Bio- technology for recovery of Pulp and Paper Industry wastes

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1. INTRODUCTION

Eleven million tons of waste are produced yearly by the European pulp and paper industry, of which 70 % originates from the production of deinked recycled paper. Waste is composed out of bark, sawdust, sludge, etc. Sludge is dangerous because it contains highly toxic dioxins. Pulp and paper mill sludges' were traditionally land filled or burned. Over the years, the use of sludges' on soil has increased, as well as concerns about their environmental effects. At the same time these sludges', containing mainly carbon and can have beneficial effects on soils.

The main idea is the successive development of appropriate white-rot fungi and earthworm communities in pulp and paper mill wastes. White-rot fungi decompose dioxins. Worms improve soil structure, aeration, increased levels of nutrients for plants.

2. MATERIALS AND METHODS

Wastes: Sludge, bark and their mixture of a chlorine (Perm and Syas mills) and non-chlorine (Svetogorsk mill) bleachers are used in this research.

Recovery time: 45 days by white-rot fungi and after 45 days by worms. Control – without processing.

Species of bioagents: white-rot fungi - *Trametes maxima, Trametes hirsuta,* consortium: *Trametes maxima + Trametes hirsute, Lenzites betulina, Peniophora lycii, Pleurotus ostreatus,* worms - *Eisenia andrei.*

Determination of dioxins: chromatography-mass spectrometry method. Dioxins transferred using the toxic equivalent of the World Health Organization (WHO-TEF).

Determination of nutrients: C, N - CHN analyzer (EA 1110 (CHNS-O); Ca, K, Mg, Mn, Na - AAC (AAnalyst 800 spectrometer).

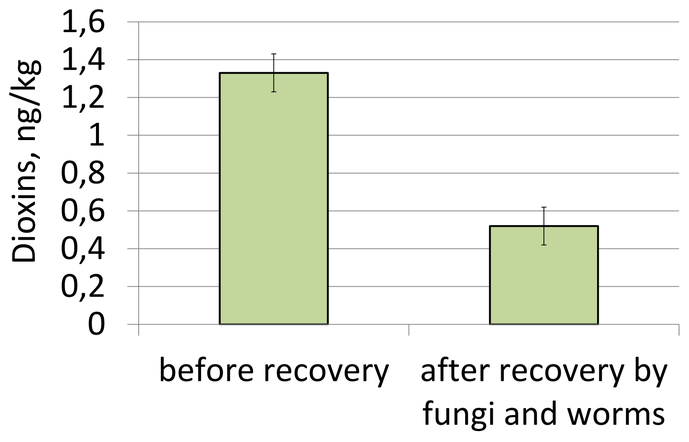
Seedling cultivation: Seedlings were grown in mixtures of biocompost Svetogorsk mill for 2 months. The soil was mulching by biocompost.

AIM: Bio- technology approaches to recovery of pulp and paper industry wastes for:
1- getting fertile and non-toxic substrate for seedlings, 2- growing the high productive tree plantations.

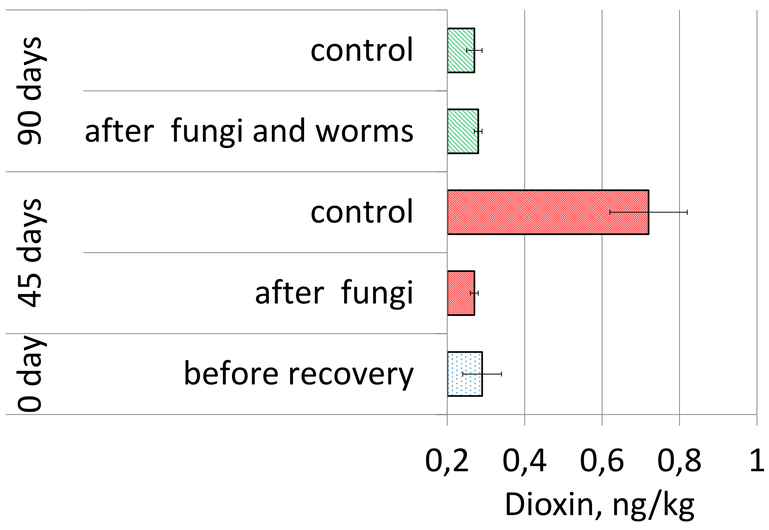
3. RESULTS

3.1. Dioxins

● **Total concentrations of dioxins (WHO-TEQ) in chlorine bleaching mill's wastes**



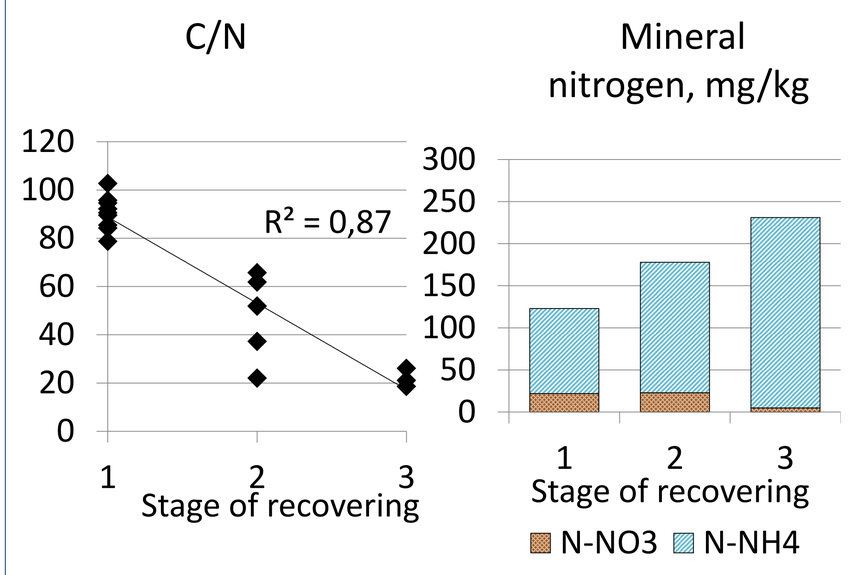
● **Total concentrations of dioxins (WHO-TEQ) in non-chlorine bleaching mill's wastes**



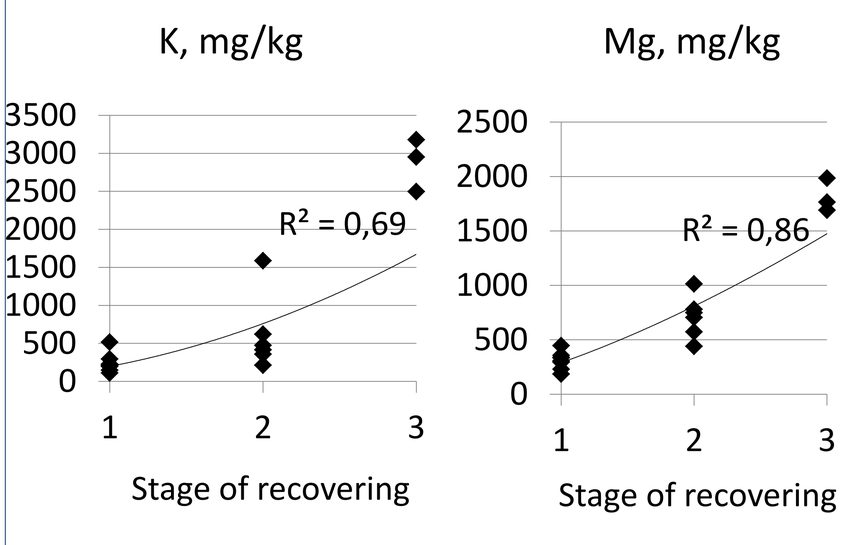
We fixed a sharp increase in dioxin concentrations in 45 days in controls. So, despite the ESF bleaching the active sludge would be toxic for some period. In a first processing step fungi reduced dioxin concentrations.

3.2. Nutrients

● **Carbon and nitrogen**



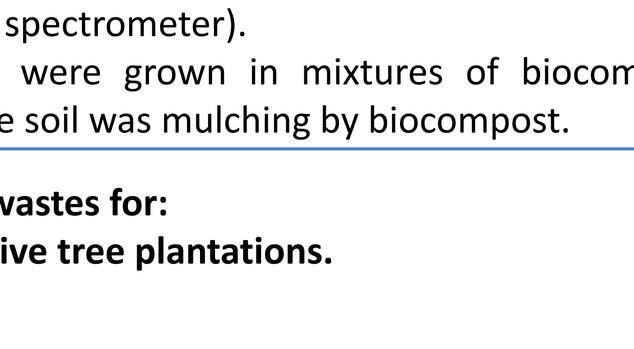
● **Nutrients**



Example – recovering Syas mill's wastes
1 - before recovery, 2- after recovery by fungi, 3 - after recovery by fungi and worms

3.3. Growing seedlings

It is possible to use biocompost for improve the growth of seedlings; increase the productivity of forest plantations and increase resistance to pests, diseases and environmental stress; accelerate the growth of timber assortments for the target in plantations.



control — growing with biocompost

Parameter	Increase of the parameter, % of control
length of the main root	52
Number of lateral roots	67
Total length of lateral roots	41
Stem height	34
Diameter of root neck	21
Current growth	41

The test of bio-compost in forest plantations is ahead of us.

4. CONCLUSION two-stage biotechnology recycling using white rot fungi and worms:

1 - detoxify dioxins of the waste, 2 - increasing of nutrients, 3 - get biocompost.

5. REFERENCES

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