

THE EFFECT OF BIOLOGICAL WASTE WATER TREATMENT IN PULP AND PAPER INDUSTRY ON THE DIBENZO-p-DIOXIN AND DIBENZOFURAN CONCENTRATIONS OF INCUBATED MUSSELS IN RECEIVING WATERS

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Polychlorinated dibenzo-p-dioxins (PCDDs) and dibenzofurans (PCDFs) are one potential environmental risk. In Finland especially the chlorobleaching of pulp<sup>1</sup> may be a significant source of these compounds. The dominating toxic isomers of PCDDs and PCDFs in pulping effluents are 2378TeCDF, 2378TeCDD, 23478PeCDF and 12378PeCDD<sup>2</sup>.

In recipients the concentrations of PCDDs and PCDFs are usually very low and impossible to analyse directly from water samples. They bioaccumulate, however, strongly<sup>3</sup>. Therefore these compounds can be found in the recipients of pulping industry by mussel incubation method<sup>4</sup>. In this method the common lake mussels (Anodonta piscinalis) are incubated in anchored plastic cages in the epilimnion. They take up all the nutrients from the surrounding waters. After an incubation time of four weeks samples of the soft tissues from mussels are prepared for analysis. Before extraction, known amount of internal standard, <sup>13</sup>C-labelled 2,3,7,8-dibenzo-p-dioxin, is added. The sample is then extracted in a Soxhlet apparatus with hexane - acetone - diethyl ether - petroleum ether.

In this study the effect of biological waste water treatment on the concentrations of PCDDs and PCDFs originating from pulp bleaching in incubated mussels has been estimated in the River Kymijoki, a recipient where remarkable changes in waste water treatment of the pulping industry have taken place during the monitoring period, 1988-91.

The first results are from the year 1988. At that time there was only mechanical treatment in the pulping industry. The highest toxic load as TCDD-equivalents<sup>5</sup>, 510 pg/g fat, was analysed in the immediate recipient of the pulp and paper mills in the upper part of the river. Especially PCDFs, but also small amounts of 123678HxCDD and 1234678HpCDD were accumulated in the incubated mussels. At the next incubation station

downstream the PCDF concentrations were still high, but the 123678HxCDD- and 1234678HpCDD-concentrations were clearly lower, which is why the result was only 218 pg/g fat as TCDD-equivalents. At the lowest incubation station in River Kymijoki it was no longer possible to find dioxins, which is why the TCDD-equivalent was only 189 pg/g fat even though considerable furan concentrations were still found.

The new activated sludge waste water treatment plant started up in the spring of 1989. From the results of the years 1989-91 it was found that biological treatment of waste water decreases the PCDDs and PCDFs considerably and that the compounds occurring after the purification process were clearly less toxic furans. The concentrations of all these compounds decreased in incubated mussels already in 1989 by about 80 %.

It may, however, be at least partly only apparent that activated sludge treatment plants could decrease the amount of PCDDs and PCDFs so significantly. These compounds absorbed physically to some extent into the activated sludge biomass may easily be discharged to watercourses<sup>6</sup>. The fate of PCDDs and PCDFs in biological treatment plants and in receiving water courses is still in many respects open.

#### References

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