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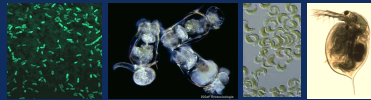
## Introduction

Bioassays offer an opportunity for a more holistic and meaningful way of assessing effects of environmental samples and wastes on ecosystems than what is possible by using chemical-based monitoring alone. They can provide predictions of environmental impacts whereas ecological community measures only determine impacts after they have occurred. Therefore, bioassays are useful in helping to implement the Water Framework Directive (WFD).

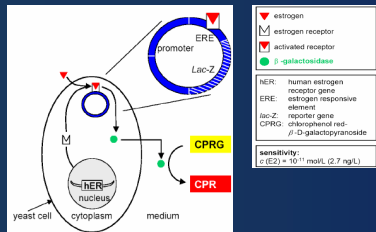
## Materials and methods

In Wallonia (Belgium), an effect directed active monitoring using bioassays is being carried out for many years. It combines ecotoxicological measurements at emission and immission and physico-chemical measurements. We use 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*. Moreover, a yeast estrogen screen (YES) assay was conducted as an assessment tool to detect the presence of endocrine disrupting compounds. During 2011, 14 major industrial discharges and 26 sampling points in the receiving waters (upstream and downstream of the effluent) were monitored. The effluents were sampled 6 times a year whereas receiving waters were sampled 4 times a year.

### Test battery used :



Function	Species	Test type	Referring to	Incubation	End point	Emission	Immission
Decomposer	<i>Vibrio fischeri</i>	Acute	NVN 6516	30 min	Luminescence inhibition	X	X
Producer	<i>Pseudokirchneriella subcapitata</i>	Chronic	ISO 8692	48 h	Growth rate inhibition	X	X
	<i>Brachionus calyciflorus</i>	Chronic	ISO 20666	48 h	Reproduction inhibition	X	X
Consumer	<i>Daphnia magna</i>	Acute	ISO 6341	48 h [6]	Immobilization/mortality	X	X
		Chronic	ISO 10706				

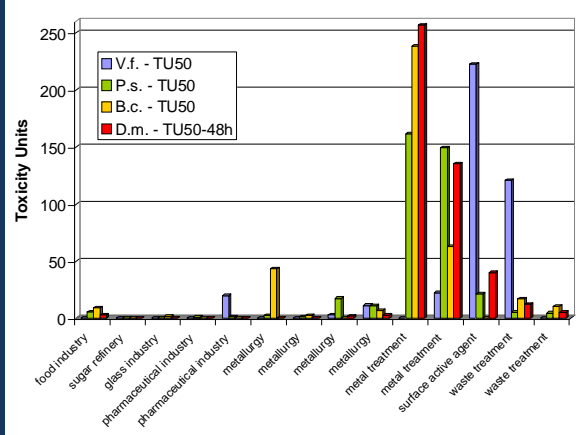


More detailed studies were carried out with complementary tools: upstream and downstream of a pharmaceutical industry and a waste recycling industry discharge, YES assay was conducted as potential assessment tools in combination with passive samplers (POCIS) placed in receiving water bodies.

## Results and discussions

### Emissions

#### Intrinsic toxicity (Toxicity Units)

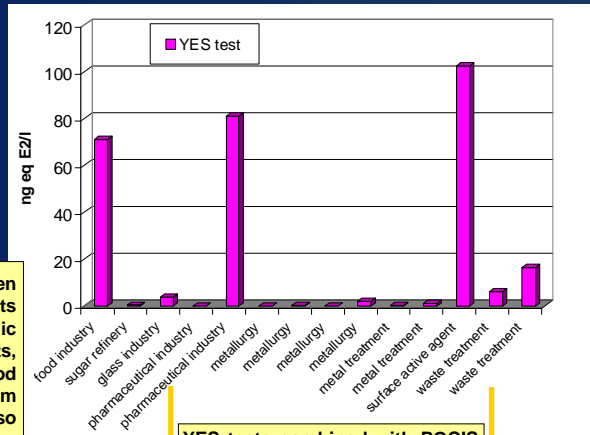


Amongst the 14 industrial effluents studied, 9 were classified as very to extremely toxic, 3 as toxic and 2 as weakly toxic. Untreated metal treatment effluents (galvanizing) particularly toxic for *Daphnia magna*, algae and *Brachionus calyciflorus* (discharge in River Vesdre). *Vibrio fischeri* appear to be very sensitive to surfactant and waste treatment effluent. Species used in the battery give complementary information

As far as Yeast estrogen screen test is concerned, 3 effluents showed very high estrogenic activities (surfactants, pharmaceutical and food industries); 2 other effluents from waste treatment industry also induce estrogenic activity.

### Emissions

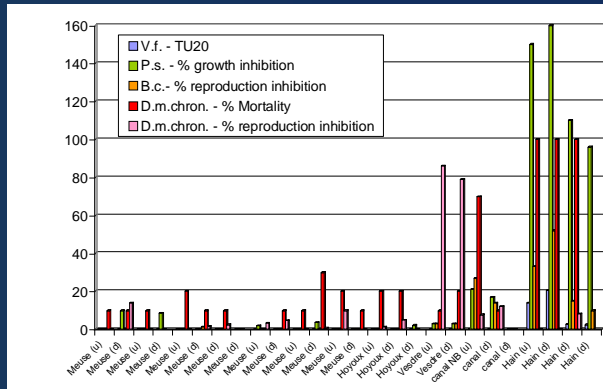
#### Yeast estrogen screen test



YES tests combined with POCIS were carried out in receiving water bodies upstream and downstream from 2 reactive effluents

### Receiving Water bodies

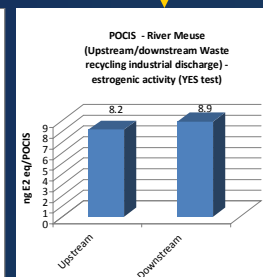
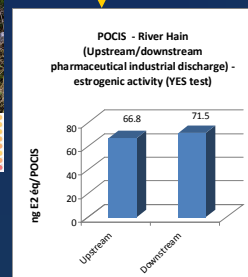
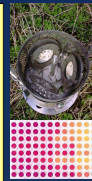
#### Intrinsic toxicity



### Receiving Water bodies

#### POCIS + YES test

The toxicity was particularly important in the River Hain for all the organisms of the battery. A high estrogenic activity was also shown by YES tests combined with POCIS (higher than in the River Meuse). The water sampled in the River Vesdre near metal treatment effluents was also toxic for *Daphnia*. Nevertheless, no significant differences were found between sampling points located upstream (u) and downstream (d) from the industrial effluents.



## Conclusion

The results of this monitoring show that bioassays are good diagnostic tools to determine the causes of poor ecological quality and to trace back to the source of contamination. They are an important "tool in the toolbox" for environmental management. They add value and provide complementary information to that supplied by the chemical and ecological community measures and could help to design appropriate management measures