

ECOTOXICITY ELEMENTS
TOXICITY TO TERRESTRIAL ORGANISMS
Soil invertebrates: *Folsomia fimetaria*

PAPER REVIEWED

Homstrup, M., Krogh, P.H. 1996. Effects of an anionic surfactant, linear alkylbenzene sulfonate, on survival, reproduction and growth of the soil-living collembolan *Folsomia fimetaria*. Environmental Toxicology and Chemistry, 15, 1745-1748.

TEST SUBSTANCE

- (C_{11.53}) LAS (Marlon[®] A350, Hüls Aktiengesellschaft, Marl, Germany).

 Remarks: Neat LAS was 50 % (w/w) active C_{11.53} LAS, average molecular weight = 344 g/mol. All data expressed in mg LAS (active substance) / kg d.w. soil.

METHOD

- Objectives To determine the effects of LAS on mortality, growth, molting rate, and reproduction of *Folsomia fimetaria* in the laboratory.
- Method/guideline followed Springtail *Folsomia fimetaria*: No internationally accepted guideline available.
Important deviations from subsequently developed ISO 11267 (survival and reproduction): adult springtails instead of juveniles were used; 20 individuals instead of 10 per test container; 21 days exposure instead of 28 days (ISO 1999).
- Test substrate/application A natural, commercially available soil (LUF A Speyer 2.2, Sp 2121) was used as test soil. Defaunation by heating at 80 °C (period not mentioned).
LAS was added to the soil, dissolved in water (type of water not mentioned).
- GLP Likely not.
- Year (study performed) ≤ 1996.
- Species/strain/supplier *F. fimetaria*: a laboratory culture, established from field-collected animals (collection site not mentioned), reared on a moistened substrate of plaster of Paris/charcoal.

- Analytical monitoring
Nominal concentrations in the test were not measured. However, a separate experiment (without animals) was set up with two concentrations not used in the animal testing (30 and 120 mg LAS / kg d.w.). The nominal LAS concentrations in this extra experiment were verified with reverse-phase HPLC with UV detection, based on a previously established method (Matthijs and De Henau 1987).
- Exposure period
21 days.
- Endpoints
Mortality (adults, juveniles), growth (juveniles), reproduction, molting frequency (juveniles).
- Statistical methods
NOEC, LOEC with ANOVA and Dunnet's test. LC10 and LC50 were estimated with probit analysis, EC10 and EC50 were estimated with regression methods (not further detailed).

 Remarks: The soil pH was not checked after addition of LAS nor during or after the test period. Water content was only adjusted after 14 days of exposure.

RESULTS

- Nominal concentrations
Survival and reproduction of adults: 0, 100, 150, 300, 500, 700, 1000 mg LAS / kg d.w.
Survival and growth of juveniles: 0, 200, 300, 500, 700, 1000 mg LAS / kg d.w.
These data were derived from tables and graphs, in the reviewed paper, since they were not literally mentioned in the text.
Molting of juveniles: 0, 300, 600 mg / kg d.w.
- Measured concentrations
Good agreement between initial nominal and measured concentrations in the extra experiment (without animals), but significant degradation of LAS occurred during exposure (half-lives of 10.7 ± 0.7 and 19.8 ± 0.8 days, for 30 and 120 mg LAS / kg d.w., respectively). The measured concentrations after 17 days (closest to the 21 days of the animal exposures) were approximately 30 and 60 % of the initial concentrations for 30 and 120 mg LAS / kg d.w., respectively.
Apart from the half-lives, these data were derived from Figure 1 of the reviewed paper, since the exact data were not mentioned in the text.
- NOEC, LOEC, EC50, EC10, LC50, LC10
See Table 1.

Table 1: NOEC, LOEC, ECx and LCx values (mg LAS / kg d.w.) for *F. fimetaria* exposed to LAS.

Parameter	NOEC	LOEC	EC10 or LC10	EC50 or LC50
Adult survival	>1000	>1000	/	/
Juvenile survival	500	700	196	570
Reproduction	500	1,000	147	737
Juvenile growth	<200	200	163 ^a	896 ^a
Molting frequency	<300	300	185 ^a	923 ^a

^a Not clear how minimal growth/moulting was determined: parameter in the regression calculation or default value (see Remarks)?

Remarks: According to ISO 11267 too few replicates were used for the ECx approach (less than 5 in the controls) (ISO 1999). Nominal concentrations were derived from tables and figures, since they were not mentioned in the text. It was not clear in the reviewed paper whether minimal growth and moulting (maximal effect) were a parameter or a default value in the ECx regression calculations. The choice for one of both possibilities might strongly influence the resulting ECx.

CONCLUSIONS

ECx calculations were not withdrawn although only 4 instead of 5 (ISO 11267) replicates for the control were used. The most sensitive parameter was reproduction (EC10 = 147 mg LAS / kg d.w.).

RELIABILITY

Klimisch score (Klimisch *et al.* 1997).

2a (acceptable, well-documented publication which meets basic scientific principles): not all nominal concentrations literally mentioned, no GLP, only 2 concentrations from a separate experiment without animals were measured), ECx calculation not fully detailed.

REFERENCES

- ISO. 1999. Soil quality – Inhibition of reproduction of *Collembola (Folsomia candida)* by soil pollutants. ISO 11267, Geneva, Switzerland.
- Matthijs, E., De Henau, H. 1987. Determination of LAS. Tenside Surfactant Detergents, 24, 193-198.