited happens. Those electron will passing threw the amplifier converts into current. The graphical values respect time and current it shows the retention time of the sample.

EFFECT OF BRINE SOLUTION IN WET PROCESSING SYSTEM

The below graphic shows efficiency of using brine solution wet processing units. Using brine sample in the dispersion dyes, azo dyes are suitable once for dark shade colors, the light shade compound dyes are fade out and little shade presence in the mixture of multiple composition due to oxidizing agents appeared in the brine solution. most widely suitable for batch process and temperature based adaptive system.

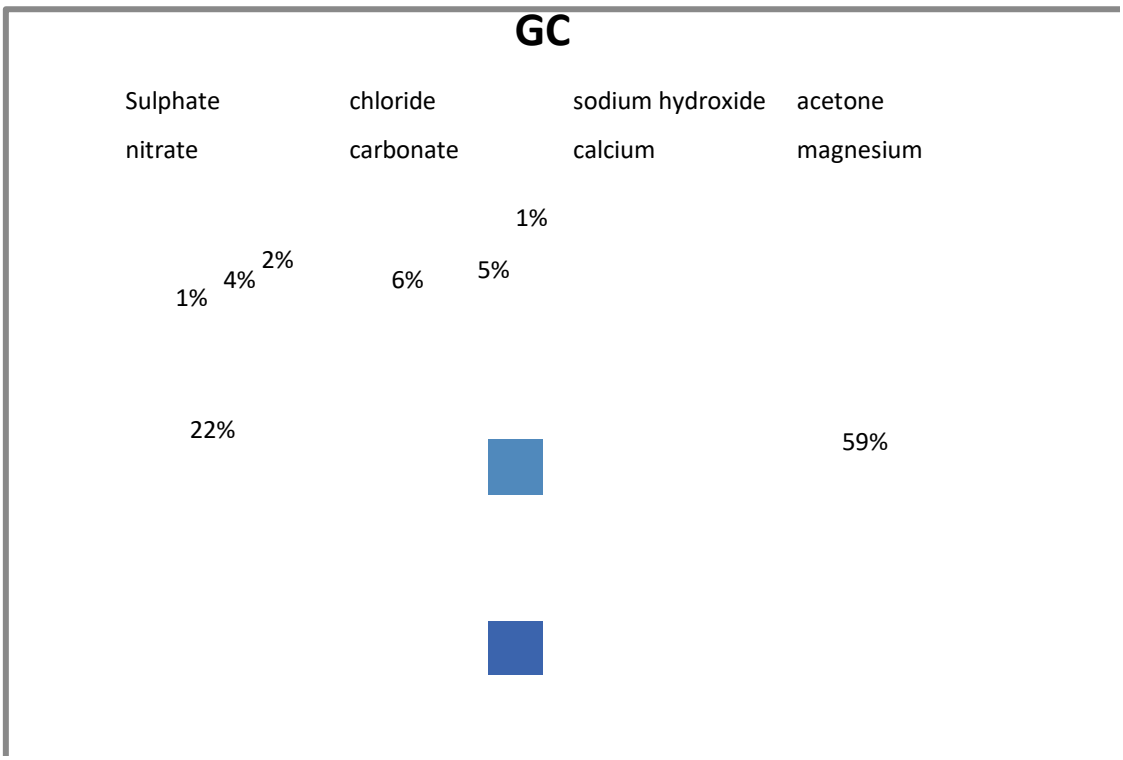

FIGURE 4
GAS CHROMATOGRAPHY PIE CHART REPORT ANALYSIS

EFFECT OF GLAUBER SALT IN WET PROCESSING SYSTEM

Glauber salt made from the crystallizer, thus the salt make from pressurized steam applying into the concentrated salt solution in forced film evaporator, applying 1.12-1.13 specific gravity for generating white crystalline salt as gluber salt. Salt as applying for increasing the concentration in dyeing process. Its matched up-to 6000-7000 TDS presence in effluent waste water

TABLE 2
SALT PROCESS RANGES

Salt	Conc.of salt	Hardness of water		Total Dissolved Solids		Ph	
			Property of boil		Property of boil		Property of boil
common salt	40	275	275	1000	920	7.4	6.8
	50	445	445	1210	1110	7.4	6.6
	60	520	520	1450	1390	7.4	6.6
vacuum salt	40	165	165	1180	1090	6.6	7
	50	235	235	1550	1330	6.6	7
	60	240	240	1870	1560	6.6	7
glauber salt	40	10	10	1020	980	7.6	6.8
	50	10	10	1270	1150	7.6	6.8
	60	10	10	1490	1380	7.6	6.8

V. CONCLUSION

This project deals with the handling of dumped agitated thin film dryer salt as a mixed salt to reused and reduction salt load in ZLD process. Mainly functioned depends upon the nature of effluent we used, either chloride based salt Alice vacuum salt to increase the concentration of effluent; it deals very difficult for the operations. Either sulphate based salt as a gluber salt mainly presence anhydrous sodium sulphate working as a drying agent and dispersion easily while working out in the wet textile processing units. It functioned both batch and continuous manner on temperature and pressure based system. In vacuum based effluent solution water our takes as a source of water. It generated as a salt nature to extract the organic eluent using a miscible organic solvent to separation occurs the chromatography techniques, applying the sodium hypo chlorite for the color removal and makes a brine solution, it was applying the dyes mixture in cotton dyeing system. in The light colors we applying the dispersion dyes was faded out and differently, in dark shaded applying perfect matches. Hence the brine solution it suits for only dark shade colors dyes only, one more drawback as we feed out to kept regular laboratory analysis needed for the brine solution from the oxidizing agent and free residual chlorine content. In gluber salt as precipitated out in crystallizer operation it will applying all the light and dark shade colors while only using in temperature based mechanism. When applying pressure based system on the modern wet processing system the dyes will faded out in some cases its depends upon the alkalinity and acidity nature and printing inks we used in that process of manufacturing.

REFERENCES

[1] Benefits of Glaubers salt in Textile Wet Processing Sushil Kumar Hada, a research article paper in fibre2fashion.com

[2] Broadbent and A.D Basic principle of textile colbration A.S.T.M.2001. 1(2): P 337.

[3] Chettiar vigneshwaran, Anbumani, January (2011), Journal of textile and apparel technology and management. Biovision in textile wet processing industry.

[4] Comparative Study of Cotton Fabric Quality Using Different Salt in Reactive Dyeing Process, Mazharul Islam Kiran, May 1 (2021), Thesis submitted by Textile learner.net

[5] Drying ability of anhydrous sodium sulfate on wet organic solvents after liquid-liquid partition. H Obana et al. Shokuhin Eiseigaku Zasshi. (2001) April.

[6] Effects of salt concentration on the dyeing of various cotton fabrics with reactive dyes, M.D Eman Talukder, MD. Kamruzzaman, international journal of textile science, vol.6 no.1,2017,pp.7-14. Doi:10.5923/j.textile.20170601.02

[7] Farbook, Y. Textile Dyeing and printing Technology. Textile today,1997.2(3): p.178-190.

[8] G.Duraisamy , January (2017), Textile wet processing laboratory manual.

[9] Nalathambhi arivithamani, Venkateshwapuram rengusami Giri Dev. Feb (2018). Characterization and comparison of salt free reactive dyed catinoized cotton hosiery fabrics with the salt.

[10] P. sonaje, M.B Chugule. March (2015), Muncipal waste water recycling in cotton textile wet processing system.

[11] R.Jeyaramakrishnan, R. ugamorthi. Aug (2018). Efficient recycling and reusing of salt from textile effluent.

[12] Role of salt in textile chemical processing treatment, Saravanan K July (2020): blog.bitsathy.ac.in

[13] Rashmita Thummar, Nitul Limbasiya, Amira Upadhyay(2015). Extraction of sodium meta bi sulphate in T-leaves(Zimpro process)

[14] Recovery of Sodium Sulfate from Farm Drainage Salt for Use in Reactive Dyeing of cotton, July (2011); Jiyoon Jung and Gang Sun, Environ. Sci. Technol. 2005, 35, 16, 3391 -3395

[15] Salt and Alkali Free Reactive Dyeing on Cotton, M Subramanian Senthil Kannan, March (2007): written a article in fibre2fashion.com.

[16] Tarikul islam, H.M Siraj Udain, March(2016), A report on industrial wet processing technology. Industrial report.