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RESEARCH ARTICLE

Direct reuse of scour and bleach effluent water for cotton knitted fabrics

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Abstract

In view on environmental aspects, the amount of pretreated effluent water from the Textile processing industry is very much harmful to the surroundings of living things and for human beings. The water which has been released from the processing industry contains chemicals and salts used in the processing of the de-sizing, scouring, bleaching and dyeing. These processes contain high BOD, COD and pH. To evaluate this, the processing mills are having the reuse of the contaminated water by the ETP process which is well known in the world. These ETP's are helped to reuse the water in the above pretreatment process to overcome the environmental issues. So in this paper, we discussed and did the process of reusing the contaminated water taken from the combined scouring & bleaching process for the Knitted fabrics. That processed water can be reused for the next day (knitted sample) and so on. When until the water gets evaporated. We can eliminate reducing the fresh water content for (Hot wash & cold wash) and by adding the required chemicals and salts used for the combined scouring and bleaching process.

Keywords: Knitted fabrics, Combined scouring and bleaching, Effluent water, Water conservation.

Introduction

Cotton is widely used in the textile industry and by the world's humans. Most of the apparels are made by cotton fiber for their rich property of comfort for the fabric. It is used worldwide and has some physical properties that help them produce an apparel product.

The agricultural field produces them and it is taken into spun into yarn to fabric and finally to dyeing. There the pretreatment process and dyeing of cotton fabric is easily. During this pretreatment of combined scour and bleach the fabric is scoured to remove wax & make them to hydrophilic and bleaching helps to improve the color of the fabric from yellow to half & full white fabric to improve them in the dyeing process. The wastewater will cost the effluent treatment more difficult in the above two processes.

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So, it should be reduced by the means of H_2O_2, alkaline and to remove the agents & detergents to neutralize the wastewater and be ready to reuse in the combined scouring and bleaching process.

Scouring and Bleaching

Before being colored, a grey fabric goes through pretreatment procedures, including de-sizing, scouring, and bleaching, which use a lot of chemicals and water. Alkali and oxidizing agents are used to scrub and bleach fabric, respectively. Wastewater from these treatments will contain any remaining chemicals.

The issues with standard scouring and bleaching with H_2O_2 include the need for more alkali, which will increase the cost of alkalinity removal in the effluent treatment plant, the use of wetting agents, sequestering agents, detergents, and stabilizer, and the requirement for acetic acid to neutralize the fabric.

Water Conservation Measures

Several measures can be adopted to save water consumption, which is given below.

- Reduction in wastewater volume.
- Washing and rinsing improvements.
- Improvement in the quality of water by proper water treatment.
- Recovering the condensate from the indirect use of steam and using it as process water.
- Use of steam in an indirect manner helps to recover the

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pure condensate and this can be used as boiler-feed water. This will reduce the make-up of water required for the plant. The amount of effluent from the process also gets reduced.

- The use of efficient machinery and process helps to use low M: L ratio in the process and therefore, water requirement will be considerably reduced.

Reduction in Wastewater Volume

Though by reducing the volume of water, the gross pollution load does not get reduced, the handling of smaller volume of concentrated effluent is quite economical. This can be achieved by following steps:

- Reducing the number of washings in the preceding washing operation.
- Recycling less contaminated water in the preceding washing operation.
- Using counter current washing wherever possible.
- Use of standing bath in dyeing.

Effluent - *Waste Water Management*

The amount of water used varies widely depending upon the type of textile fiber processed, the type of product (woven, knit, etc.), and the specific processes and equipment. Significant reductions in water use can be achieved by preventing unnecessary water consumption in textile processing mills (Osman et al., 2015).

The raw wastewater has high BOD, COD, SS and pH. The average BOD, COD, and SS levels were 324, 2009, and 95 mg/1, respectively, with an average pH level of 10.9. The combined pretreatment method might enhance the wastewater's quality, with average reductions in BOD, COD, and SS of 48, 488, and 27 mg/1, respectively. The treatment system's overall effectiveness shows that land irrigation is effective for treating textile effluent. The reuse of treated wastewater in fisheries and agriculture is a possibility.

They were separated by removing the waste waters from the dyeing machine's drain line. Then the knitted cotton fabric was bleached using the waste water that had been collected. One of them has been proven to be perfectly appropriate and secure to reuse for the scouring-bleaching of cotton goods.

Table 1: Water requirements for cotton textile wet finishing operations Process Requirements in liters'/1000 kg of product (SonajeȦ and ChouguleḂ, 2014)

Process	Amount of water consumed
Sizing	500-8200
De-sizing	2500-21000
Scouring	20000-45000
Bleaching	2500-25000
Mercerizing	17000-32000
Dyeing	10000-300000
Printing	8000-16000

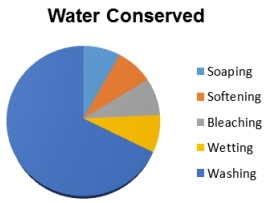

Figure 1: Water conservation chart

To produce sustainable water, recycled wastewater is an important aspect in water conservation in the processing industry refer Figure 1. It should be implemented in all countries with safety and reusable to the environment.

Because water is a need for all living-organisms, we should not affect them (or) us. Water is used in huge amounts in the textile processing industries. In the textile processing industry, the water is the main source to produce colorful garment fabric. But it directly affects the living-organisms.

The scoured and bleached water in the treatment should be reused to enhance that process. It contains the chemicals but the reusing of pretreated water will help us decrease the freshwater quantity.

Water recycling and reuse can enable communities to strategically link the distribution and use of locally available water resources with specific water quality and quantity goals, particularly in areas with water concerns (Sonaje and Chougule, 2014) refer Table 1.

The global textile industry's released chemicals are continuously harming the environment (Shaid et al., 2013: Sonaje & Chougule, 2015). The focus of this research is to investigate the opportunities to prevent pollution by recycling and reusing water and chemicals without addition of any treatment.

Materials and Methods

Cotton knitted fabric has been used for this process. The type of fabric weaved is Knitted – Single jersey, the GSM of the fabric is about 120 & the Loop dimensions are (Loop Length-43.59cm, Wales/Inch-56, Coarse/Inch-60).

The following preparatory processes were conducted prior to combine scouring and bleaching trails;

- Scouring (for yarn and knitted fabric).
- Bleaching (for yarn and knitted fabric).
- Combined Scouring and Bleaching.

Process Sequence

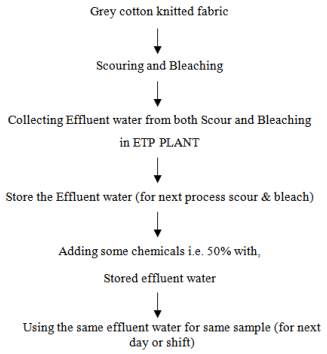

Table 2: Industry's standard values for BOD, COD & TDS

Parameter	Industrial Method					
	Full White Fabric			RFD Fabric		
	Bath liquor	Hot wash with OBA	Cold wash with neutral	Bath liquor	Hot wash	Cold wash with neutral
BOD	267	59	69	200	45	31
COD	696	92	62	620	78	45
TDS	7300	2500	2100	6800	1800	2000
PH	13.5	12	6.5	13.5	13	7.0

Table 3: Bath method values for BOD, COD & TDS

Parameter	Bath Method					
	Full White Fabric			RFD Fabric		
	Bath liquor	Hot wash with OBA	Cold wash with neutral	Bath liquor	Hot wash	Cold wash with neutral
BOD	195	47	32	190	45	30
COD	580	80	55	575	85	55
TDS	6500	6000	800	6400	3200	500
PH	13	12	7.5	14	13	7.0

Testing Methods

The methods used for testing the samples were done by the standard values of 65 ± 2% in atmospheric conditions and also followed the ASTM, AATCC instrument standards.

Results and Discussion

The below results and they are discussed with the reusing of the scour and bleached water in the pretreatment process that cannot affect the product quality with the effectiveness.

Bod, Cod & Tds

The industry's standard BOD, COD & TDS values are 350, 800 and 2000 mg/l.

In the Industrial method, the experiment samples are done by using industry effluent water. Table 2 indicates the BOD, COD and TDS values. But only the BOD and COD values are equal to the standard values. TDS value is higher than the standard.

In Bath method, the experiment samples are done by using tested effluent water. Table 3 indicates the BOD, COD and TDS values. But only the BOD and COD values are equal to the standard values.TDS value is higher than the standard.

Table 4: shows the results of the HALF white and FULL white samples of Drop Test

S.No	*Samples description*	*Test*	*Duration in sec*	*Repo Rt*
1	Rfd White 3%	Absrobency	2-3	Pass
2	Rfd White 1.5%	Absrobency	2-3	Pass

Table 5: shows the results of the HALF white and FULL white samples of the Immersion Test

S.No	*Samples description*	*Test*	*Duration in sec*	*Report*
1	White rfd (3%)	Immersion	1-2	Pass
2	White rfd (1.5%)	Immersion	1-2	Pass

Absorbency Test

The samples are tested in the fabric absorbency of one drop of water by AATCC - 79 which gives good results as shown in Table 4.

Here we conducted two types of experiment one is 3% it indicate standard recipes, another one is 1.5% it indicate 50% 0f chemicals added from standard recipe. Table 4 results show that both samples' absorbency test values are equal.

Immersion Test

The samples are tested in the fabric immersion tester by ASTM - D570 which gives good results as shown in Table 5.

Here we conducted two types of experiment one is 3% it indicate standard recipes, another one is 1.5% it indicates 50% 0f chemicals added from the standard recipe. Table 5

Table 6: shows the results of the HALF white & FULL white samples with Mean, SD and Variance of Bursting Test

Sample no	*Full white*	*Rfd*
1	42	43
2	49	40
3	45	55
4	60	52
5	55	60
6	60	70
7	50	52
8	52	62
9	60	55
10	50	52
MEAN	52.3	54.1
SD	6.39	8.73
CV	12.21	16.1

Table 7: shows the results of the HALF white & FULL white samples with of Whiteness Index

Sample no	*Observer*	*Light*	*Standard W.I value*	*Test value*
1 WHITE	10 deg	D 65	100.020	109.8
RFD	10 deg	D 65	67.623	76.5
2 WHITE	10 deg	D 65	100.020	109.9
RFD	10 deg	D 65	67.623	71.9
3 WHITE	10 deg	D 65	100.020	103.9
RFD	10 deg	D 65	67.623	76.6
4 WHITE	10 deg	D 65	100.020	110.2
RFD	10 deg	D 65	67.623	75.48
5 WHITE	10 deg	D 65	100.020	101.5
RFD	10 deg	D 65	67.623	73.7
6 WHITE	10 deg	D 65	100.020	104.6
RFD	10 deg	D 65	67.623	70.8
7 WHITE	10 deg	D 65	100.020	96.9
RFD	10 deg	D 65	67.623	66.8

results show that both samples' immersion test values are equal. But compared to standard, our test reports are greater than standard.

Bursting Strength Test

The samples are tested in the fabric bursting strength tester by ASTM - D3786 which gives good results as shown in Table 6.

Here we conducted two types of experiment one is 3% it indicate standard recipes, another one is 1.5% it indicate 50% 0f chemicals added from standard recipe. Table 6 results show the strength test values of both samples with the Mean, SD & CV are similar. But compared to standard our test reports are greater than standard.

Whiteness Index

The samples are tested in the whiteness index tester for the fabric by AATCC - 110 which gives good results as shown in Table 7.

Here we conducted two types of experiment one is 3% it indicate standard recipes, another one is 1.5% it indicates 50% 0f chemicals added from the standard recipe. Table 7 results show that the strength test values of both samples are similar. But compared to standard, our test reports are greater than standard.

Conclusion

In this investigation, we conclude that the reuse of effluent water obtained in the textile pretreatment process is possible to reuse some of the effluent water for the scouring & bleaching process without a negative impact on the product quality. Reusing effluent water will save water and chemicals and reduce energy consumption.

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