IMPACT OF SEWAGE SLUDGE AND SEWER SLIMES BY POLYCHLORINATED DIBENZO-P-DIOXINS AND POLYCHLORINATED DIBENZOFURANS

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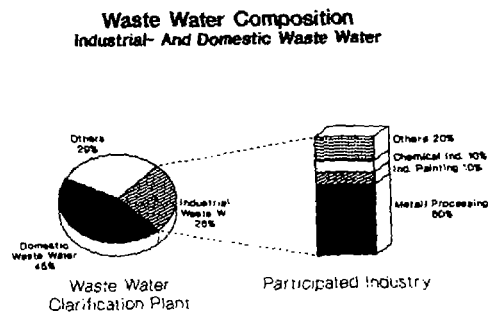
Abstract
The aim of this research project is to establish a register for the impact of municipal waste water by polychlorinated dibenzo-p-dioxins (PCDD) and polychlorinated dibenzofurans (PCDF). By means of this register it should be possible to detect any kind of emission sources. As significant impact patterns were determined by investigating the sewage sludge we analysed sewer slimes of the main sewers and typical enviromental compartments to compare the differences between the sewage sludge patterns with those from the investigations of the compartments. The results show that the pattern of PCDD/PCDF in the sewer slimes is directly comparable with the air samples in particular for hexachloro dibenzo-p-dioxins.

INTRODUCTION

The yearly appearance of sewage sludge in the Federal Republic of Germany which corresponds to 2,5 Mio m^3 dry matter (1) amounts to 50 Mio m^3 . Due to the increasing concentrations of pollutants the agriculture application of sewage sludge is meanwhile drastically restricted. A 50000 inhabitant city serves as an example for this pilot study to detect the emission of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans sources which are the main subjects of this project.
The overall composition of the total daily quantity of 18000 m^3 of waste water is shown in Figure 1.

Figure 1: Waste water composition



Experimental

The impact of sewage sludge by PCDD/PCDF isomers was disscussed previously (2,3). The partially very high concentrations demand for the ascertainment of the emittents. To monitor the impact profil the PCDD/PCDF concentrations in sewage sludge were analysed for several months.

	T_4CDD	P_5CDD	H_6CDD	H_7CDD	O_8CDD	T_4CDF	P_5CDF	H_6CDF	H_7CDF	O_8CDF
Jan.	N.N.	N.N.	4	2422	11652	56	479	125	135	478
Feb.	22	17	294	4598	15567	121	47	121	249	433
Mar.	12	25	219	4184	15859	119	64	121	161	353

Table 1: *Summary of PCDD/PCDF concentrations in sewage sludge* (ng/kg dry matter)

It was difficult to ascertain the source of pollution by the evaluation of the dioxin and furan patterns in the sewage sludge because they are very similar due to of the continuously stirring of the sewage sludge. For this reason the sewer slimes of the main sewers were analysed to determine the difference between the patterns.
Sewer slimes are the internal coatings of sewers and comparable with the biological film of bacterial beds i.e. the biological lawn of trickling filters for waste water treatment (4).

For better source ascertainment we divided the total sewer entry of PCDD/PCDF into three main groups.

- industrial waste water
- domestic waste water
- surface street waste water (representing the general environmental impact)

The indicator function of sewer slimes (5) for heavy metall entry was described. In order to characterize the industrial and domestic entry (input) we investigated the sewer slimes of the different sewers. The input of the general environmental pollutants by means of surface street waste water should be monitored by analysing the ambient air, the urban dust and the rain water.

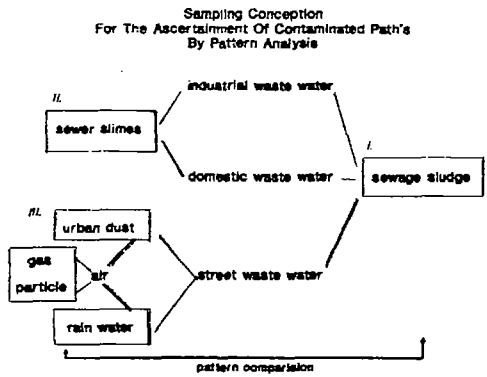
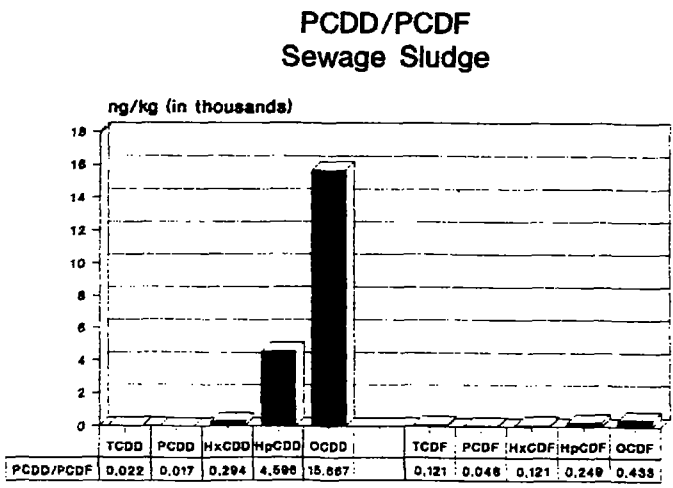
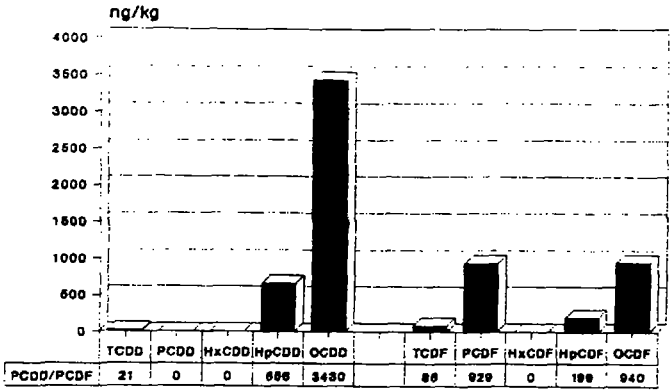


Figure 2: Sampling conception

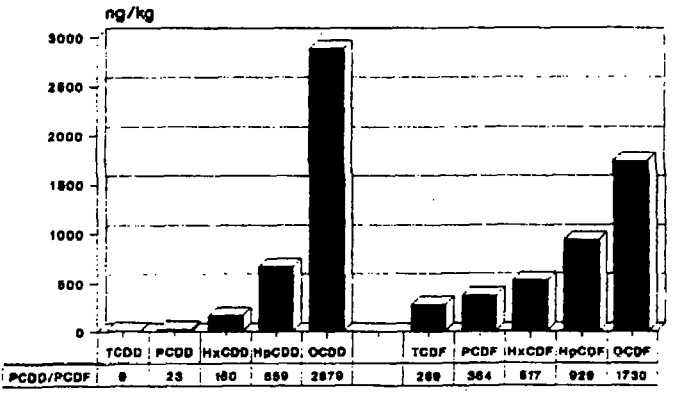
The following figures illustrate a typical sewage sludge pattern (a), a sewer slime pattern of a main pipe with a predominant content of industrial waste water (b), a sewer slime of a main pipe with a predominant content of domestic waste water (c) and a pattern of urban dust (d).



PCDD/PCDF
Sewer Slime (Main Pipe 3)



PCDD/PCDF
Sewer Slime (Main Pipe 2)



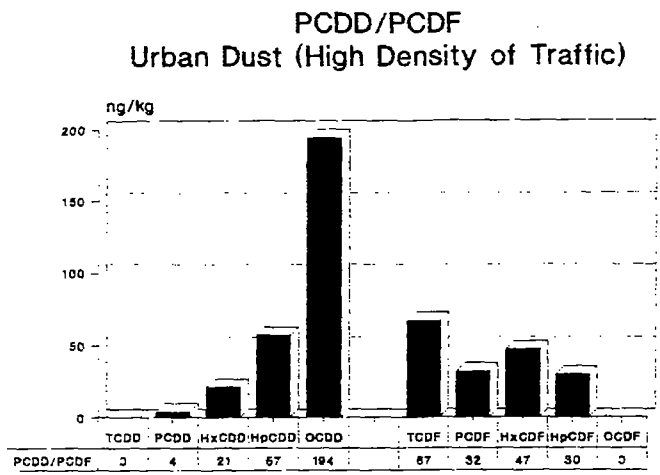


Figure 3a-3d: Pattern of different matrices as mentioned above
A difference results by comparing the pattern of the chlorinated homologous compounds of the sewer slimes with those of the sewage sludge and urban dust, especially for the PCDF homologous. Urban dust shows a typical combustion related pattern in contrast to the pattern of the sewer slimes of the main pipes with mainly domestic and industrial waste water.
Simultaneous investigations of sewage sludge before and after digestion led to the results that the concentrations of PCDD and PCDF after the digestion as well as the pattern were different. The increase of PCDD/PCDF during the fouling of 70 days is shown in Figure 4.

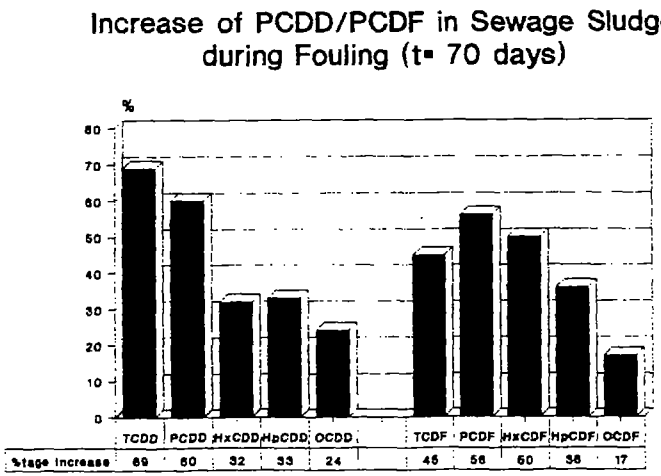


Figure 4: Percentage increase of PCDD/PCDF in sewage sludge

Conclusions

It seems that sewer slimes have a potential indicator function for the identification of PCDD/PCDF entry. Until now the results of our investigations show that the pathway of contamination could not be completely determined. To obtain more detailed information it is nessesary to monitor the different individual industrial entries of PCDD/PCDF. Concluding results to this study will be published soon.

References:

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