

English Summary

In spring 2002, the National Environmental Research Institute in cooperation with five Danish Counties analysed 45 samples of liquid manure: 17 samples from cattle, 8 from organically raised cattle, 17 from pigs and 2 samples from mixed livestock. The samples were analysed for a number of heavy metals and hazardous substances (cf. table below).

The analyses showed that all samples contained one or more of the heavy metals (aluminium, cadmium, copper, nickel and zinc) included in the analysis. The generally high concentrations of copper, nickel and zinc in liquid manure from pigs probably origin from fodder additives. One liquid manure sample from pigs exceeded the stipulated limit values for zinc applying to sludge. One liquid manure sample from cattle exceeded the limit value for cadmium.

All liquid manure samples contained one or several of the 19 PAH compounds (naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene, benzo(a)anthracene, chrysene/triphenylene, benzofluoranthenes (b, j, k), benzo(a)pyrene, indino(1,2,3-cd)pyrene, dibenzo(a,h)anthracene, benzo(g,h,i)perylene, 1-methylnaphthalene, 2-methylnaphthalene, sum-dimethylnaphthalenes and sum-trimethylnaphthalenes) included in the analysis. The samples were analysed for 19 PAH compounds out of which 14 compounds were detected. None of the samples contained concentrations that exceeded the stipulated cut-off values applying to sludge.

Eighty-four per cent of the samples contained detergents in the form of LAS and/or alcohol-polyethoxylate. The latter was not found in liquid manure from neither organically raised cattle nor pigs. There are no stipulated cut-off values for alcohol-polyethoxylate. None of the concentrations of LAS were close to the cut-off values applying to sludge.

Sixty-seven per cent of the samples contained one or more of the 8 types of antibiotics (sulfadiazine, sulfadimidine, sulfatroxazole, sulfadoxine, sulfamethoxazole, tiamulin, trimethoprim and tylosin) included in the analysis. There are no stipulated limit values, cut-off values or soil quality criteria for the mentioned substances. The analysed eight types of antibiotics constitute less than 30% of the total consumption in 2001. The analysis did not include tetracyclines, penicillin or aminoglycosides.

Twenty-two per cent of the samples contained one or both of the plasticizers (DBP and DEHP) included in the analysis. DBP was not detected in liquid manure from pigs. The properties of plasticizers slightly resemble those of hormones. None of the samples contained concentrations close to the stipulated cut-off values for sludge.

Twenty per cent of the samples contained nonylphenol-polyethoxylate. There are no stipulated cut-off values for nonylphenol-polyethoxylates.

Five per cent of the samples (two samples) contained nonylphenols. The substance was not found in liquid manure from organically raised cattle. Nonylphenols have hormone-mimicking properties and are highly toxic for aquatic organisms. The two samples contained concentrations of 1.6 and 1.7 mg nonylphenol/kg TS, respectively. The stipulated cut-off value applying to sludge is 10 mg/kg TS.

Liquid manure is applied to the fields in large amounts each year, so although the manure contained only low concentrations of the examined substances, there is a risk that these substances may be lost to the aquatic environment via drains and surface runoff. A quantification of this loss will require further investigations of the substance transport from fields to drains and streams. In order to examine the impact of the substances on the environment, the investigation should also include ecotoxicological assessments

Results from the liquid manure samples from the two mixed livestock are not compared with other types of manure. However, the results of the analyses are found in appendix I in the report.

Average concentrations (mg/kg TS) of substance groups found in the three types of liquid manure

Substance group	Liquid manure from cattle	Liquid manure from organically raised cattle	Liquid manure from pigs
Aluminium	664.71 ± 380.71	657.50 ± 319.63	330.83 ± 182.94
Cadmium	0.37 ± 0.21	0.26 ± 0.13	0.37 ± 0.14
Copper	64.24 ± 58.42	35.13 ± 10.74	263.33 ± 108.63
Nickel	6.31 ± 7.15	2.93 ± 1.17	10.22 ± 2.49
Zinc	231.76 ± 63.07	140.38 ± 26.85	1016.67 ± 1085.81
PAH compounds (9)	0.05 ± 0.09	0.35 ± 0.61	0.04 ± 0.04
PAH compounds (19)	0.88 ± 1.18	1.58 ± 1.26	0.36 ± 0.39
Antibiotics	0.12 ± 0.16	0.09 ± 0.12	1.32 ± 1.88
LAS (linear alkylbenzene sulphonates)	15.57 ± 10.44	20.25 ± 9.78	15.64 ± 8.95
Alcohol-polyethoxylate	26.50 ± 12.02	-	-
Nonylphenol	1.06 ± 0.0	-	1.7 ± 0.0
Nonylphenol polyethoxylate	1.08 ± 0.43	1.24 ± 0.35	0.65 ± 0.0
DBP (di-n-butyl phthalate)	1.30 ± 0.0	0.80 ± 0.0	-
DEHP (Di(2-ethylhexyl)phthalate)	2.50 ± 1.71	2.95 ± 0.78	2.00 ± 0.53