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Composting of animal mortalities – Procedure and preconditions

S. Kavasilis[1], M.K. Doula[1] A.A. Zorpas[1], L. Cambanis[2]

[1]Laboratory of Chemical Engineering and Engineering Sustainability, Faculty and Pure of Applied Science Environmental Conservation and Management, Open University of Cyprus, Giannou Kranidioti, 33, P.O. Box 12794, 2252, Latsia, Nicosia, Cyprus

[2]L. Cambanis S.A., Ifigenias 81, Nea Ionia, Attica, 14231, Greece

Keywords: composting, animal mortalities, green wastes, zeolite, circular economy

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Large animal mortalities management

- Are not environment friendly
- Are likely to disperse diseases to humans and animals
- Do not promote the circular economy of livestock units.

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Green wastes management

Plant raw materials form:

- Gardens
- Parks
- Tree-lined streets

Nowadays green wastes management:

- Are discharged unexploited to landfill sites, causing:
  - Rapid filling of landfills (almost 65% of the total discharged wastes)
  - Fire risk increase that can be also spread from landfills to residential areas
  - Burden municipalities with fees (transportation, fuels, routes to and from the landfill sites, machinery and vehicles damages)
  - Environmental and social impacts

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Mediterranean tropical-like cyclone or Medicane “Ianos”

- 14-21 September 2020
- Central Greece (Karditsa regional unit)
  - 3.500 dead sheeps and goats
  - 1.000 dead cows

Central Greece (Karditsa)

Kefalonia island

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Dead Whale in Piraeus, Attica region

- 23 December 2020
- The whale killed by a ship

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Cold front “Medea”

- 13-17 February 2021
- Snowfalls in Athens, Attica, Greece
  - North suburbs of Athens: 30.000 m^3 trees and branches were moved

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Composting animal mortalities

- Animal mortalities
- Green wastes from municipalities
- Agricultural additives (zeolite)

- Safe and environment friendly product
- For agricultural and forest ecosystems

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EU Regulation & Greek law about animal by-products

- Cemented floor
- Leachate collector (tank)
- Fence
- Bait stations
- Special transporting carcasses vehicles
- Refrigerator for carcasses storage
- Shower for the people

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Building the compost piles – Compost treatments

- Region of Attica, Greece
- Three compost treatments
  - Compost pile No1: 2 sheep mortalities and a balking agent of prunings and straw at the lowest layer
  - Compost pile No2: 2 sheep mortalities, a balking agent of prunings and straw at the lowest layer and also by adding zeolite. Zeolite was added in layers below and above the mortalities
  - Compost pile No3: 2 sheep mortalities and a balking agent of prunings and straw at the lowest layer. At the end of composting and during the maturity phase an amount of zeolite equal to this added in compost pile No2, was added. Then, the compost was incubated for three months.
- Zeolite: Clinoptilolite, size 0.0-0.8 mm, up to 5%.

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Building the compost piles

- First layer was prepared using straw (about 200 x 200 x 30 cm)
- Then a layer of green wastes about 1.5 m^3 was added consisting of green wastes (Xerophytic Mediterranean Vegetation)
  - Pistacia lentiscus, Robinia pseudoacacia, Cupressus sempervirens, Viburnum sp, Ligustrum sp, Laurus Nobilis, Pittosporum chinense, Eucalyptus globulus, Olea europea, Ceratonia siliqua, Nerium Oleander, Lavandula sp, Rosmarinus officinalis, Gaura sp
  - Small amounts of soft plant tissues, leaves of Platanus orientalis, Pinus halepensis, Viburnum sp., Ligustrum sp., Laurus Nobilis, Pittosporum chinense, weeds residues, fruits and vegetable stems

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Building the compost piles

Green wastes after crumbling and watering

First layer, watering the straw 200 x 200 x 30 cm

Second layer of green wastes about 1.5 m^3 for each compost pile

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Building the compost piles

Second layer, green wastes 1.5 m^3

Zeolite addition at Compost treatment No2

Zeolite

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Building the compost piles

- 2 sheep mortalities were placed parallel to each other on the green waste layer for each of the compost piles
- 50 cm above the floor
- Mortalities → not being chopped or making additional incisions to their bodies, none of vital organs or wool was removed
- Mortalities were cover with 3 m^3 of green wastes
- Final dimensions of the compost piles were 2 m long, 2 m wide and 1.2-1.3 m high (ca. 5 m^3).
- Straw bales: around the piles (3 m long, 0.30 m wide and 1 m high)
  - Excellent odor-absorbing potential
  - Deterring predators and scavenging animals
  - The compost piles cover: Compost-textile (Toptex fleece)

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Building the compost piles – Animal mortalities

2 sheep mortalities, parallel to each other on the green waste layer

Mortalities: 50 cm above the floor

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Building the compost piles – Straw bales

Straw bales 3 m long, 0.30 m wide and 1 m high

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Building the compost piles – Covering mortalities

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Building the compost piles

3 m^3 of green wastes: a layer over mortalities

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Building the compost piles – Compost Treatment No2

3 layers of zeolite – 1 under and 2 over the mortalities

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Building the compost piles – Covering the piles

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Composting conditions

- Anaerobic microorganisms degraded the carcasses
- Releasing fluids and odorous gases such as hydrogen sulfide and ammonia
- The fluids and the gases were diffused into the bulking agent → Degradation by aerobic microorganisms to odor-free carbon dioxide and water.
- The aerobic process: heat
- The active bacteria in both the aerobic and anaerobic zones are heat-tolerant.
- The heat extinguished common viruses and bacteria that may be presented in the carcasses.

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Composting mortalities

- Temperature, moisture and O_2 content were monitored periodically.
- The temperature increased up to 55^{o}C.

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Watering compost piles

- 1st October 2020
- Dry season for Attica region, Greece
- Ambient temperature 30-35^{o}C
- Green wastes moisture: 4,5%
- Watering days: 0, 20, 22, 32

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Watering by drip irrigation system

- Drip line Φ16, embodied drippers 3/m, discharge: 2 L/h
- 4 drip lines for each pile (4 x 2 m)
- Day 42: 240 L of water in 5 hours
- Day 43: 480 L of water in 10 hours
- Day 44: 480 L of water in 10 hours
- Day 51: 480 L of water in 10 hours
- Day 60: 480 L of water in 10 hours

- About 2.2 m^3
- In 45 hours
- In 5 days

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Watering compost piles by drip irrigation system

Drip irrigation system

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1st Turning

1st turning: day 116

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1st Turning

Day 116: Foot bones

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1st Turning

Day 116: Skull bones

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1st Turning

Day 116: Rib bones

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1st Turning

Day 116

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Cold front “Medea”

Days 135-142

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2nd turning – Zeolite at Compost Treatment No3

Days 174: 2nd turning

Days 174: Zeolite at Compost Treatment No3

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2nd turning – Zeolite at Compost Treatment No3

Day 174

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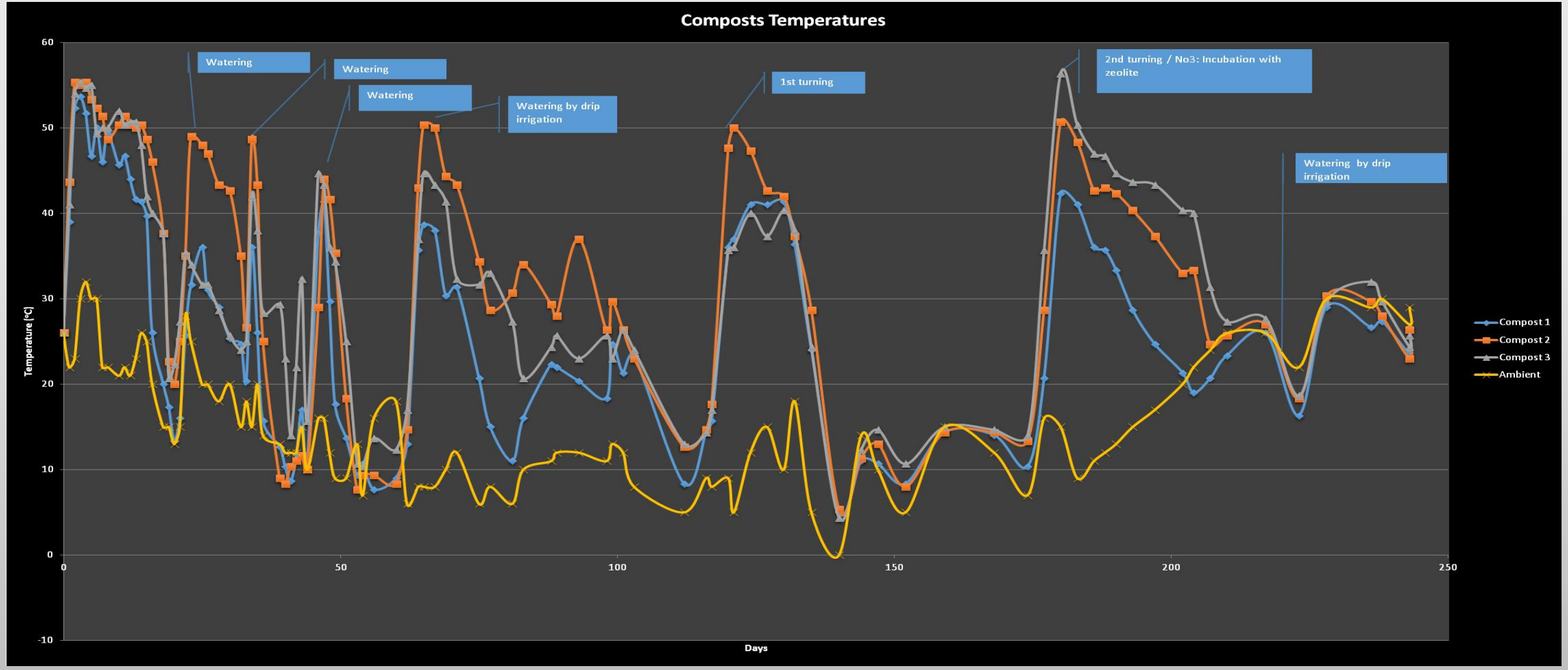
Composts temperatures



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Composting mortalities

- The composting process lasted 200 days.
- 50 days over 50^{o}C important for human and animal pathogens.
- 2 turnings after the 100th and 150th days, are recommended.
- Drip irrigation system is the most effective method to increase the moisture content of the piles to the optimum levels, without wasting water.
- Straw bales placed around the compost piles and the green waste ensures an odorless procedure, as well as deterring scavenging animals from carcasses.
- At the end of the maturity and incubation phase some resistant bones (e.g. skull parts, teeth) were visible, but they were soft and easily crumbled by hand.

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Composting animal mortalities by exploiting green wastes

Composting animal mortalities by exploiting green wastes (lignin-rich plant raw materials) from municipalities and zeolite (clinoptilolite) under the Mediterranean climate conditions could be an effective and environment friendly method to manage mortalities and green wastes, as well as to promote circular economy of livestock units. Specific and strict preconditions for the composting area and the procedures implemented must be applied to protect human and animals' health, the environment and also to ensure the production of safe composts.

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Thank you!

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