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### ► To cite this version:

Najat Amellal-Nassr, Christian Mougin, Dominique Patureau. Safety and agronomic efficiency of sludge with respect to their treatment and chemical contamination.. 17. Annual SETAC Europe, May 2007, PORTO, Portugal. 1p, 2007. hal-02813428

**HAL Id: hal-02813428**

**<https://hal.inrae.fr/hal-02813428>**

Submitted on 13 Mar 2023

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# Safety and agronomic efficiency of sludge with respect to their treatment and chemical contamination

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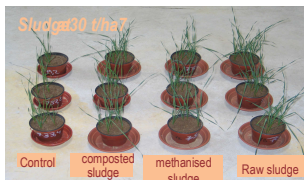
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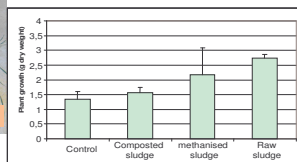
**Objective of the EU project BIOWASTE:** study both the safety and agronomic efficiency of sludge that have been submitted to different transformation processes, with respect to PAH contamination

- 1- development of bioassays for the characterization of the toxicity of organic fertilizers adapted to agronomic matrices.
- 2- study the transfer of organic pollutants in outdoor lysimeters and long-term field experiments.

## Agronomic and Environmental Impacts of organic pollutants after sludge application ?



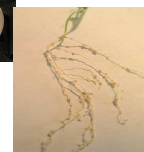
Phytotoxicity test (Norme XP44-167)



### Test for estimating the impact on *Rhizobium-Trifolium* symbiosis

The development of this test was also supported by ADEME

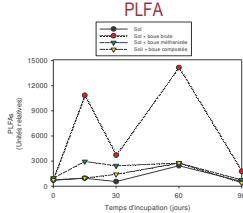
No effect of sludge at 30t/ha on plant growth



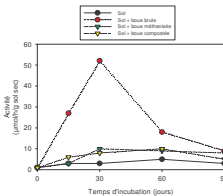
The raw and methanised sludge decrease the root nodulation

Sludge	nodulation (% of control)
raw	16
methanised	50
composted	70

### Microbial tests



### Deshydrogenase activity



### Test of genic toxicity: *Vicia faba* micro nuclei (test adapted from NFT90-327)



Sludge	Micronuclei / cells
raw	1 - 4
methanised	1 - 5
composted	0 - 1

Genotoxic effects were detected in the root cells of *Vicia faba* with the raw and methanised sludge

## Dynamic of organic pollutants after soil sludge application ?

### Outdoor lysimeters

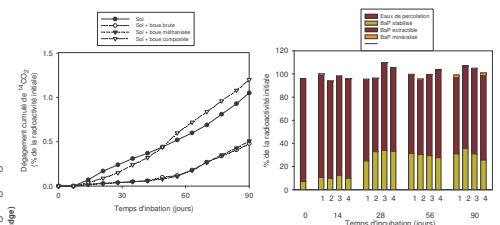
Unspiked sludge added to sandy soil (0.7% OM) at 30T/ha

Sludge	Carrots (peel)	Barley
raw	< LQ	< LQ
methanised	0.8 mg/kg DW pyrene	< LQ
composted	0.6 mg/kg DW pyrene	< LQ

Compounds	Composted sludge	Methanised sludge	Raw sludge
Benzo(a)anthracene	< LQ	950	< LQ
Chrysene	< LQ	1000	< LQ
Fluoranthene	< LQ	840	< LQ
Phenanthrene	< LQ	460	< LQ
Pyrene	340	1300	< LQ
Benzo(b)fluoranthene	< LQ	100000	20000
2-bis-ethylhexylphthalate	28000	28000	46000
Di-N-butylphthalate	5000	< LQ	< LQ

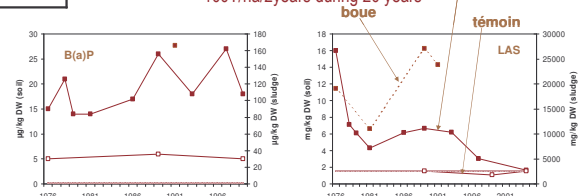
### Microcosm experiment

Spiked sludge (2 mg/kg of <sup>14</sup>BaP) added to clay soil (2.2% OM) at 30T/ha



### Field experiment

Unspiked limed sludge added to sandy soil at 100T/ha/2years during 20 years



A long-term field experiment demonstrated the accumulation in the soil amended with sludge containing low amounts of hydrocarbon. Microcosm experiment showed that benzo(a)pyrene was poorly mineralized and remained mainly as an extractable form in the soil. The transfer of the chemical to carrots, barley or wheat plants, or leachates in lysimeter experiments was negligible.

