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RECYCLING OF WASTE ACRYLIC TEXTILES

D3.1: Report on Lab-scale wastewater treatment – Executive summary

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Abstract	Report about lab-scale trials processes needed to treat wastewater obtained by previous purification steps (WP2); explanation of treatment and filtration methods and related results
Keywords	Wastewater, treatment and filtration methods

Document Revision History

Version	Date	Description of change	List of contributor(s)
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Acknowledgment

** REPORT: Document, report (excluding the periodic and final reports)*

DEM: Demonstrator, pilot, prototype, plan designs

DEC: Websites, patents filing, press & media actions, videos, etc.

OTHER: Software, technical diagram, etc

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CI	Classified, information as referred to in Commission Decision 2001/844/EC	
CO	Confidential to REACT project and Commission Services	

EXECUTIVE SUMMARY

This deliverable has been created in the context of the WP 3 (Treatment of removed chemicals) of the H2020-funded project REACT (Grant No. 820869).

The document provides the results related at characterization of effluent streams from the removal processes performed in industrial scale in WP2 and the treatment tests performed in laboratory scale to remove the contaminants and chemicals released in water during the removing process. The results described on this deliverable are the basis for design of opportune wastewater treatment plant such as will describe on D3.3.

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ABBREVIATIONS

WP	Work Package
COD	Chemical Oxygen Demand
BOD	Biochemical Oxygen Demand
TSS	Total Suspended Solid

1 INTRODUCTION

The main objective of the project to remove the finishes from acrylic fabrics involves the possibility of reusing the acrylic instead of sending it to incineration or landfill; but on the other hand, it also involves the production of treatment waste containing a high amount of organic chemicals that can contribute negatively as a total environmental impact on the project. Wastewater treatment is a highly consolidated process in modern society and involves the use of various technologies and options to reduce the contaminants present that could affect the environmental sector, contributing to the eutrophication of water and in the long run to the death of the aquatic compartment.

Characterization of effluents is an important step in developing the most appropriate strategy for wastewater treatment. The characterization takes place through different analyses that identify the state of pollution of the water, among which the most important are in the COD (Chemical Oxygen Demand) and BOD (Biochemical Oxygen Demand) two parameters that identify the quantity of oxygen necessary for chemical degradation and biochemistry, respectively, of the pollutants present in wastewater. These values have legal limits according to which the waters can be divided and treated in different ways. The goal of WP3 is to find a method that can reduce pollutants in order to obtain transparent waters and with pollution values below the limits for discharge into the sewer, i.e., TSS (Total Suspended Solid) less than 160 mg/l, COD below 500 mg/l and BOD not exceeding 250 mg/l.

The deliverable describes the following activities:

- Physical-chemical characterization of wastewater arising from waste treatment in according to the project objectives
- Pilot tests to individuate the best wastewater treatment
- Physical-chemical characterization of water treated to confirm the reduction of hazardous substances and pollutants and to verify the limit values for discharges into public drainage system, in according to the D.lgs 152/06

2 WASTEWATER CHARACTERIZATION

Samples of wastewater produced during WP2 treatments are being extensively analysed in order to develop an optimal biodegradation process. A starting point for wastewater characterization is the identification of pollutants released during the treatment.

To these are added the compounds removed from the fabrics. On the basis of the compounds present in the chemicals used for the treatment of waste, it can be deduced that the most influenced parameters are pH, COD, BOD, surfactants and solvents. The wastewater resulting from the treatment looks like the following image:

Figure 1: Picture of wastewater arising from finishing removal process.

Below are the analytical results obtained considering only the parameters where a value higher than the instrumental quantification limit was found:

Parameters	Unit of measurement	Analytical value
pH	-	12.33
Colour	-	perceptible at 1:40 dilution
TSS	mg/l	76
BOD_5	mg/l	7993
COD	mg/l	56360
Zinc	mg/l	0.7113
Sulfate (as SO_4)	mg/l	251.6
Ammonia nitrogen (as NH_4)	mg/l	106
Nitrous nitrogen (as N)	mg/l	1.7
Organic chlorinated solvents	mg/l	0.285
Tetrachlorethylene	mg/l	0.0951

Total surfactants (calculated)	mg/l	3659.76
Anionic surfactants	mg/l	0.34
Non-ionic surfactants	mg/l	3659.42

Table 1: Characterization results of wastewater.

The results of analysis evidence high value for ammonia nitrogen content that could be contributed at eutrophication if the wastewater is spilled. In addition, BOD and COD have high values, evidence of a large amount of pollutants released during the treatment. In particular, COD value are two orders of magnitude respect the limit for municipal wastewater. On basis of results, it is important evaluate the correct processes to reduce of these parameters.

3 LAB-SCALE WASTEWATER TREATMENT

Based on the sector of origin and the chemical characterization of the wastewater subject to the tests, the treatment tests were oriented towards the following technologies:

- Ultrafiltration treatment
- Evaporation treatment
- Combination of ultrafiltration and aerobic biological treatment

Treatment	COD after treatment (mg/l)
Wastewater	56000
Ultrafiltration	27100
Evaporation	44800
Ultrafiltration + biological	370

Table 2: COD value after lab-scale wastewater treatments.

CONCLUSION

The process of removing the finishings developed in the REACT project involves the production of a potentially hazardous waste resulting in the resulting wastewater. These waters are industrial waste waters with high values of the identification parameters of the state of pollution. In case of wastewater disposal without processing it means that these must be considered as a special waste. The project worked to avoid this state of definition of wastewater and identified a laboratory-scale method to reduce the polluting load and be able to manage the water as municipal wastewater and therefore the possibility of reusing a precious resource. Retracing the tests performed and mainly evaluating the COD concentration on the treated wastewater samples, it can be concluded that the ultrafiltration process has a positive impact on the water treatment process, reducing the polluting load by 52%. Instead, the evaporative process is to be excluded as an option for wastewater treatment, most likely because the substances present are highly volatile, and it is difficult to remove them completely from the water. The combination of ultrafiltration and subsequent aerobic biological treatment completely reduces the pollutant load by removing contaminants up to 99.3%, making this process the candidate to be considered for the development of a targeted industrial treatment plant.