



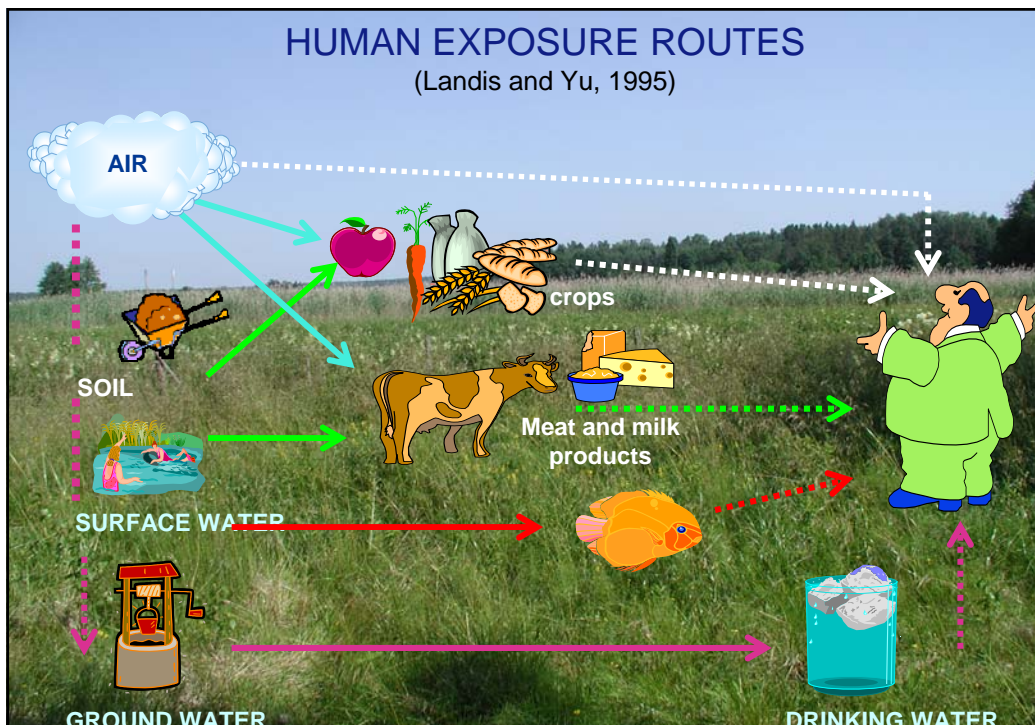
SAFETY OF COMPOST PRODUCTS

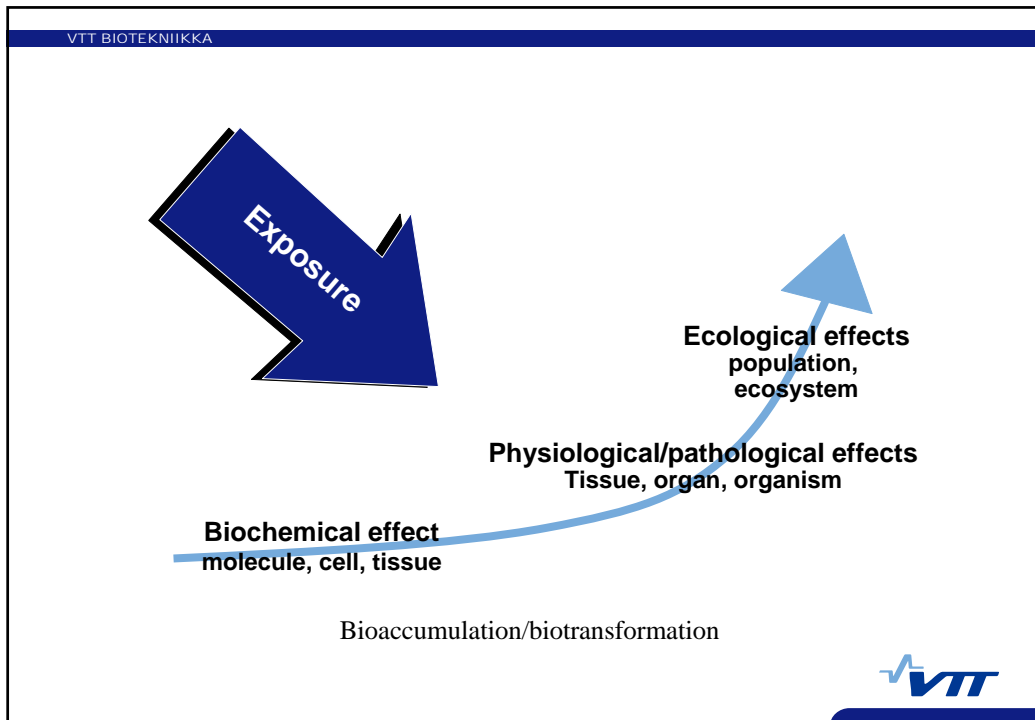
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The slide features a collage of images at the top: a scientist in a lab coat working with petri dishes, a large pile of dark compost, and a hand holding a petri dish with a bacterial culture. Below the title, there are two more images: a scientist in a lab coat working with large green tanks, and two scientists in lab coats working with potted plants. The VTT logo is located in the bottom right corner of the slide.





Safe use of municipal sludges as growth media

Composting is a biodegradation process decrease the amount of POPs

Maturity

Pathogens

Chemicals

Organic pollutants
POPs
LIETU2

Polymers used
in Sewage treatment
LIETU1

Private sector:
cosmetics
laundry chemicals
medicine
paints
solvents

Industry

→

AOX (halogenated organic compounds) 500 mg/kg dm
 LAS (linear alkylbenzene sulfonates) 2600
 DEHP (di(2-ethylheksyl)ftalaatti) 100
 NPE (nonylphenol and nonylphenoletoxylates) 50
 PAH (polyaromatic hydrocarbons) 6
 PCB (polychlorinated bifenyls) 0,8
 PCDD/F(dioxines) 100
 Brominated flame retardants

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How plants and bacteria responde to toxic chemical?

Cellulose acetate + plastiziser (diethylphthalate (DEP) 25%)
Modified OECD 208 Plant growth assay

Phthalates are=

- widely used as plastiziser in PVC
- endocrine disruptors
- found in toys, cancelled 2003
- in house hold chemicals, end up in sewage sludge

DEP g kg ⁻¹ (fresh weight)	g (dry weight)
100	~0.05
10	~0.1
1	~0.6
0.1	~0.75
0.01	~0.75
control	~0.8

Kapanen, A., Brüggemann, J., Stephen, J., Kiviranta, A. and White, D.C., Itävaara M. 2007. Diethyl phthate in compost:ecotoxicological effects and response of the microbial community → *Chemosphere* 67, 2201-2209.

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FLASH - Toxicity of compost:soil mixture at different DEP concentrations

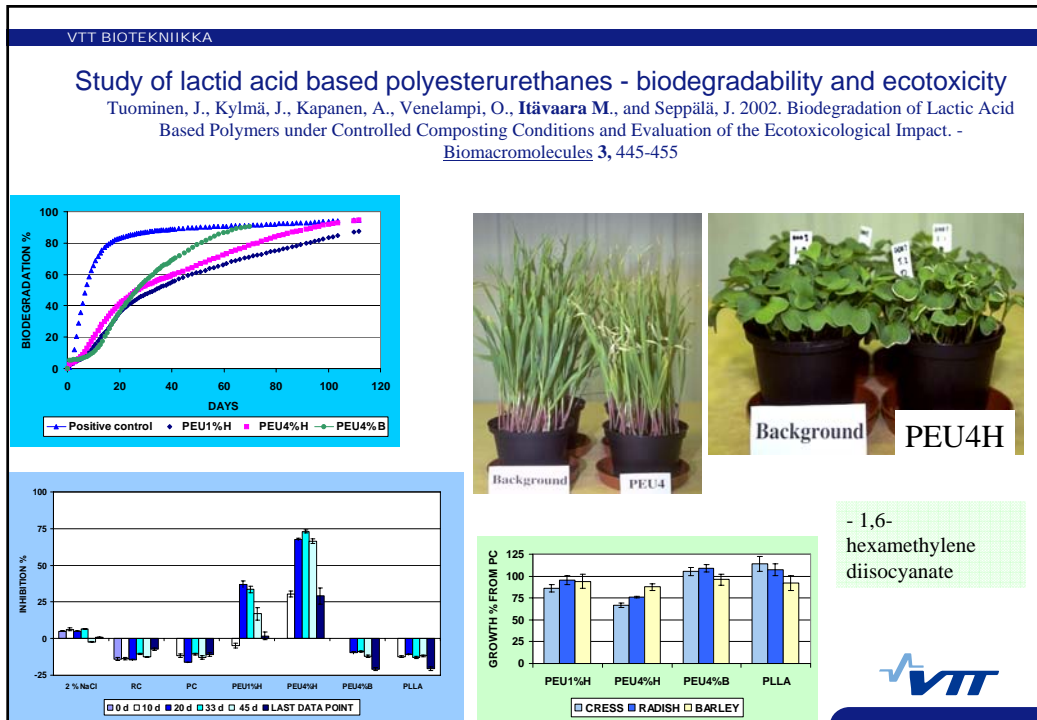
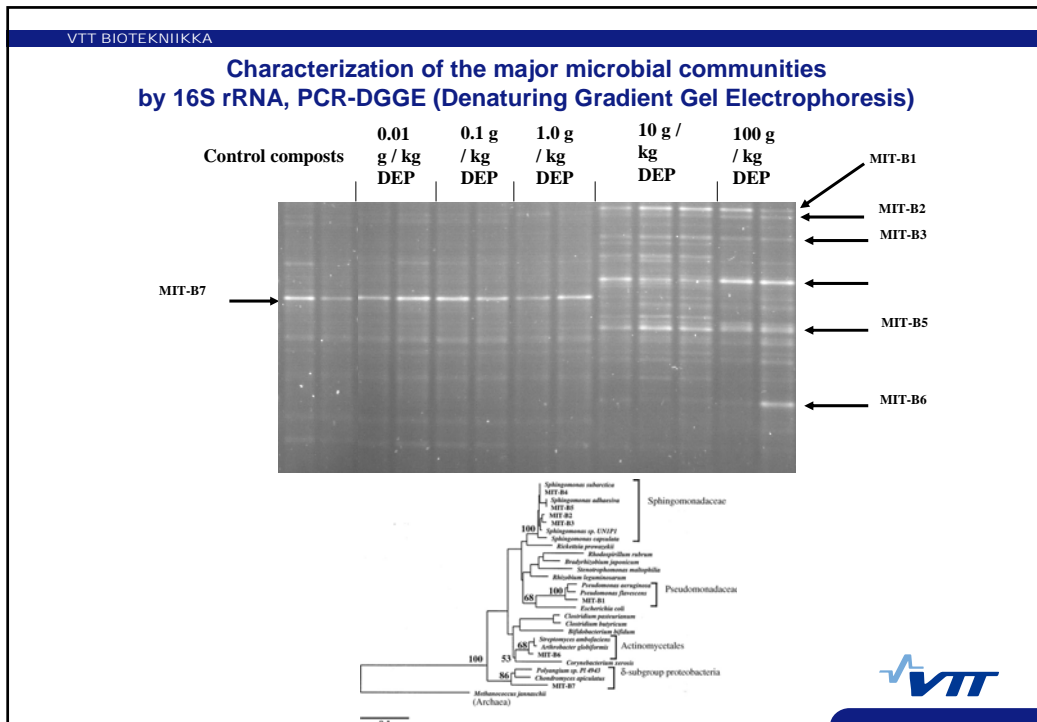
- Vibrio fischeri*
- KINETIC MEASUREMENT
- EXPOSURE TIME 30s (30 min)
- INHIBITION %

DEP g/kg	40 g dw/l (%)	20 g dw/l (%)
100	~75	~70
10	~50	~25
1	~-10	~-10
0.1	~-10	~-10
0.01	~-10	~-10
0	~-10	~-10
Test control	0	0

Time (s)	Toxic (mV)	Not toxic (mV)
0	~0	~0
5	~250	~500
10	~100	~500
15	~100	~500
20	~100	~500
25	~100	~500
30	~100	~500
35	~100	~500

Kapanen, A. and Itävaara, M. (2001). REVIEW Ecotoxicity Tests for Compost Applications - *Ecotoxicology and Environmental Safety* 49: 1-16 Environmental Research, Section B.

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The questions raised?

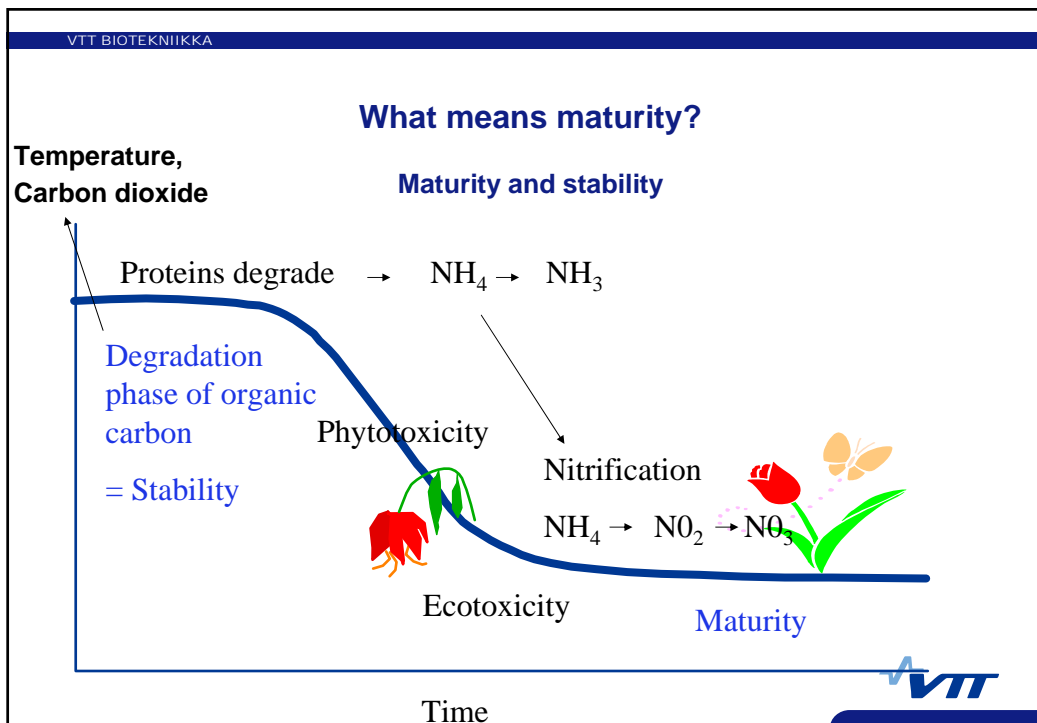
How to separate toxicity (ecotoxicity) from toxicity due to natural degradation products in composting?

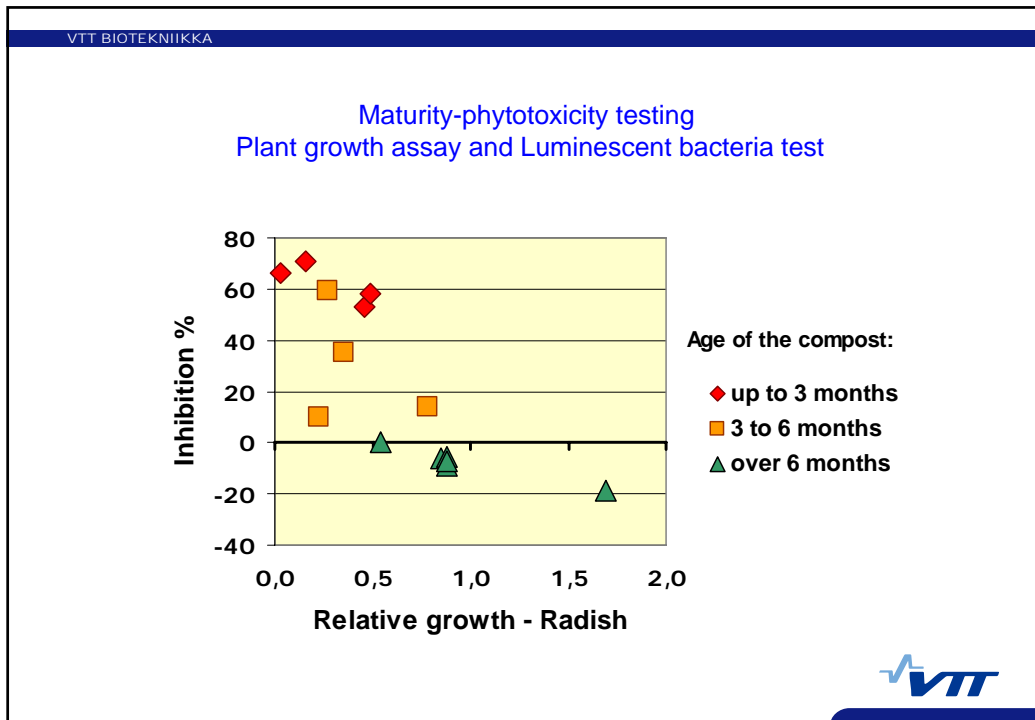
What means maturity?

- Can maturity be assessed with a single test?
- Do composting processing conditions affect maturity?
If so can the lack of aeration slow down the biodegradation
- Can processing conditions induce formation of toxic compounds and cause phytotoxicity?

Biological quality of compost

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FAST STABILITY TESTS

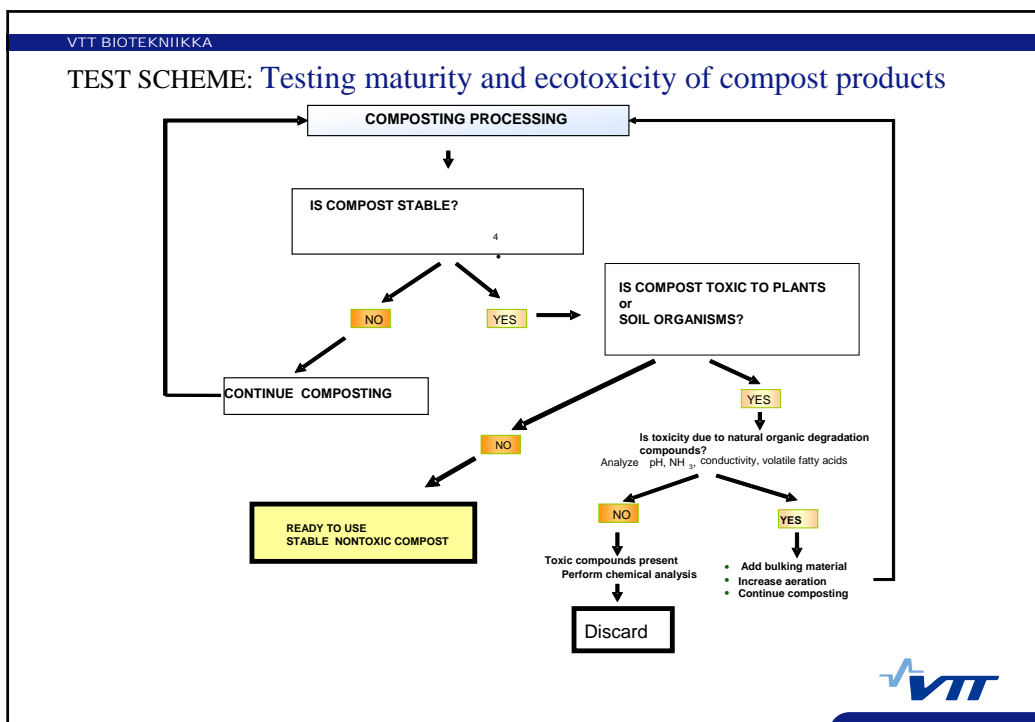
suitable for composting plants

Solvita -testi
 -Commercial
 - fast
 - 8 maturity classes based on CO₂ ja NH₃

Carbon dioxide and ammonia detection tubes

Ammonium-nitrate strips
pH strips

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EVALUATION OF THE RESULTS

Limits: stability 2-3mg CO₂/VS
nitrate/ammonia ratio 1
FLASH, light reduction more than 20%

NRO	WASTE	CARBON DIOXIDE EVOLUTION TEST	NITRATE/AMMONIUM RATIO	FLASH-TEST		PH	RESULT
				10 S	30 MIN		
178	manure	4,9	0	9	47	7,3	immature
179	manure	0,6	>1	-2	-5	4,9	mature
180	manure	9,3	0	5	-33	7,9	immature
181	manure	1,3	>1	-4	-99	8,4	mature
182	Food waste	0,2	0	66	75	4,1	immature
183	Food waste	4,6	0	-3	-14	8,9	immature

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SUMMARY

- a set of tests are required to test maturity and ecotoxicity
- ISO 190 Soil quality tests do not all suit for testing ecotoxicity of composts due to
 - a) high ammonia concentration
 - b) high conductivity, salt concentration
 - c) coloured sample
 - d) high amount of organic matter