

**ECOTOXICITY ELEMENTS**  
**TOXICITY TO SEDIMENT ORGANISMS**  
**Freshwater benthic organisms, laboratory ecotoxicity study**

**PAPER REVIEWED**

Bressan, M., Brunetti, R., Casellato, S., Fava, G.C., Giro, P., Marin, M., Negrisolo, P., Tallandini, L., Thomann, S., Tosoni, L., Turchetto, M., Campesan, G.C. 1989. Effects of linear alkylbenzene sulfonate (LAS) on benthic organisms. *Tenside Surfactants Detergents*, 26, 148-158.

**TEST SUBSTANCE**

- LAS: details of the test substance and supplier not mentioned.

 Remarks: /

**METHOD**

- Laboratory University of Padua, Italy
- Objectives To assess the acute and subacute or chronic effects of LAS in water or absorbed to sediment to freshwater tubicific oligochaetes (*Branchiura sowerbyi* and *Limnodrilus hoffmeisteri*) and to freshwater bivalve molluscs (*Anodonta cygnea* and *Unio elongatulus*).  
Additional objectives not reviewed in this summary: tests on marine species *Tisbe holoturiae* (benthic copepod), *Mytilus galloprovincialis* (bivalve mollusc) and *Paracentrotus lividus* (sea urchin).
- Method/guideline followed Methods fully described in reviewed paper. Tests are briefly described below;
  - Tests on oligochaetes *B. sowerbyi* and *L. hoffmeisteri*:
    - A series of LC<sub>50</sub> tests was carried out with 24 h solution replacement, both with and without sediment.
    - Chronic effects of aqueous LAS (solution changed daily and in the presence of unspiked sediment) and of sediment-sorbed LAS (water changed weekly) were evaluated for different stages of the biological cycle of *B. sowerbyi*.
  - Tests on molluscs *A. cygnea* and *U. elongatulus*:
    - Acute and subchronic effects of aqueous LAS were determined with 24 h solution replacement.

Subchronic tests with *A. cygnea* were performed during the reproductive period and during the non reproductive period.

- Chronic effects of sediment-sorbed LAS on *A. cygnea* were studied for 80 days with continuous water exchange.

- Test substrate/application  
Sediments were collected from river (for the oligochaetes) and pond (for the molluscs) environments.  
For pond sediment, a high LAS quantity was equilibrated by a unique addition of LAS solution, followed by exhaustive washing. The river sediment was repeatedly equilibrated with water-LAS solutions of low concentrations and then washed twice.  
Details of the physical and chemical characteristics of the natural and the treated sediments are mentioned in the reviewed paper.
- GLP  
Likely not.
- Year (study performed)  
≤ 1989
- Species/strain/supplier  
*B. sowerbyi* and *L. hoffmeisteri* were collected from various areas (not specified), representative of a more general environment.  
*A. cygnea* and *U. elongatulus*: not specified.
- Analytical monitoring  
LAS levels in natural and treated sediments were determined by HPLC as described by Matthijs and De Henau (1987) and MBAS methods as described by the American Public Health Association (1985).
- Exposure period
  - Tests on *B. sowerbyi* and *L. hoffmeisteri*:
    - Acute tests: 96 h.
    - Chronic tests: ~ 130 days (for aqueous LAS) and ~180 days (for sediment-sorbed LAS) (derived from figure in reviewed paper).
  - Tests on molluscs *A. cygnea* and *U. elongatulus*:
    - Acute tests: 96 h.
    - Subchronic tests: ≥ 20 days (derived from table in reviewed paper).
    - Chronic tests: 80 days.
- Endpoints
  - Tests on *B. sowerbyi* and *L. hoffmeisteri*:
    - Acute tests: mortality.
    - Chronic tests: number of laid cocoons, number of eggs for cocoon, total number of oocytes, period of embryonic development, % of degenerated cocoons and % of hatching worms.

- Tests on *A. cygnea* and *U. elongatulus*: mortality
- Statistical methods N.A.

Remarks: /

## RESULTS

- Nominal concentrations
  - Tests on *B. sowerbyi* and *L. hoffmeisteri*:
    - Acute tests: not mentioned.
    - Chronic tests (water exposures): 0, 0.5, 2.5 and 5 mg/L (degradation ~ 20 % within 24 h).
  - Tests on *A. cygnea* and *U. elongatulus*:
    - Acute tests (water exposure): 0, 5, 10, 25, 50, 100, 200 and 400 mg/L
    - Subchronic tests (water exposure): 0, 7.5, 10, 15 and 50 mg/L.
- Measured concentrations
  - Tests on *B. sowerbyi* and *L. hoffmeisteri*:
    - Acute tests: not mentioned.
    - Chronic tests (sediment exposures): initially 4 (control) and 26 mg/kg d.w.
  - Tests on *A. cygnea*:
    - Chronic tests (sediment exposures): 750 mg/kg d.w. (initially) to 200 mg/kg d.w. (after 80 days) in the treated sediment and 18 mg/kg d.w. to 3 mg/kg d.w. in the control sediment.
- NOEC, LOEC, LC<sub>50</sub> See Table 1.
- LT<sub>50</sub> See Table 2. Results for other endpoints than mortality are briefly described in Table 3.

Table 1: NOEC, LOEC and LC<sub>50</sub> for LAS dissolved in water, with and without sediment (aq LAS; mg LAS/L) and for LAS sorbed to sediment (sed LAS; mg initial LAS/kg d.w.).

Species	Exposure time	Aq LAS						Sed LAS
		With sediment			No sediment			
		NOEC	LOEC	LC <sub>50</sub>	NOEC	LOEC	LC <sub>50</sub>	
<i>B. sowerbyi</i>	96 h	2.5	5.0	10.8 <sup>a</sup>	1.0	2.0	4.4 <sup>a</sup>	N.A.
<i>L. hoffmeisteri</i>	96 h	1.0	2.5	7.8 <sup>a</sup>	0.25	0.5	2.0 <sup>a</sup>	N.A.
<i>A. cygnea</i> in non reproductive period	96 h	N.A.	N.A.	N.A.	N.A.	N.A.	200	N.A.
<i>A. cygnea</i> in reproductive period	80 days	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	≥ 750
<i>U. elongatulus</i>	96 h	N.A.	N.A.	N.A.	N.A.	N.A.	50	N.A.

N.A. = Not available.

<sup>a</sup> = Derived from figure in reviewed paper.

Table 2: LT<sub>50</sub> values for LAS dissolved in water, without sediment.

Species	LAS concentration (mg LAS / L)							
	50	30	25	20	15	12.5	10	7.5
<i>B. sowerbyi</i>	N.A.	60'	70'	111'	210'	N.A.	N.A.	N.A.
<i>L. hoffmeisteri</i>	N.A.	N.A.	N.A.	16'	30'	45'	81'	240'
<i>A. cygnea</i> in reproductive period	3.24 days	N.A.	N.A.	6.31 days	5.13 days	N.A.	8.71 days	7.94 days
<i>A. cygnea</i> in non reproductive period	6.31 days	N.A.	N.A.	11.41 days	14.12 days	N.A.	14.79 days	19.95 days

N.A. = Not available.

Table 3: Results for the different endpoints considered during exposure of *B. sowerbyi* to LAS dissolved in water and LAS adsorbed to sediment.

Parameter	Result	
	LAS dissolved in water	LAS adsorbed to sediment
Beginning of the cocoon-laying period	At 2.5 and 5 mg LAS / L, worms laid the cocoons precociously, compared to controls.	No significant differences between treated and control series.
Number of laid cocoons	Lower for the worms exposed to 0.5 and 2.5 mg LAS / L but the 5 mg LAS / L series were paradoxically more similar to controls.	Similar in treated and control series.
Number of oocytes / cocoon	Similar in treated and control series.	Similar in treated and control series.
Total number of oocytes	Lower for the worms exposed to 0.5 and 2.5 mg LAS / L but the 5 mg LAS / L series were paradoxically more similar to controls.	Similar in treated and control series.
Period of embryonic development	Similar in treated and control series.	Similar in treated and control series.
% degenerated cocoons	Similar in treated and control series.	Similar in treated and control series.
% hatching worms	Similar in treated and control series.	Similar in treated and control series.

- Remarks:
- It is not clear whether the mentioned concentrations in aqueous solutions were nominal or measured.
  - *A. cygnea* and *U. elongatulus* closed their valves and seemed to be pushed to an anaerobic metabolism when LAS was dissolved in water. Thus, contacts with the external environment were limited or excluded for long periods.

