# Thermal Decontamination of Sewage Sludge

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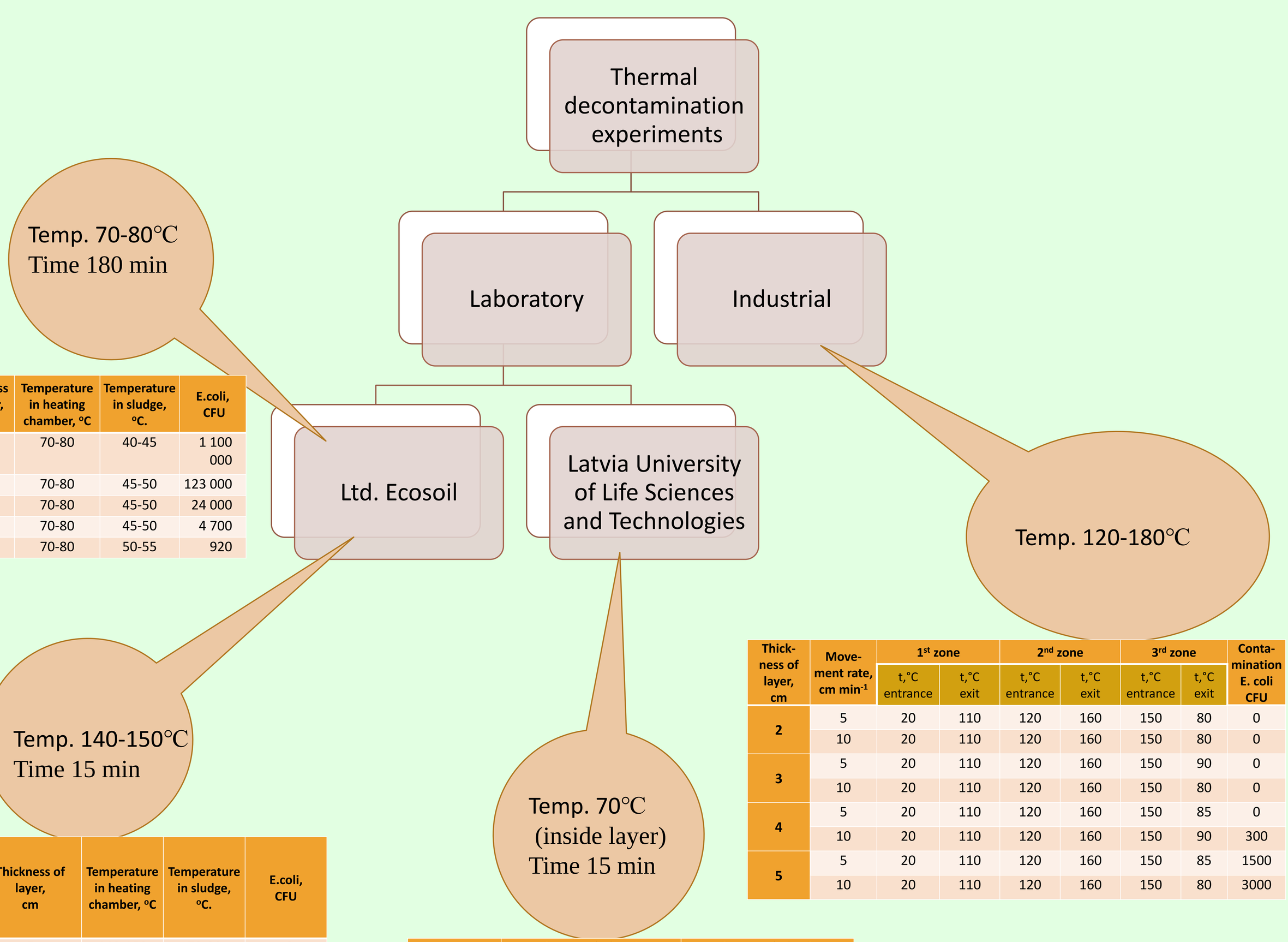
Every year a huge amount of sewage sludge is formed at municipal wastewater treatment plants. Sewage sludge contains a sufficient amount of biogenic elements and organic components, which characterizes them as possible raw materials for the production of organic fertilizers. However, direct incorporation of these sediments into the soil is impossible due to the fact that, in addition to useful organic and mineral components, they contain pathogens, viruses and helminth eggs.

The aim of the study was to optimise thermal disinfection conditions for preparing of safety sewage sludge fertilizer.
Laboratory studies were carried out using sediments from wastewater treatment plants of some cities.




| Nr. | Thickness of layer, cm | Temperature in heating chamber, °C | Temperature in sludge, °C. | E.coli, CFU |
|---|---|---|---|---|
| 1 | 5 | 70-80 | 40-45 | 1 100 000 |
| 2 | 4 | 70-80 | 45-50 | 123 000 |
| 3 | 3 | 70-80 | 45-50 | 24 000 |
| 4 | 2 | 70-80 | 45-50 | 4 700 |
| 5 | 1 | 70-80 | 50-55 | 920 |

| Nr. | Thickness of layer, cm | Temperature in heating chamber, °C | Temperature in sludge, °C. | E.coli, CFU |
|---|---|---|---|---|
| 1 | 5 | 140-150 | 70-80 | <3 |
| 2 | 4 | 140-150 | 70-80 | <3 |
| 3 | 3 | 140-150 | 75-85 | <3 |
| 4 | 2 | 140-150 | 85-90 | <3 |
| 5 | 1 | 140-150 | 85-90 | <3 |

| Thick-ness of layer, cm | Move-ment rate, cm $min^{-1}$ | 1st zone | | 2nd zone | | 3rd zone | | Conta-mination E. coli CFU |
|---|---|---|---|---|---|---|---|---|
| | | t,°C entrance | t,°C exit | t,°C entrance | t,°C exit | t,°C entrance | t,°C exit | |
| 2 | 5 | 20 | 110 | 120 | 160 | 150 | 80 | 0 |
| | 10 | 20 | 110 | 120 | 160 | 150 | 80 | 0 |
| 3 | 5 | 20 | 110 | 120 | 160 | 150 | 90 | 0 |
| | 10 | 20 | 110 | 120 | 160 | 150 | 80 | 0 |
| 4 | 5 | 20 | 110 | 120 | 160 | 150 | 85 | 0 |
| | 10 | 20 | 110 | 120 | 160 | 150 | 90 | 300 |
| 5 | 5 | 20 | 110 | 120 | 160 | 150 | 85 | 1500 |
| | 10 | 20 | 110 | 120 | 160 | 150 | 80 | 3000 |

| Microorganisms, CFU $g_{dw}^{-1}$ | Sewage sludge 1 | | Sewage sludge 2 | |
|---|---|---|---|---|
| | Before treatment | After treatment | Before treatment | After treatment |
| E.coli | $1.4 \times 10^5$ | 0 | $2.8 \times 10^4$ | 0 |
| Salmonella spp | *Salmonella enterica* | 0 | 0 | 0 |
| MAFAM | $4.1 \times 10^6$ | $7.8 \times 10^5$ | $3.4 \times 10^6$ | $2.8 \times 10^5$ |

## Conclusions

1. To ensure disinfection of the whole volume of sludge, it is necessary to maintain a temperature of 140 – 150 °C in the heating chamber, while the temperature reaches 70 – 80 °C in the entire volume of sediment, which ensures reliable performance in 15 minutes disinfection .
2. Complete disinfection of sediment occurs at a layer thickness of no more than 5 cm. Reduction of the thickness of the sludge layer increases microbiological quality of material.
3. An increase in the duration of temperature exposure without an increase in its intensity seems to be irrational, since a further increase in the thickness of the layer unnecessarily slows down the process of disinfection of large amounts of sludge.
4. Based on laboratory studies, a conveyor thermal disinfection furnace was constructed at the municipal waste water treatment facilities in Odessa, including a heating zone, a disinfection zone and a cooling zone with established optimum temperature conditions 20 – 110 ℃, 120 – 160 ℃ and 150 – 80 ℃ respectively and with an optimum sediment layer thickness of 3 cm and conveyor speed of 10 cm $min^{-1}$, providing complete disinfection of the sediment.

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