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WASTE WATER TREATMENT

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Rezumat: *Studiind rezultatele obținute prin diverse metode de prelevare a apei, în funcție de tipul de apă uzată, concluzia a fost că cea mai convenabilă alternativă de epurare, nu este controlul sursei, ci tratarea ei prin diverse metode.*
Acest lucru se datorează sistemelor de reciclare a apelor uzate care nu mai cer optimizarea epurării prin diluare, ci prin alimentarea cu apă din alte sisteme cu ape curate. A mai fost propusă o diagramă a lucrărilor de tratare a apelor uzate reproiectate.
Cuvinte cheie: *lucrări de preepurare a apelor uzate, niveluri de poluare, epurare a apelor uzate, NTPA, organigrame tehnologice.*

Abstract: *Studying the results obtained through various water sampling methods, depending on the type of wastewater, the conclusion was that the most convenient purification alternative is not source control, but its treatment through various methods.*
This is due to wastewater recycling systems that no longer require optimization of treatment by dilution, but by supplying water from other clean water systems. A diagram of the redesigned wastewater treatment works was also proposed.
Key words: *wastewater pre-treatment works, pollution levels, wastewater treatment, NTPA, technological flowcharts.*

Introduction

An important water consumer, the textile industry is one of the most pollutant industries.

The textile companies have thus provided their technological networks with prepurge stations, in order to minimize the ecological impact on the emissary. However, along the industrial process, or sometimes as a consequence of a profile switch, the technological schemes no longer match the depollution standards.

This leads to the necessity for periodical studies and research on how to modify the initial data related to pollution decrease, thus raising the efficeincy and adapting the wastewater flow networks to the new objectives of the technological sceme and the EU standards for emissary pollution reduction [10, 11].

The present paper is part of a cycle which is intended to conclude as a study on the decrease of the ecological impact based on the analysis of wastewater from a Moldavian textile company which works with textile and textile-like fabrics.

As a first step [3], the analysis was focused on the technological scheme used in order to obtain these articles, mostly the chemical finishing technology, which is the major wastewater pollutant.

The paper also presents the data obtained after analyzing wastewater characteristics corresponding to the 8 sectors in the finishing section: the singeing/ gassing sector, the bleaching sector, the mercerizing sector, the thermofixation sector, the dyeing sector, the printing sector, the stiffening sector and the dye storage room. The analysis were carried out according to the present regulations [4].

The aim of the present paper is that of establishing the pollution risk of each of the 8 finishing sectors, as well as that of looking for solutions for the decrease of pollution load in the wastewater resulting from these sectors, in order to match the requirements of **NTPA 002 / 2005.**

Experimental part

Starting from the data obtained through the analysis of wastewater parameters presented in a previous paper [11], the wastewater pollutant load values in the finishing sector were compared to those given by **NTPA 002 / 2005.**

Tabel 1. Comparative data concerning pollution factors characteristics

Value	pH	NO_3^- mg/L	MTS mg/L	Cl^- mg/L	CCO-Cr mg O_2/L	H_2S mg/L	NH_4^- mg/L	NO_2 mg/L	Fixed residue value mg/L	CBO_5 mg O_2/L
Wastewater	9.66	5.9	523	295.4	2527.8	3.32	9.69	1.47	4102.5	257.3
NTPA	6.5-8.5	-	350	-	500	1	30	-	-	300

The parametres in table 1 show that the ecological impact could be decreased through a physico-chemical treatment of 80-85% and a biological treatment of 15-20%. Starting from these data, the following wastewater treatment sollutions were suggested:

a) wastewater treatment in the production sectors;
b) wastewater treatment in the prepurge station.

Wastewater treatment in the production sectors

First, the pollution level in the 8 sectors of the Finishing section had to be determined. The pollution level was thus graded from 1 – the most pollutant to 8 – the least pollutant, according to the pH value and the concentration of the other pollutant agents. The data can be found in table 2.

Table 2. Pollution level of the Finishing sectors according to the pH value and the concentration of the other pollutant agents

Sector	Grades given according to the pH value and the concentration of the other pollutant agent										Average value
	pH	NO_3^-	MTS	Cl^-	CCO	H_2S	NH_4^-	NO_2^-	Fixed residue value	CBO_5	
1- Singeing/ gassing Sector	3	6	2	4	2	4	6	3	2	1	5
2 - Bleaching Sector	1	3	3	1	4	3	5	4	1	4	2
3 - Mercerizing Sector	2	1	6	5	3	6	4	1	3	3	1
4 - Thermo fixation Sector	8	8	8	8	8	8	8	8	8	8	8
5 - Dye storage room	6	7	7	7	7	7	7	7	7	7	7
6 - Dyeing Sector	5	2	1	2	5	5	2	5	5	5	4
7 – Printing Sector	4	4	5	3	1	2	1	6	4	2	3
8 - Stiffening Sector	7	5	4	6	6	1	3	2	6	6	6

Table 3 presents data related to the grading of the pollution level according to the pH value and the pollutant quantity in kg/day for the same 8 finishing sectors.

Table 3. Pollution level of the Finishing sectors according to the pH value and the pollutant quantity in kg/day

Sector	Grades given according to the pH value and the pollutant quantity										Average value
	pH	NO_3^-	MTS	Cl^-	CCO	H_2S	NH_4^-	NO_2^-	Fixed residue value	CBO_5	
1- Singeing/ gassing Sector	3	6	3	5	5	3	5	4	4	3	4
2 - Bleaching Sector	1	2	1	1	1	1	2	2	1	2	1
3 - Mercerizing Sector	2	1	4	3	2	5	3	1	2	1	2
4 - Thermo fixation Sector	8	8	8	8	8	8	7	8	8	8	8
5 - Dye storage room	6	7	7	6	7	7	8	7	7	7	7
6 - Dyeing Sector	5	3	2	2	3	2	1	3	3	4	3
7 – Printing Sector	4	5	5	4	4	4	4	6	5	5	5
8 - Stiffening Sector	7	4	6	7	6	6	6	5	6	6	6

A total average value of the pollution level was obtained by combining the data in the two tables above, having in view the pollutant concentration as well as its quantity. The data obtained, concerning the risk level for each of the 8 finishing sectors, is presented in table 4.

Table 4. Pollution level of the 8 Finishing sectors

Sector	Average for pollutant concentration	Average for pollutant quantity	Total average

1 – Singeing/ gassing Sector	5	4	4.5
2 – Bleaching Sector	2	1	1.5
3 – Mercerizing Sector	1	2	1.5
4 – Thermo fixation Sector	8	8	8
5 – Dye storage room	7	7	7
6 – Dyeing Sector	4	3	3.5
7 – Printing Sector	3	5	4
8 – Stiffening Sector	6	6	6

Starting from these data, a classification of the finishing sectors according to the pollution risk is presented in table 5.

Table 5. Pollution risk forf the 8 Finishing sectors

1. Bleaching Sector	5. Singeing/ gassing Sector
2. Mercerizing Sector	6. Stiffening Sector
3. Dyeing Sector	7. Dye storage room
4. Printing Sector	8. Thermo fixation Sector

Analysis on the efficiency of the solution for wastewater depollution directly in the production sectors were run in two sectors with an average pollution value, the Dyeing sector and the Singeing/ gassing sector.

The Dyeing sector was chosen for analysis as it also raises pollution issues caused by the dyestuff in the wastewater.

Wastewater from the Singeing/ gassing sector was treated with a cationic polyelectrolyte solution of 5 mg/L and an aluminium sulphate solution of the same concentration. Subsequent to the treatment, the mixture was briskly shaken and then given 30 minutes for sedimentation.

Eventually, the concentration of CCO-Cr and the pH were established, introducing the results in the Table 6.

Table 6. Results of wastewater depollution treatment with polyelectrolyte in the Singeing/ gassing Sector.

Wastewater sample	pH value	Concentration CCO-Cr mg O_2/L	Comments
1. Untreated wastewater in the Singeing/ gassing Sector	6.5	3606.5	-
2. Wastewater in the Singeing/ gassing Sector treated with a polyelectrolyte solution of 5 mg/L and an aluminium sulphate solution of 5 mg/L	7.5	2777.3	Decrease of 23%, but the value exceeds the NTPA standards
3. Wastewater in the Singeing/ gassing Sector treated with a polyelectrolyte solution of 10 mg/L and an aluminium sulphate solution of 10 mg/L	7.5	1442.3	Decrease of 61%, but the value exceeds the NTPA standards

In case of the sample gathered from the Dyeing Sector, which was equally prepared through treatment with a solution of 5 mg/L polyelectrolyte and 5 mg/L aluminium sulphate, the results obtained (the pH value and the CCO-Cr concentration) were introduced in the Table 7.

Table 7. Results of wastewater depollution treatment with polyelectrolyte in the Dyeing Sector

Wastewater sample	pH value	concentration CCO-Cr mg O_2/L	comments
1. Untreated wastewater in the Dyeing Sector	9.5	1342	-
2. Wastewater in the Dyeing Sector treated with a polyelectrolyte solution	7.3	1255.5	Decrease of 7,34%, but the value

of 5 mg/L and an aluminium sulphate solution of 5 mg/L			exceeds the NTPA standards
3. Wastewater in the Dyeing Sector treated with a polyelectrolyte solution of 10 mg/L and an aluminium sulphate solution of 10 mg/L	7.3	448.4	Decrease of 66,6%, a value at hte border of NTPA standards

Wastewater samples from the Dyeing sector were also analyzed from the view point of their ability to floculate and bleach.

After the pH correction, the wastewater sample in this sector was run through the following treatments. ***Bath 1***

- non-diluted bath + 5 mg/L polyelectrolyte + 5 mg/L aluminium sulphate - no change
- diluted bath 1/2 + 5 mg/L polyelectrolyte + 5 mg/L aluminium sulphate - no change
- diluted bath 1/20 + 5 mg/L polyelectrolyte + 5 mg/L aluminium sulphate - no change
- diluted bath 1/100 + 5 mg/L polyelectrolyte + 5 mg/L aluminium sulphate - no change
- diluted bath 1/100 + 10 mg/L polyelectrolyte + 5 mg/L aluminium sulphate - no change

Results and comments

The data analysis shows that a physico-chemical treatment with cationic polyelectrolyte and aluminium sulphate leads to a pH correction down to **NTPA 002/2005** standards and a decrease in the CCO-Cr concentration which does not always match the **NTPA 002/2005** standards.

Floculation ability does not occur either at high dillution values or the increase of the electrolyte concentration.

The conclusion would be that this physico-chemical treatment must be followed by a biological treatment. As a consequence, the following chart for the complete wastewater treatment was suggested to be used in the prepurge station (chart 1).

Proposed technological chart

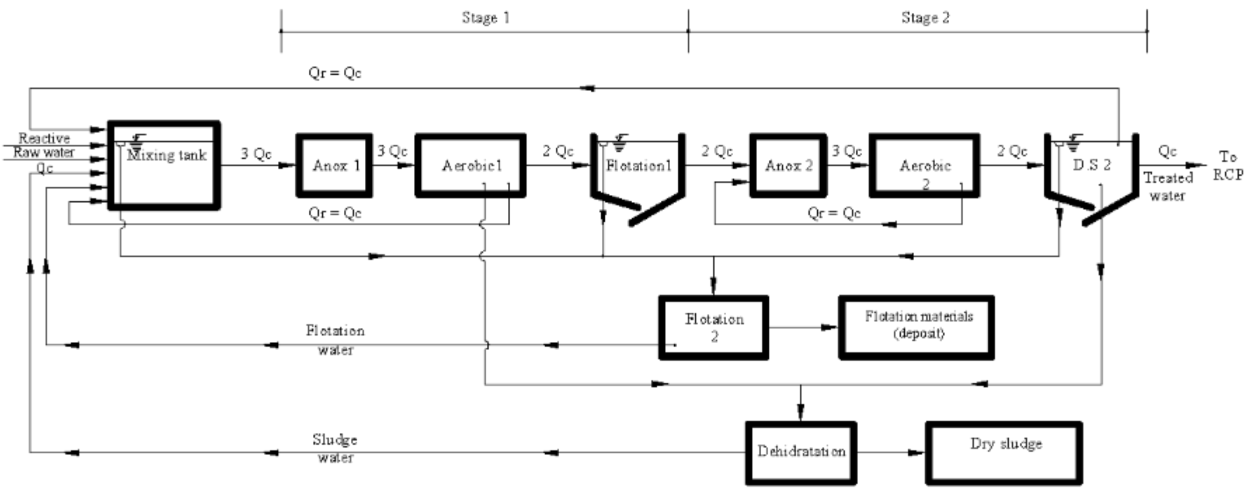

Chart 1 – Technological chart for the industrial wastewater depollution treatment

The treatment chart aims at decreasing concentration parametres which do not match the **NTPA 002-2005** standards, as for instance pH, concentration measured in H_2S mg/L and CCO-Cr concentration measured in mg O_2/L. The chart thus aims at:

- reducing H_2S concentration down to under 1 mg/L, which will be done through air stripping;
- reducing CCO-Cr mg O_2/L concentration, which will be done through multiple procedures;
- eliminating suspension materials through floculation, by using aluminium sulphate and cationic polyelectrolytes;
- reducing CCO-Cr mg O_2/L concentration down to **NTPA** standards through oxidation with the oxygen in the aeration systems;
- eliminating the biological component of wastewater by using biological procedures of advanced treatment by alternating anox and aerobe areas (**Anox treatment**: primary mud prefermentation; denitrification; anaerobe dephosphorization; aerobe dephosphorization, biodegrading şi nitrification; secondary decantation.

In order to achieve the denitrification and the dephosphorization, the effluent of the primary decantor, rich in volatile fatty acids, is guided through the anoxic denitrification step and then through the anaerobe dephosphorization one.

This way, the anaerobe denitrification and dephosphorization processes receive a sufficient amount of electron doners. **Biological aerobe purge** is done in open spaces, the biomass being either suspended in water as microorganisms (flocons), or it is fixed on a solid support as a gelatinous pellicle. In both cases, the systems are provided with oxygen.

The most usual purge method of suspended microorganisms in water is that which uses active mud). This leads to biological processes such as: nitrification, denitrification and dephosphatation.

In conclusion, the physico-chemical treatment sceme, although dominant, was followed by a two-step advanced biological treatment.

Conclusions

- It was established that wastewater treatment by source control in the production sectors leads to satisfactory ph results if using cationic polyelectrolyte and aluminium sulphate, but it does not properly reduce the CCO-Cr concentration value.
- It was noticed that floculation in the Dyeing sectors does not occur at high dillution values or at high polyelectrolyte and aluminium sulphate concentration.
- A wastewater treatment chart in the prepurge station was proposed, a chart which also involves a biological treatment step which will ensure a decrease of the pollution value which would match the present standards.
- A future paper will also present the results obtained when using this depollution chart.

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