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Tool for the Toxicity Assessment of Chemicals on Marine Organisms

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Context

Rational

- Acute toxicity (regulatory context):
  - OSPAR, Impact assessment of chemicals
  - REACH and Material Safety Data
  - French regulation concerning the use of dispersants at sea

- Sublethal effect (accidental context):
  - Chemical spill
  - Oil spill

} Toxicity of the product or of the response technique on **marine organisms**

The *Ievoli Sun* incident

Requests from the French authorities

Impact on seafood?
Is it necessary to establish a network for controlling the quality of seafood sold in local markets?

- Fast contamination, fast decontamination
- Tainting perceptible before danger for health

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Oil spill response at sea

Oil recovery (Containment and recuperation)

⬇

Few impact

In situ treatment

- In situ burning
- Chemical dispersion

⬇

Impact assessment needed

Chemical Dispersion

- Increasing temporary and locally the oil toxicity
- Dispersed oil toxicity is related to the dispersed oil concentration, and therefore to the natural dilution of the dispersed plume

Toxicity due to

Oil ???

Dispersant ???

The mixture ???
(oil + dispersant droplets)

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Characteristics of the test bench

ENVIRONMENT

Thermostatic room (0 to 30°C)

Air supply

Sea or Fresh water

Exposure and Recovery

12 exposure tanks (16L)

12 recovery tanks

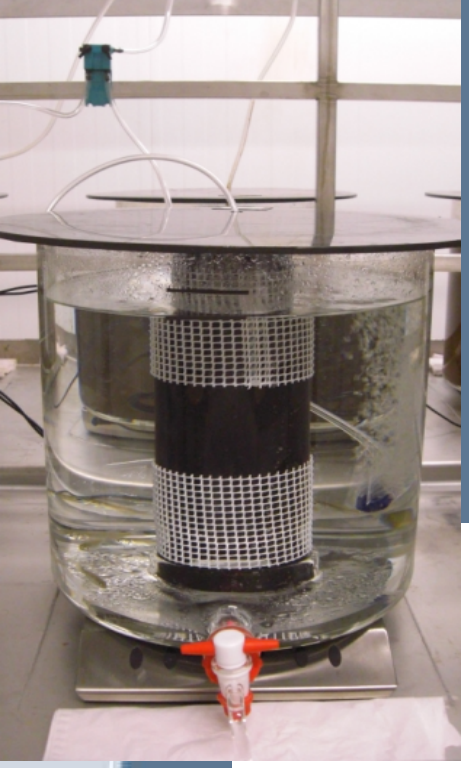
WASTES TREATMENT

(ISO 14001)

Air extractor

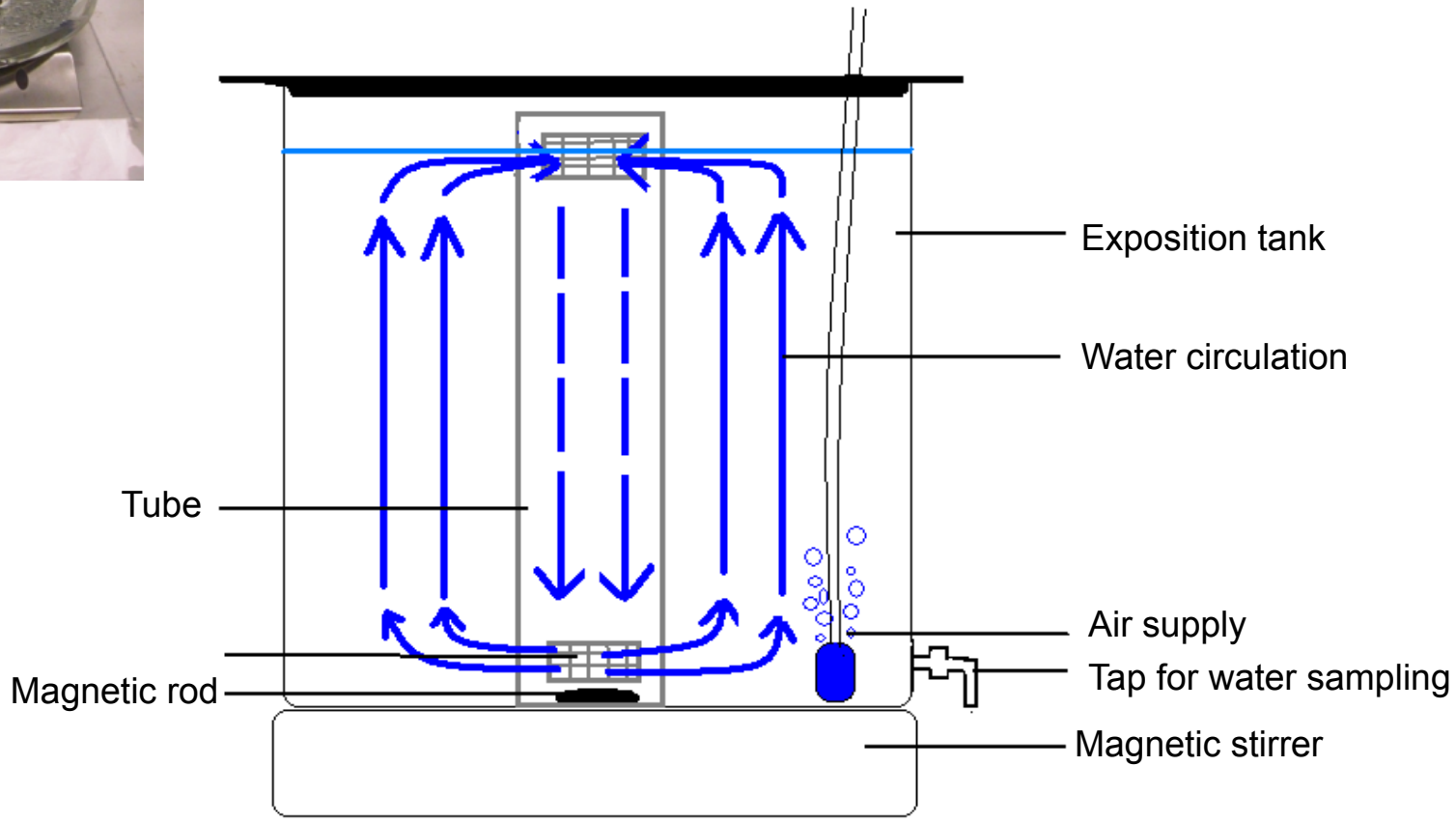
Water

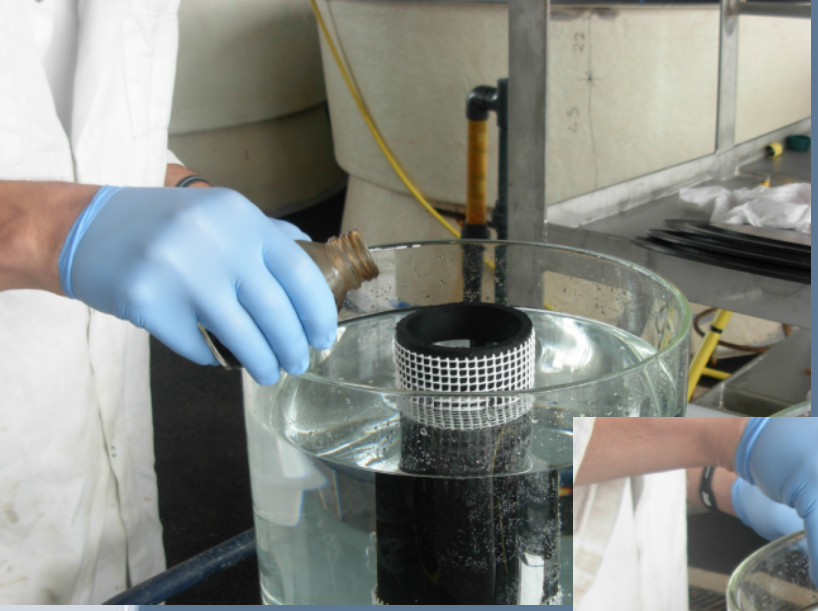
Organisms

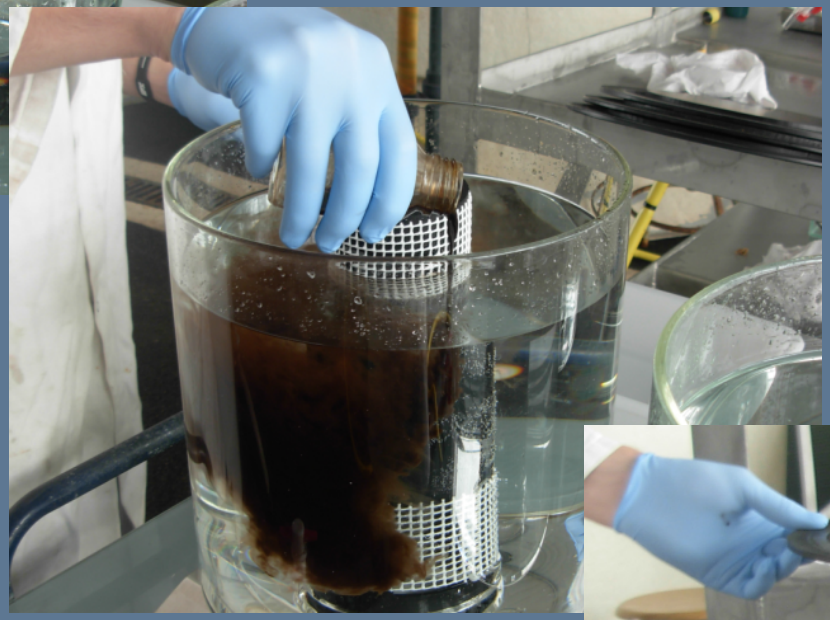


Exposure tank

Possible to have a supply of water (static, semi-static or continuous flow)



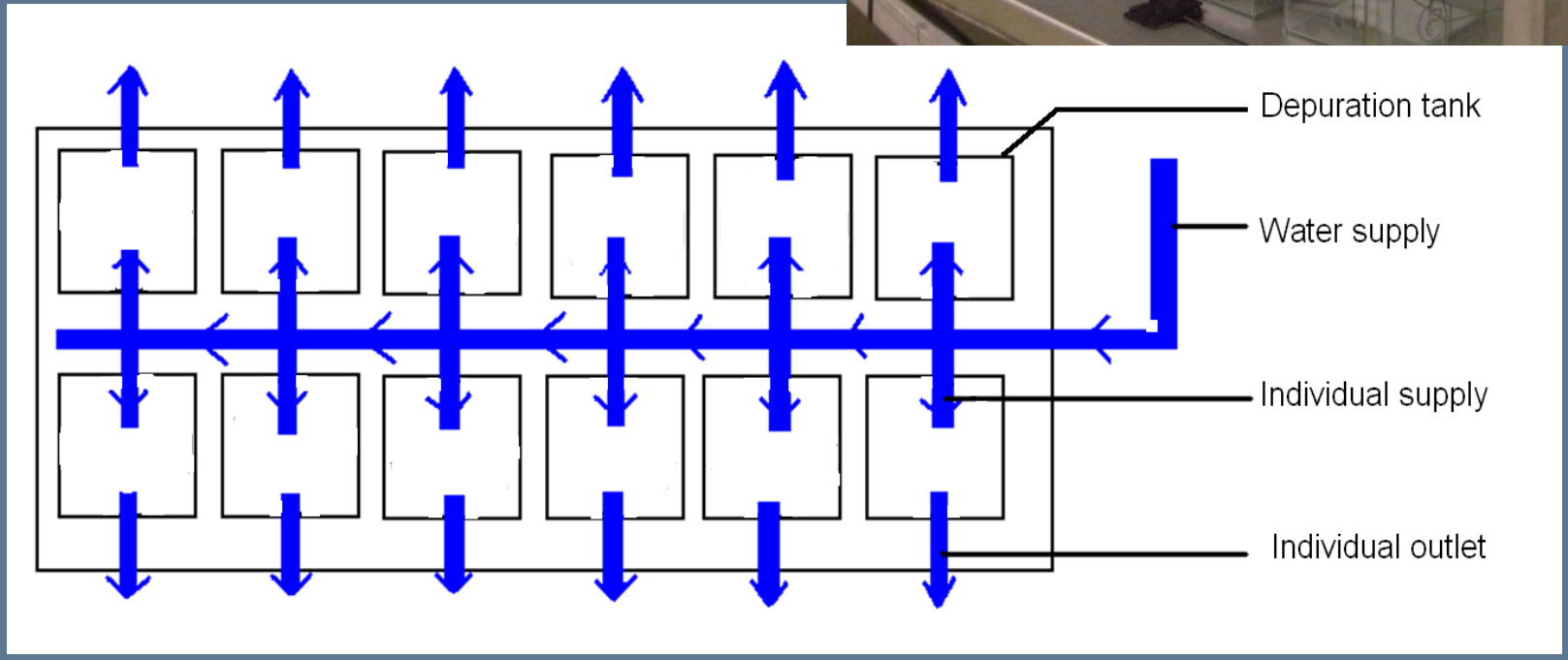




Dispersed or Dissolved products can be tested

Recovery tank

- Allows to perform tests according to different standards
- 6 liters volume
- Individual water supply



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Organisms

Products can be evaluated on organisms from different trophic levels:

- **Teleosteen** (juvenile): sea bass, grey mullet, turbot

- **Crustaceous:** shrimp
- **Bivalves**: oyster, mussel

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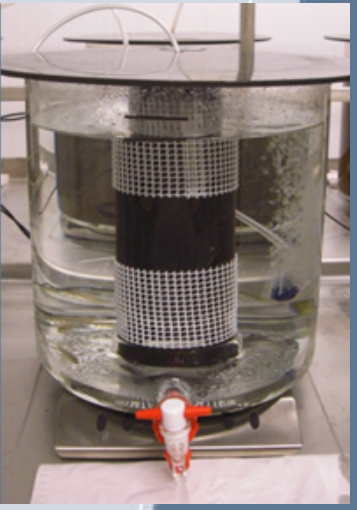
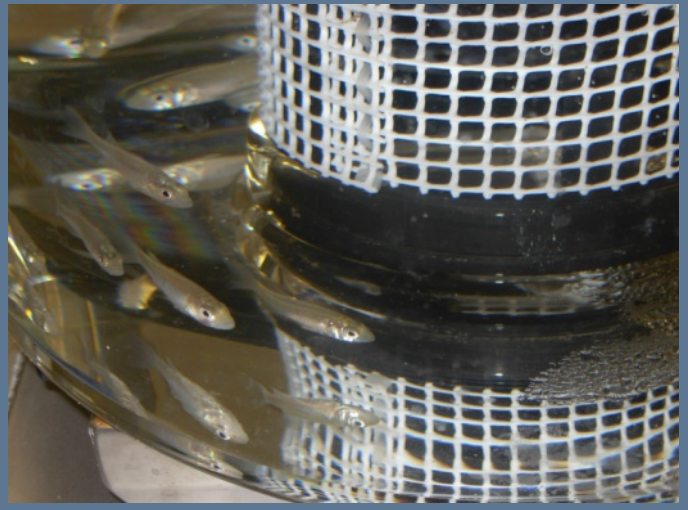
Example of results

Toxicity of chemically dispersed oil





Assessment of the toxicity of oil + dispersant mixtures on sea bass (project DISCOBIOL)

- Reference oil (Brut Arabian Light) chemically dispersed with two different dispersants (A and B).

- Juveniles sea bass *Dicentrarchus labrax* (mass: 0.6 ± 0.18g)

Toxicity of chemically dispersed oil on sea bass

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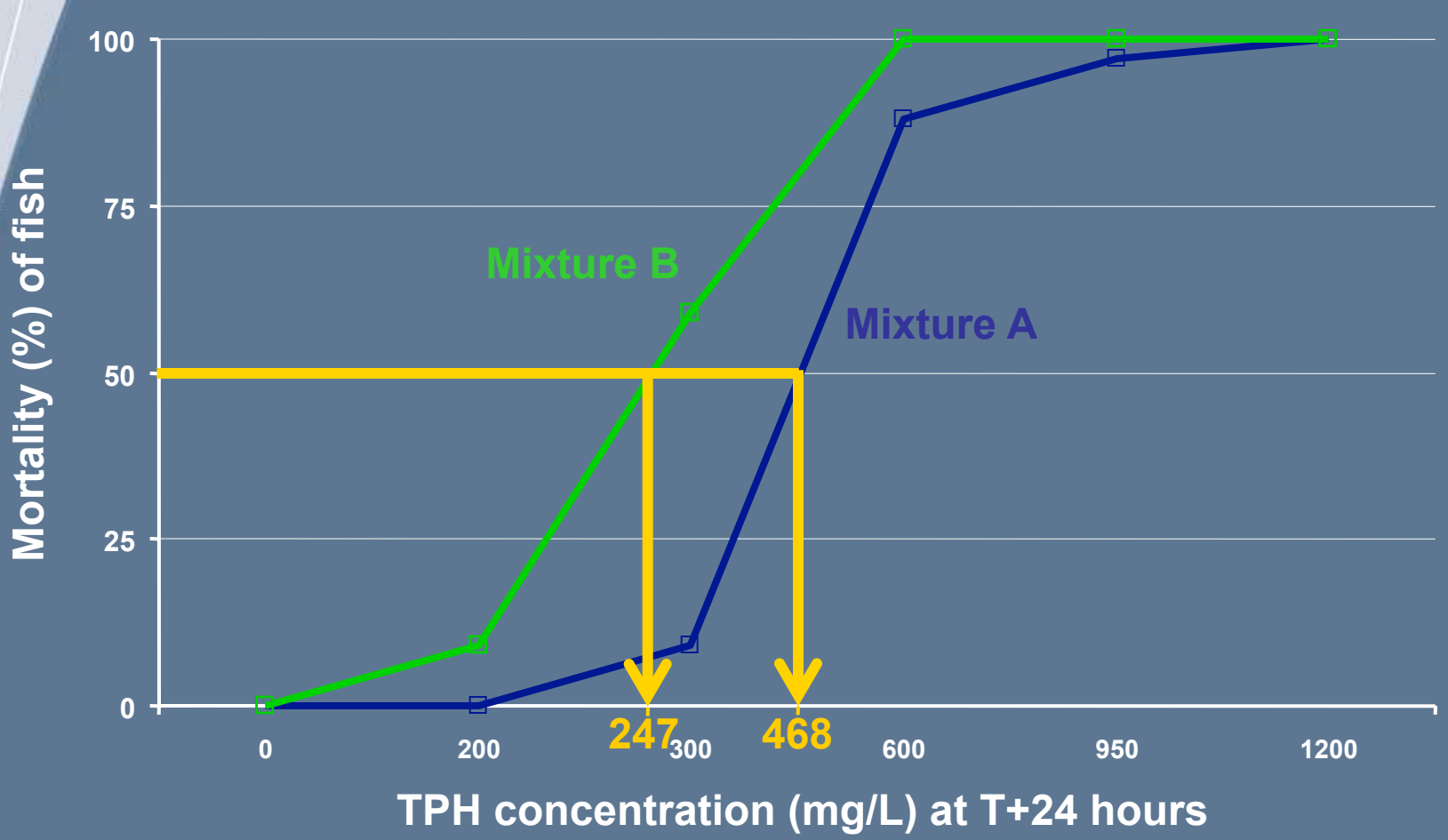
Mixture A		Mixture B	
[THC] (mg/L)	Mortalities (%)	[THC] (mg/L)	Mortalities (%)
0	0	0	0
101 ± 7	0	68 ± 10	9
217 ± 12	9	191 ± 6	59
613 ± 17	88	254 ± 36	94
712 ± 20	97	474 ± 13	100
1019 ± 28	100	824 ± 38	100

Concentrations measured at T+24 hours, 4 replicates



	Mixture A	Mixture B
Spearman-karber estimates: LC_{50} at 24h :	468 mg/L	247 mg/L
95% lower confidence:	423 mg/L	220 mg/L
95% upper confidence:	528 mg/L	277 mg/L

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Toxicity of chemically dispersed oil on sea bass

Same oil, two dispersants, two LC_{50}

Hypotheses

Toxicities of dispersants are different?

Toxicity of the mixture (oil+dispersant) is link to the efficiency of dispersant (oil bioavailability)?

To characterize the size of oil+dispersant droplets

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Conclusions

- **This tool provides standardized data on the toxicity of chemicals on aquatic organisms (regulatory context) BUT, also, allows to perform studies on sublethal effects (accidental context)**

- **All experimental conditions are controlled (good reproducibility)**

- **Possible to work on a wide range of**
  - **chemicals**: from very to slightly soluble (oil is particularly hydrophobic); liquid or gazeous
  - **Organisms**: different levels of the trophic scale
  - **Ecosystems**: from tropical conditions to Arctic ones