



Parameters Describing Compost Quality



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Outlook

Quality of Compost

- Compost Ordinance (pollutants/contaminants)
- Sanitisation
- Benefits of Compost
- Parameter Describing Compost Quality
- Humic Substances
- Methods to Measure Humic Acids

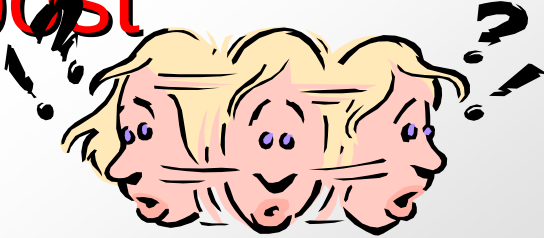
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Quality of Compost



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Quality of Compost Compost Ordinance (BGBI.II 292/2001)

Compost Ordinance regulates:

- requirements to quality of compost
- kind and origin of raw materials
- designation of compost
- rules for selling compost
- end of the waste characteristics



compost = product, not waste any longer!

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**Quality of Compost**
Contaminants / Physical Contaminants

Contaminants	Physical Contam.
➤ substances, which can damage soil, plant, animal and humans as a function of kind and concentration in compost ➤ heavy metals (Cd, Cr, Hg, Pb, ...) ➤ organic contaminants (PCB, pesticides, lindane,..)	➤ substances, which reduce quality of compost but do not have detrimental effects on soil, plant, animal and humans. ➤ glass, plastics, stones

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**Quality of Compost**
Contaminants

Heavy Metals	Organic Contam.
➤ limitation values in compost ordinance [referred on DM] ➤ no decrease during composting process	➤ no limit values, because in separate collected bio waste there are very low contents ➤ except lindane (when bark is used) ➤ decrease during composting process (degradation and volatilisation)

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Quality of Compost
Contaminants / Physical Contaminants

activities to decrease contaminants

measures in preliminary stage

- source separate collection
- „supervised“ collection of yard waste
- intensive collection of problematic wastes
- motivation of people

measures during composting

- separation of foreign materials (by manual sorting)
- use of machines which do not contaminate compost (pretreatment, turning)

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Quality of Compost
Contaminants / Physical Contaminants

activities to decrease contaminants

measures at application

amounts are to adjust to the local conditions

- projected use
(agriculture / recultivation of landfills)
- type of soil (sand / clay)
- geogenic background
- content of contaminants in compost

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Quality of Compost

Pathogens → see Monitoring

how to kill pathogens?

self heating up to 65 °C / 60 °C / 55 °C

- longer than 3 days / 3 days / 10 days
- in case of open windrow composting
2 / 3 x 3 Tage + 1 / 2 turning processes / 3 turn.
- in case of closed systems
3 / n.d. / 4 days without turning
- optimised rotting conditions
(oxygen supply)
- water content > 40%

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Quality of Compost

low contents
of heavy metals
hazardous or
no negative effect on plant germination

that's self evident !!



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Quality of Compost

benefits of compost:

- **addition of stable organic substance !!**
- source of steadily released nutrients
- growth-promoting and yield increasing effects on plants under suboptimal conditions
- aggregate stability and structure of soil
- phytosanitary effects
- increase of filter and puffer-capacity
-and many others

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Quality

benefits of compost:

- **addition of stable organic substance !!**

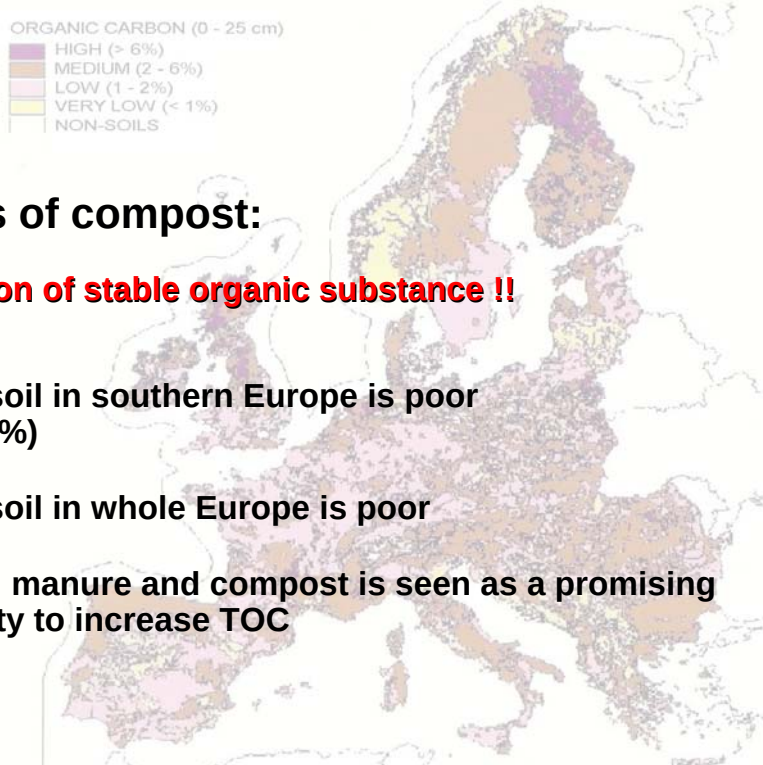
75 % of soil in southern Europe is poor (TOC < 2%)

45 % of soil in whole Europe is poor

farmyard manure and compost is seen as a promising possibility to increase TOC

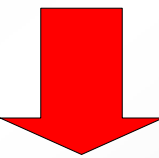
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source: L. Montanarella, 2002



ABF BOKU Quality of Compost

Our definition for Compost-Quality



high content of stable humic compounds

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ABF BOKU Quality of Compost
Parameters Describing the Quality

- **organoleptic analysis** (odour, crumb structure)
- **rotting parameter (chemical analysis)**
 - organic substance **statement about total content, not about quality of organic substance!**
 - nutrients (N, P, K, Mg) **low concentrations of nutrients: no fertilizer but soil conditioner**
 - ammonia / nitrate-ratio **statement about rotting status**
 - C/N- ratio **depends on ratio in feedstock, gives at best knowledge about rotting status**

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Quality of Compost
Parameters Describing the Quality

- **rotting status**
 - self heating
 - respiration activity

knowledge about reactivity -
assessment of rotting
status respectively
mineralisation status
- **germination-test**

characterises phytotoxicity!
utilizable effect needs long-time plant
tests
- **humic acids**

very good parameter for quality,
but time consuming
- **FTIR-analysis**

seems to be usable to characterise
status and quality of organic substances

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Quality of Compost
Humic Compounds

humins, humic acids (brown-, grey-humic acids), and fulvic acids

- development starts during intensive phase
- in composts we always find „young“ humic acids
- concentration in compost 5 to 45 % of OS
- large specific surface (sorption capacity)
- contain ~ 50-60 % C and 2-8 % N
- humic substance in soil is 100 to 1,000 years old (in bogs 3,000 to 5,000 years)

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Composting of Bio-Wastes
Compost Quality – Humic Substances

humic compounds are very heterogeneous

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Quality of Compost
Analysis of Humic Acids

Humic compounds

soluble

Fulvic Acids

Brown Humic Acids

Grey Humic Acids

Humins

not soluble

analysed by photometer at 400 nm

results in: OD/g oDM

after gravimetric calibration HA in: % oDM

method: according to Danneberg, 1974

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Quality of Compost
Humic Compounds - Analysis

very time-consuming method
(method DANNEBERG/SCHAFFER)

fractionation according to acid - alkali solubility

- fulvic acids (alkali soluble)
- brown-humic acids (alkali soluble / acid precipitable)
- grey-humic acids (alkali soluble / acid precipitable)
- humins (not alkali soluble)

elution in alkali-solution
precipitation, photometry, result as **optical density**

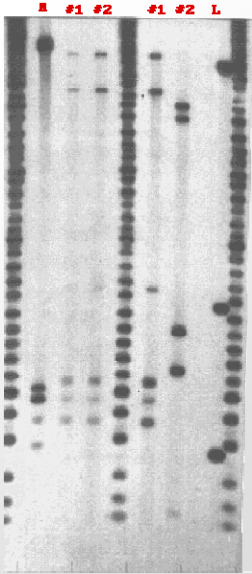
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New Methods for Waste Analysis
How to Characterise



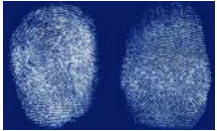
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New Methods for Waste Analysis

How to Characterise



physical characterisation:

colour: green

length: 45 cm

width: 55 cm

height: 105 cm

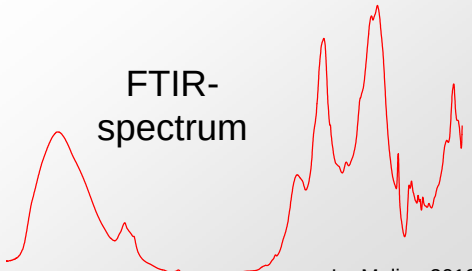
chemical characterisation:

LOI: 28,8 %

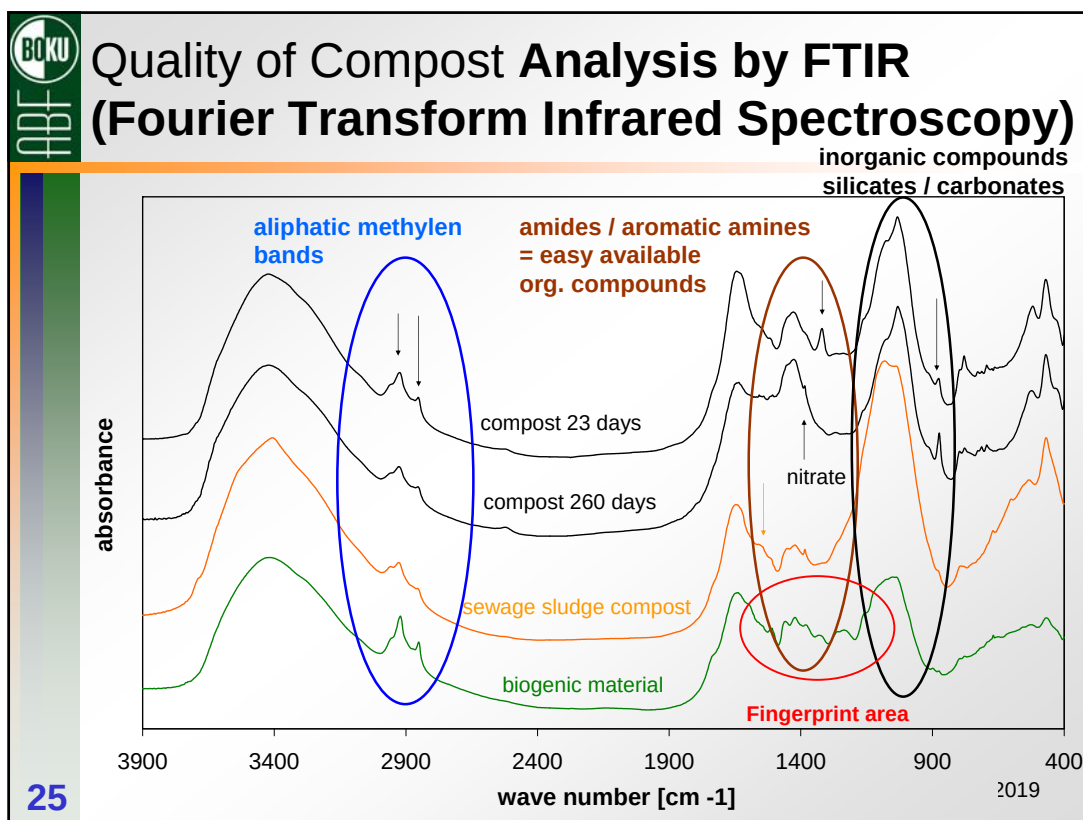
TOC: 14,9 %

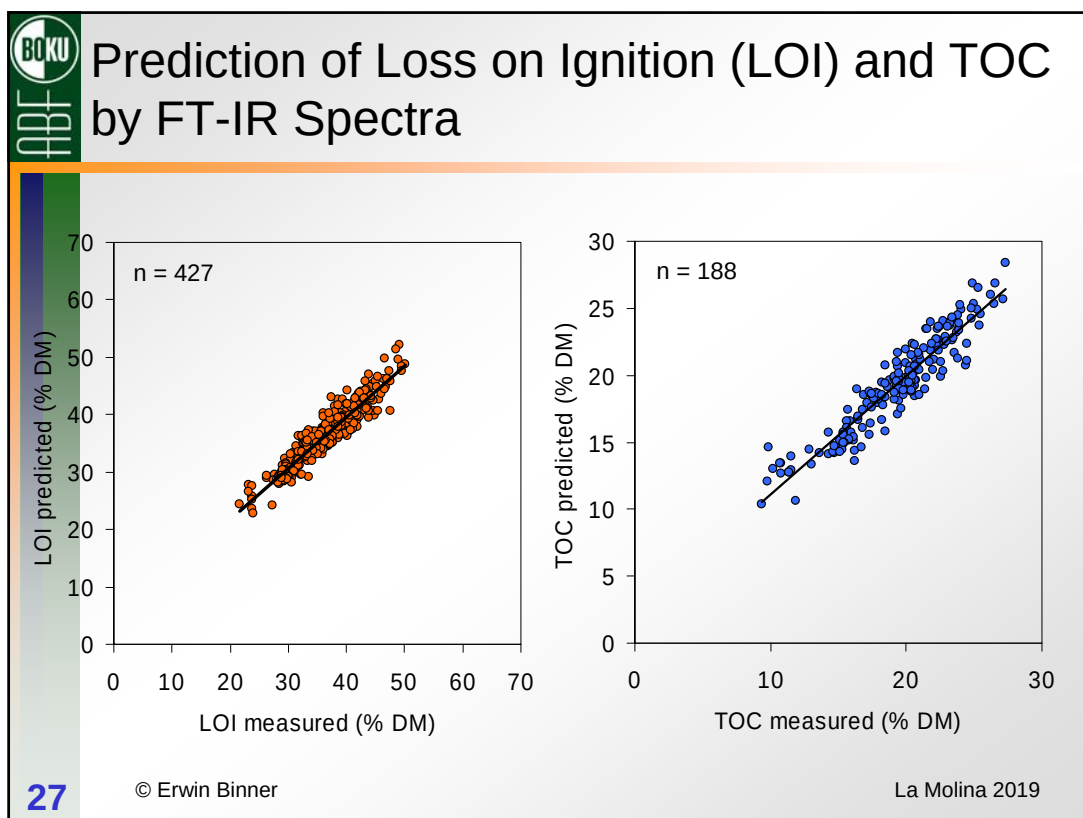
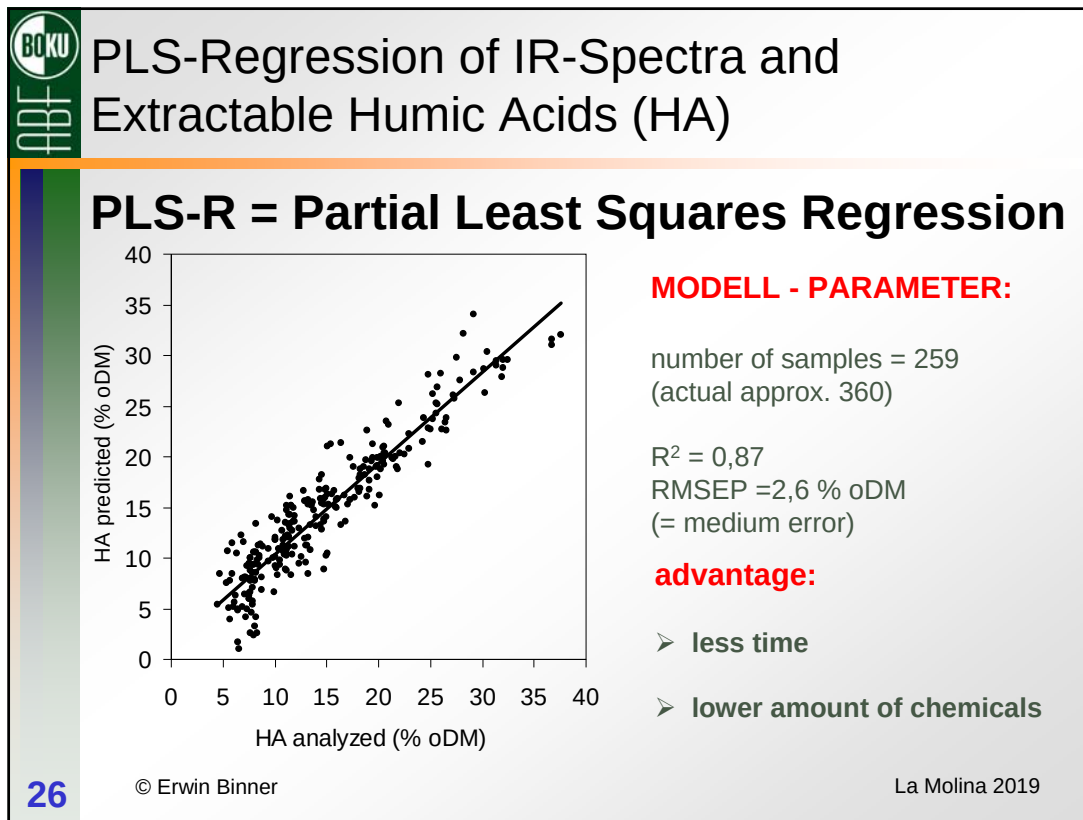
TN: 1,62 %

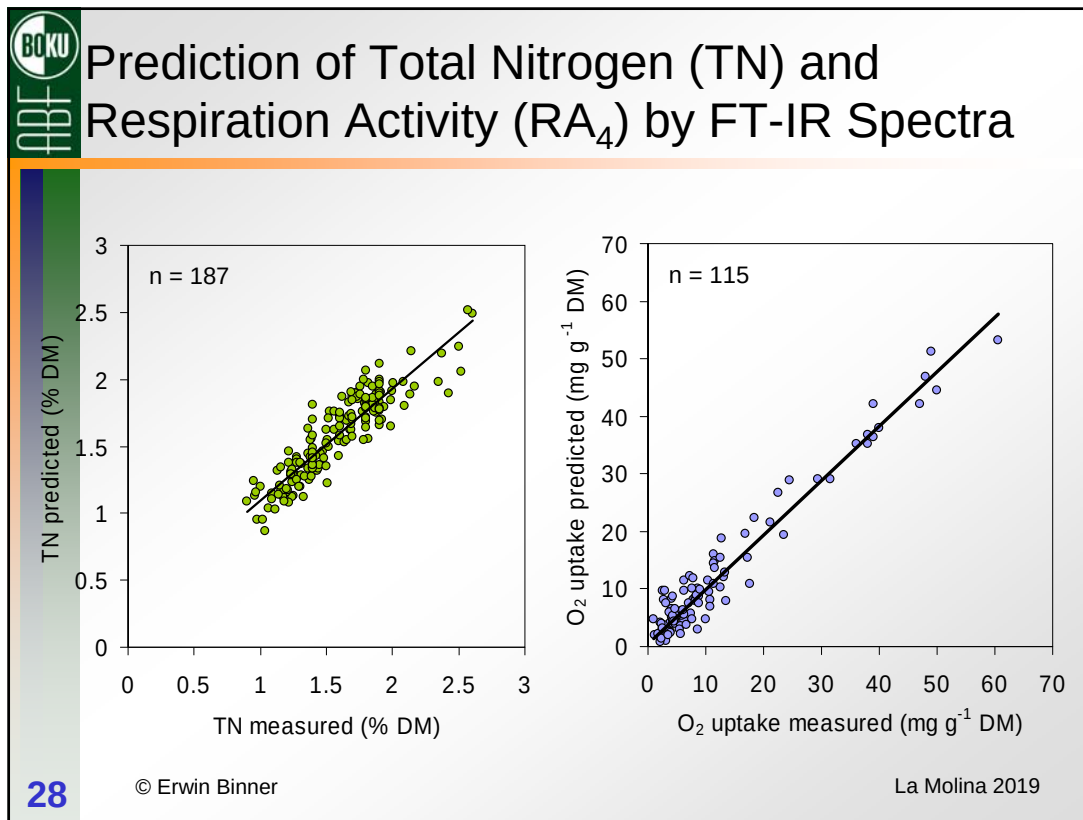
AT₄: 2,3 mg O₂ / g DM

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Quality of Compost Conclusions

- contaminants and pathogens only describe negative effects
- we need addition of organic matter to soil
- humic compounds are very stable, humus rich compost is a **carbon sink**
- analyses by photometric method, according to Danneberg very time consuming (4 days per sample)
- analyses by FTIR statistical model is necessary (PLS-Regression)
- additional advance: also conventional parameters (LOI, TOC, N, RA₄) can be predicted by FTIR

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**Muchas
Gracias por
Su Atención**

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