

**ECOTOXICITY ELEMENTS
TOXICITY TO TERRESTRIAL ORGANISMS**


Plants: *Lepidum sativum*, *Lactuca sativa*, *Helianthus annuus*, *Brassica rapa rapa*, *Sinapis alba*, *Trifolium pratense*, *Vicia sativa*, *Linum usitatissimum*, *Brassica chinensis*, *Sorghum vulgare*, *Brassica napus*, *Avena sativa*, *Raphanus sativus radicola*, *Lolium perenne*, *Triticum aestivum*, *Trigonella coerulea*, *Phaseolus aureus vigna radiata*

PAPER REVIEWED

Günther, P., Pestemer, W. 1992. Phytotoxicity of surfactants to higher plants. In: Hall, J.E., Sauerbeck, D.R., L'Hermite, P. (eds.). Effects of organic contaminants in sewage sludge on soil fertility, plants and animals. Proceedings of a seminar held at Braunschweig (D) on 6-8 June 1990. Office for Official Publications of the European Communities, Brussels, Belgium.

TEST SUBSTANCE

- LAS (Hüls, Marl, Germany).

 Remarks: No further details were given on LAS and it is not mentioned whether the data presented are given in mg neat LAS / kg d.w. soil for growth and mg neat LAS / L for germination and bioavailability.

METHOD

- Laboratory Federal Biological Research Centre, Weed Research Institute, Braunschweig, Germany.
- Objectives To determine the effects of LAS on germination (*in vitro*), growth (soil test and hydroponic test, short- and long-term), and on the effect of LAS on pesticide (lindane) availability for different plant species.
Additional objectives not reviewed in this summary:
 - to assess the phytotoxicity of distearyldimethylammoniumchloride and 4-nonylphenol;
 - to determine the availability of lindane in soil under influence of surfactant addition.
- Method/guideline followed
 - Germination, radicle length: comparable to ISO 11269-3 (ISO 1993a).
 - Growth inhibition in soil: range-finding and dose-response tests: comparable to ISO 11269-2 (ISO 1993b).
 - Hydroponic culture (bioavailability): no internationally accepted guideline available.
 - Long-term growth inhibition: no internationally accepted guideline available.

- Test substrate/application
 - Germination: distilled water, paper (type not mentioned) in petri dishes.
 - Growth inhibition in soil: sandy loam soil. Supplier or collection site not given; pH, texture, maximum water holding capacity given in the reviewed paper.
 - Hydroponic culture: not mentioned in the reviewed paper but in Günther and Pestemer 1990.
 - Long-term growth inhibition (hydroponic test): not mentioned in the reviewed paper but in Günther and Pestemer, 1990.

- GLP
 - Likely not.

- Year (study performed)
 - ≤ 1990

- Species/strain/supplier
 - Germination: *Lepidum sativum* (garden cress): supplier not mentioned
 - Growth inhibition in soil:
 - Range-finding tests: *Lactuca sativa* (head lettuce), *Helianthus annuus* (sunflower), *Brassica rapa ssp. rapa* (turnip), *Sinapis alba* (mustard), *Trifolium pratense* (red clover), *Lepidum sativum* (garden cress), *Vicia sativa* (common vetch), *Linum usitatissimum* (flax), *Brassica chinensis* (Chinese cabbage), *Sorghum vulgare* (great millet), *Brassica napus* (rape), *Avena sativa* (oats), *Raphanus sativus var. radicula* (small radish), *Lolium perenne* (perennial ryegrass), *Triticum aestivum* (winter wheat), *Trigonella coerulea* (sweet trefoil), *Phaseolus aureus vigna radiata* (mung bean): supplier not mentioned.
 - Dose-response tests: *Avena sativa* (oats), *Brassica rapa ssp. rapa* (turnip), *Sinapis alba* (mustard).
 - Hydroponic culture: *Sinapis alba* (mustard): supplier not mentioned.
 - Long-term growth inhibition (hydroponic test): *Sinapis alba* (mustard): supplier not mentioned.

- Analytical monitoring
 - Nominal LAS concentrations not measured.

- Exposure period
 - Germination: 72 hours.
 - Growth inhibition in soil: range-finding tests: not mentioned; dose-response experiments: 14 days.
 - Hydroponic culture: 14 days.
 - Long-term growth inhibition (hydroponic test): 6 weeks.

- Endpoints
 - Germination: radicle length.
 - Growth inhibition in soil: fresh weight (as % of the control).
 - Hydroponic culture: fresh weight (as % of the control).
 - Long-term growth inhibition (hydroponic test): fresh weight.
- Statistical methods

The EC50 values were calculated with nonlinear regression (logistic curve fitting) (Günther et al. 1989).

Remarks: \

RESULTS

- Nominal concentrations
 - Germination: 0, 50, 100, 200, 400, 800, 1600, 3200, 6400, 12800 mg LAS / L.
 - Growth inhibition in soil:
 - Range-finding tests: 0, 100, 1000, 10000 mg LAS / kg d.w.
 - Dose-response tests: not mentioned in the reviewed paper.
 - Hydroponic culture: not mentioned in the reviewed paper.
 - Long-term growth inhibition (hydroponic test): 0, 10, 20, 50, 100, 200, 300, 600 mg LAS / L.
- Measured concentrations

Not available.
- EC50, EC10

See Table 1 (EC10 derived from graphs in the reviewed paper, since they were not mentioned in the text).

Table 1: EC10 and EC50 values (mg LAS / kg d.w.) for growth of the different endpoints in the different tested plant species.

Endpoint	Species	EC10	EC50
Fresh weight as % of the control (growth, dose-response test)	<i>Avena sativa</i>	80	320
	<i>Brassica rapa</i>	100	180
	<i>Sinapis alba</i>	200	300

- Remarks: No NOEC, LOEC, ECx were given for the following endpoints:
- Germination (radicle length);
 - Growth inhibition in soil: range-finding test with 17 species (although 'Fig 2' represents results without standard deviations or errors of this exposure);
 - Hydroponic culture: 14 day fresh weight as % of the control;
 - Hydroponic culture: 6 weeks fresh weight (although 'Fig 5' represents results

without standard deviations or errors of this exposure).
In annex 1 ECx calculations of germination of garden cress and fresh weight (6 weeks hydroponic test) are given, based on Vanewijk & Hoekstra 1993.

CONCLUSIONS

Avena sativa was the most sensitive plant with an EC10 of 80 mg LAS / kg d.w. (fresh weight at % of the control after 14 days exposure).

RELIABILITY

Klimisch score (Klimisch *et al.* 1997) 3b (documentation insufficient for assessment): no measured concentrations; test-substrate not fully described, nominal concentrations not measured.

REFERENCES

- Günther P., Rahman A., Pestemer W. 1989. Quantitative bioassay for determining residues and availability to plants of sulfonylurea herbicides. *Weed Research*, 29, 141-146.
- Günther P., Pestemer W. 1990. Risk assessment for selected xenobiotics by bioassay methods with higher plants. *Risk Management*, 14, 381-388.
- ISO. 1993a. Soil quality – Determination of the effects of pollutants on soil flora. Part 3: Method for the measurement of germination. ISO 11269-3
- ISO. 1993b. Soil quality – Determination of the effects of pollutants on soil flora. Part 2: Method for the measurement of effects of chemicals on the emergence and growth of higher plants.
- Vanewijk, P.H., Hoekstra, J.A. 1993. Calculation of the EC50 and its confidence interval when subtoxic stimulus is present. *Ecotoxicology and Environmental Safety*, 25, 25-32.