Case Study: Optimizing bleaching processes to achieve higher efficiency and Detox conformity

REWE Group Detox Program

Sustainability | March 2017

AGENDA

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1 / INTRODUCTION

Abstract: REWE Group aims to eliminate restricted hazardous chemicals from the production process of private label textiles like apparel, home textiles and shoes by 2020. In order to learn more about the substitution of hazardous chemicals REWE Group develops case studies with different suppliers from its textile supply chain. In the following case study, REWE Group helped a dyeing mill to optimize the bleaching process in order to achieve Detox compliance and to save utilities like electricity, water, chemicals and to reduce CO2 emissions at the same time.

Involved supplier: Dyeing mill in Bangladesh

Aim of the project: Optimizing bleaching processes to achieve higher efficiency and Detox conformity

Project period: June 2016 – Nov 2016

2 / BACKGROUND INFORMATION

REWE Group Detox Program

The REWE Group takes its responsibility for society and the environment very seriously. That is why REWE Group initiated its own program for a safer use of chemicals in the textile production and also joined the Greenpeace Detox Campaign in 2014. The objective of the REWE Detox Program is to assure the use of safer and less hazardous chemicals in the whole lifecycle and production procedures of textiles such as apparel, footwear and home textiles for private label products by no later than 2020.

REWE Group supports its suppliers with information and training in managing chemicals aiming at a toxic free textile supply chain. The following link could provide further information about our Detox Program: https://www.rewe-group.com/en/nachhaltigkeit/gruene-produkte/unser-detox-programm

2 / BACKGROUND INFORMATION

Wet processes

With the REWE Group Detox Program, we focus on the crucial stages of textile production in which toxic chemicals could be used, such as the main wet processes (e.g. dyeing, washing and printing). The individual wet processes are analyzed and a risk assessment is carried out, thereby enabling the evaluation of risks regarding contamination with restricted substances. In this project, pre-dyeing bleaching process is concerned.

Information about process optimization

REWE Group would like to help the dyeing mill to achieve Detox conformity and high efficiency in their production process. The chemical supplier Archroma could provide such services as it is an expert in optimization of wet processes using its chemistries and has developed a digital sustainability calculator, ONE WAY, which can digitize current conventional wet processes, design new processes which save resources (water, energy, chemicals) and use Detox conform chemicals.

3 / MANUFACTURER IN BANGLADESH

- The factory was located in Dhaka, Bangladesh with more than 3000 factory staff. It is capable to produce 2.7 million pieces of clothing per month.

Fig. 1 Cutting

Fig. 2 Factory Overview

Fig. 3 Sewing

4 / PROJECT OVERVIEW

REWE Group aims to support the dyeing mill in Bangladesh in order to achieve Detox conformity and improve the efficiency of the bleaching processes. The project steps are outlined below:

Project steps

a. **Kick-off meeting** with supplier and wet process facility to explain the project and discuss project steps

b. **Digitize current process and optimize** the process with proposed technologies which ensure the compliance with Detox requirements and at the same time save time and utilities including water, energy and chemical usage

c. **Conduct trial run and bulk run** to verify the savings with the use of the technologies proposed by Archroma

d. **Water testing** by third-party testing institute to assure compliance with Detox requirements

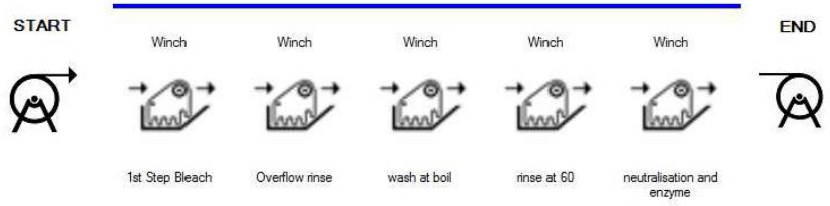
4A / PROJECT STEP: KICK-OFF MEETING

Kick-off meeting

- The kick-off meeting was held in June 2016 in Bangladesh.
- Representatives of the supplier, the dyeing mill, the REWE Group (Corporate Responsibility and Merchandising) as well as representatives from Archroma which supported the project joined this meeting.
- During the meeting, the Detox Program and the planned project were explained to the supplier and the dyeing mill. The project aimed to help the supplier meet Detox requirements as well as optimize the pre-dyeing/ bleaching process for savings on time, energy, water and chemicals usage.
- Project timelines were agreed with all the participants.

4B / PROJECT STEP: DIGITIZE CURRENT PROCESS

Data from the bleaching process of the dyeing mill were collected and digitized. Archroma then suggested technologies to optimize the process.



Total values						
Time [min]:	268.5	124.5	38	39	27	40
Water consumption [l]:	6400	1400	2300	900	900	900
Water cost [TK]:	83.2	18.2	29.9	11.7	11.7	11.7
Electr. consumption [kWh]:	89.5	41.5	12.67	13	9	13.33
Electricity cost [TK]:	447.5	207.5	63.33	65	45	66.67
Heating Energy [MJ]:	1051.51	400.52	184.45	334.5	74.82	57.22
Total Energy [MJ]:	1373.71	549.92	230.05	381.3	107.22	105.22
Steam consumption [kg]:	504.32	192.09	88.47	160.43	35.89	27.44
Steam cost [TK]:	165.67	63.1	29.06	52.7	11.79	9.01
Gas consumption [m³]:	42.92	16.35	7.53	13.65	3.05	2.34
Gas cost [TK]:	165.67	63.1	29.06	52.7	11.79	9.01
CO_2 (Heating Energy) [kg]:	83.69	31.88	14.68	26.62	5.96	4.55
Total CO_2 [kg]:	83.69	31.88	14.68	26.62	5.96	4.55
Recipe cost [TK]:	451.2	451.2	-	-	-	-
Total cost [TK]:	1147.57	740.01	122.29	129.4	68.49	87.38
Total cost per kg [TK/kg]:	5.74	3.7	0.61	0.65	0.34	0.44

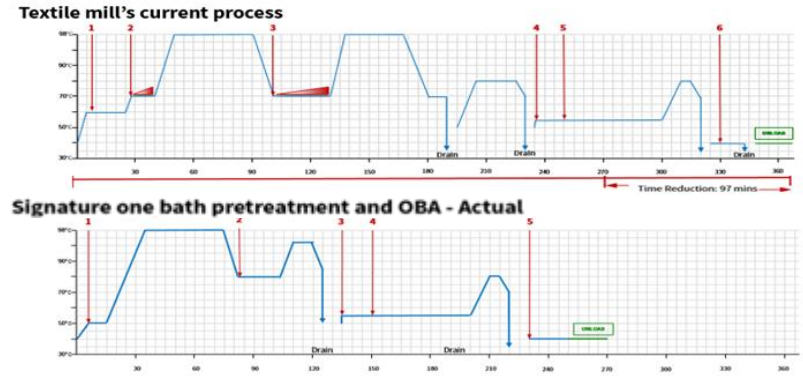
Fig. 1 Example of digitized process

4C / PROJECT STEP: TRIAL RUN AND BULK RUN

From the trail run result, significant savings on time, water, energy and chemical usages were achieved with the proposed technologies.

Comparing the mill's current bleaching process with the optimized process, below outcomes were achieved:

- Time saving: the new process saved 97 minutes compared to the old process.
- Water saving: the number of drain points have reduced from 3 to 2 every time there is a bleaching operation to be done. In the trial with 400kg fabric, 40 % savings in water was achieved.
- Energy saving: the blue lines in the graph represent the heating and cooling curves, and the upward movement or lowering of the blue line means there is either a heating or cooling process. The new process saved 30% of energy used for heating and cooling.



4D / PROJECT STEP: WATER TESTING (1/3)

Four water samples from bleaching process were collected and tested. The results were as follows:

1. Fresh water

Ref. No.	ITEMS	CAS No.	METHOD	Water	
				Reporting Limit	**Fresh Water**
9.9	Total Zinc (Zn)	7440-66-6	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**93**

2. Softener water

Ref. No.	ITEMS	CAS No.	METHOD	Water	
				Reporting Limit	**Softening Water**
2.27	Sodium Tetraborate*^	1303-96-4, 1303-43-4, 12179-04-3, 215-540-4	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**949.2**
2.28	Boron trioxide*^	1303-86-2	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**656.9**
2.29	Boric acid*^	10043-35-3, 11113-50-1	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**1166.9**
9.8	Total Copper (Cu)	7440-50-8	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**116**
9.9	Total Zinc (Zn)	7440-66-6	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**112**
9.10	Total Manganese (Mn)	7439-96-5	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**91**

3. Bio-polishing water

Ref. No.	ITEMS	CAS No.	METHOD	Water	
				Reporting Limit	**Bio-Polishing Water**
2.27	Sodium Tetraborate*^	1303-96-4, 1303-43-4, 12179-04-3, 215-540-4	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**2801.1**
2.28	Boron trioxide*^	1303-86-2	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**1938.4**
2.29	Boric acid*^	10043-35-3, 11113-50-1	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**3443.4**
9.8	Total Copper (Cu)	7440-50-8	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**348**
9.9	Total Zinc (Zn)	7440-66-6	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**240**
9.10	Total Manganese (Mn)	7439-96-5	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**206**

4. Bleaching and optical brightening agent water

Ref. No.	ITEMS	CAS No.	METHOD	Water	
				Reporting Limit	Bleaching & OBA Water
2.27	Sodium Tetraborate*^	1303-96-4, 1303-43-4, 12179-04-3, 215-540-4	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**10078.4**
2.28	Boron trioxide*^	1303-86-2	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**6974.5**
2.29	Boric acid*^	10043-35-3, 11113-50-1	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**12389.5**
9.8	Total Copper (Cu)	7440-50-8	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**904**
9.9	Total Zinc (Zn)	7440-66-6	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**30**
9.10	Total Manganese (Mn)	7439-96-5	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**46**

4D / PROJECT STEP: WATER TESTING (2/3)

The corrective action plan for positive findings

Boric Flame Retardant (2.27, 2.28 and 2.29)

- The enzyme formulation provided by other chemical suppliers may contain boric flame retardants. Information from the chemical suppliers is requested.

Total Zn and Mn (9.9 and 9.10)

- Trace amount of Mn and Zn was detected in the OBA water.

Total Cu (9.8)

- The source of Cu has been identified and Archroma could provide a new version of their product which will be launched in 2017 to eliminate Cu in wastewater.

Bleaching and OBA water

Ref. No.	ITEMS	CAS No.	METHOD	Water	
				Reporting Limit	Bleaching & OBA Water
2.27	Sodium Tetraborate*^	1303-96-4, 1303-43-4, 12179-04-3, 215-540-4	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**10078.4**
2.28	Boron trioxide*^	1303-86-2	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**6974.5**
2.29	Boric acid*^	10043-35-3, 11113-50-1	Acid Digestion with ICP or ICP/MS analysis	0.5 µg/L	**12389.5**
9.8	Total Copper (Cu)	7440-50-8	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**904**
9.9	Total Zinc (Zn)	7440-66-6	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**30**
9.10	Total Manganese (Mn)	7439-96-5	Acid Digestion with ICP or ICP/MS analysis	1 µg/L	**46**

4D / PROJECT STEP: WATER TESTING (3/3)

The concentration of boric flame retardants, total Zn, total Cu and total Mn (positive findings in bleaching process water samples) has been compared between the wastewater test report of March 2016 and November 2016. The results show that the concentration of these chemicals has substantially decreased in wastewater before treatment.

Chemicals	Reporting Limit (µg/L)	Detected Limit in March 2016 (µg/L)	Detected Limit in November 2016 (µg/L)
2.27 Sodium Tetraborate	0.5	297.8	Not detected
2.28 Boron Trioxide	0.5	206.1	25
2.29 Boric Acid	0.5	366.1	50
9.8 Total Copper (Cu)	1	32	3
9.9 Total Zinc (Zn)	1	287	Not detected
9.10 Total Manganese (Mn)	1	38	11

5 / SUMMARY

Water test results demonstrated that the pilot project has successfully analyzed the use of safer chemicals and at the same time optimized the bleaching process. The concentration of 11 priority chemical groups has been reduced. Comparing the conventional bleaching process with the new process, the dyeing facility achieved significant savings in water, power, energy, time and CO2 emissions. Archroma also provided a chemical action plan for detected non-compliant chemicals based on REWE Group's MRSL. The aim of the project is achieved with the support of Archroma and the dyeing mill.

Main Challenges:
As the pilot project focused primarily on optimizing the bleaching process and ensuring the use of safer chemicals in the bleaching process, Archroma could not ensure that hazardous chemicals were not used in other production processes in the dying mill.

Outlook:
The dying mill is interested in adopting the new bleaching process in future if the savings from the pilot can be reproduced. In addition, Archroma will introduce a new chemical product in 2017 to eliminate Cu in wastewater. REWE Group appreciated the holistic resource saving approach of the project but would expand the scope of the pilot project in future to achieve Detox compliance for all processes.

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