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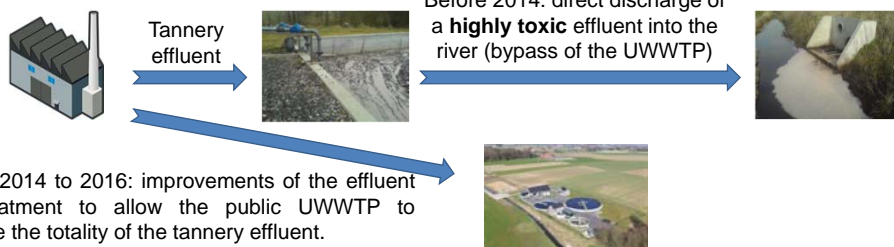
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## Introduction

Until 2014, industrial effluent from a tannery was discharged into the urban wastewater treatment plant (UWWTP) of Pas-à-Wasmes after a series of expensive and complex biological and physico-chemical treatments aiming to decrease the carbon load. Despite these efforts, the effluent quality did not allow the treatment of the totality of the effluent in the UWWTP (nitrification and clarification deterioration) and an important volume was directly bypassed into the river. Polluted (C/N) and toxic loads discharged by the tannery remained problematic for the receiving waterbody (EL13R), as shown by a battery of bioassays.

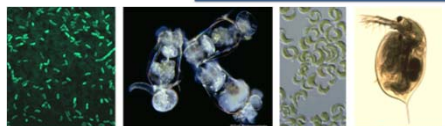
## Implemented Strategy



The improvements of the effluent treatment carried out by the tannery and the UWWTP:

- tannins recycling
- oxidation or precipitation of residual sulfites,
- Decrease of suspended matters by clarification (addition of lime and ferric chloride)
- Constant flow of wastewater to the UWWTP
- Improvement in the UWWTP (optimal use of reagent, improvement of the nitrification process, better flocculent injection, ...).

## Assessment of management effectiveness with bioassays



We used a battery of short term and chronic bioassays with the bacteria *Vibrio fischeri*, the alga *Pseudokirchneriella subcapitata*, the rotifer *Brachionus calyciflorus* and the microcrustacea *Daphnia magna*

The tannery and the UWWTP effluents were sampled 9 times from September 2014 to april 2016 to assess the decrease of toxicity before and after the treatment.

## Results and discussions

### Overall toxicity of the tannery effluent

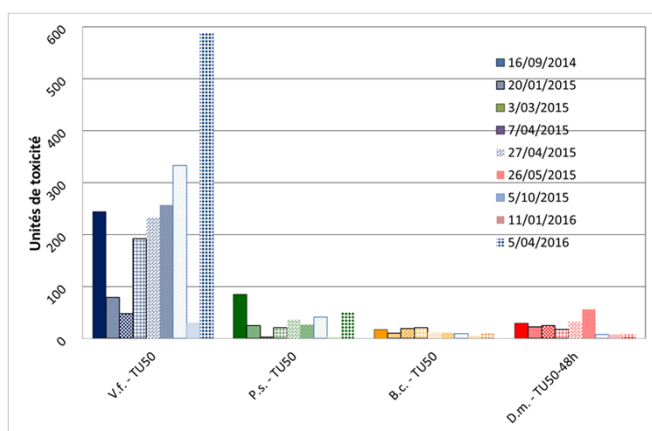


Figure 1 : Toxicity of the Tannery effluent in Toxicity Units (TU50 = 100/EC50) (V.f. *Vibrio fischeri* (bacteria) ; P. s. *Pseudokirchneriella subcapitata* (algae) ; B.c. *Brachionus calyciflorus* (rotifer) ; D.m. *Daphnia magna* (crustacea)).

The toxic characterisation of the effluents and the evaluation of "toxicity:dilution" ratio predict the capacity of the receiving river to dilute the toxic loads and therefore the propensity of the river to endure toxic pressure (risk assessment in worst case conditions with maximum toxic load and low flow in the river).

This risk assessment points out that without the improvements of the effluent treatment carried out by the tannery and the UWWTP, the effluent would exceed the EPA criteria for maximum protection of the receiving waters for every sampling date (more than 1 TU50 in the river). On the contrary, with UWWTP treatment, these exceedances are rare and slight.

The Tannery effluent induced an effect on all the organisms of the bioassays battery including different trophic levels (decomposer (bacteria), producer (algae), primary consumers (rotifers and daphnia)). The most important effects were observed on bacteria and algae. For example, a P.s. TU50 of 85 (16/9/2014) means that the sample diluted 85 times still induces a 50% inhibition of the algal growth rate. The effluent was also very toxic for the primary consumers. Important variations of the toxicity were observed for unicellular organisms (algae and bacteria) whereas the toxicity was more constant for pluricellular organisms (rotifers and daphnia).

### Overall toxicity of the effluent after treatment by the UWWTP

	6/10/2014	20/01/2015	3/03/2015	7/04/2015	27/04/2015	26/05/2015	5/10/2015	11/01/2016	5/04/2016
V.f. - TU50	0	0	0	0	0	0	0	0	0
P.s. - TU50	0	0	0	0	0	1.1	0	0	0
B.c. - TU50	1.4	0	0	1.3	<1.1	2.9	0	0	0
D.m. - TU50-48h	0	0	0	0	0	<1	0	0	0

Table 1 : Toxicity of the UWWTP effluent in Toxicity Units (TU50 = 100/EC50)

In the UWWTP, the toxicity of the tannery effluent was strongly decreased. Only slight toxicity is still observed for the rotifer *B. calyciflorus* and the algae *P. subcapitata*.

### Risk assessment for the river Pas-à-Wasmes

Estimated TU in the Pas-à-Wasmes without UWWTP process	16/09/2014	20/01/2015	3/03/2015	7/04/2015	27/04/2015	26/05/2015	5/10/2015	11/01/2016	5/04/2016
V.f. - TU50	41	13	8	32	39	43	56	5	98
P.s. - TU50	14	4	0	3	6	4	7	1	8
B.c. - TU50	3	2	3	4	2	2	2	1	2
D.m. - TU50-48h	5	4	4	3	5	9	1	1	1
Estimated TU in the Pas-à-Wasmes with UWWTP process	16/09/2014	20/01/2015	3/03/2015	7/04/2015	27/04/2015	26/05/2015	5/10/2015	11/01/2016	5/04/2016
V.f. - TU50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
P.s. - TU50	0.00	0.00	0.00	0.00	0.00	0.59	0.00	0.00	0.00
B.c. - TU50	0.00	0.00	0.00	1.58	0.94	1.64	0.00	0.00	0.00
D.m. - TU50-48h	0.00	0.00	0.00	0.00	0.00	0.28	0.00	0.00	0.00

Table 2 : Estimated TU in the river in worst case conditions (TU50 effluent x max effluent discharge/ minimum river discharge) with and without UWWTP process.

## Conclusion

Until 2014, the quality of an effluent from a tannery did not allow the treatment of the totality of the effluent in the UWWTP, and an important volume was directly bypassed into the river Pas-à-Wasmes inducing high toxic loads for the receiving waterbody. In 2014, all the concerned stakeholders implemented a strategy in order to manage the problem and to assess the effectiveness of the program of measures. The improvements of the effluent treatment carried out by the tannery and the UWWTP allowed the UWWTP to handle the totality of the tannery effluent. An advisory committee was appointed to assess the improvements and bioassays were used to regularly assess the effectiveness of the improvements on the effluent quality discharged into the waterbody. Moreover, a procedure of permanent information exchange concerning the flow rate of the industrial effluent was adopted between the tannery and IPALLE (in charge of the UWWTP). These results gave evidence to support the modification of environmental permits to match with best available techniques (BAT). The implementation of a multi-actor strategy for the management of an industrial wastewater effluent induced an important improvement of the water quality in the waterbody.