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# SHORT- AND LONG-TERM SETTLEMENT PROPERTIES OF MBT WASTE

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# QUICK OVERVIEW

1. INTRODUCTION
2. MATERIALS AND METHODS
3. RESULTS
4. CONCLUSIONS

# 1. INTRODUCTION

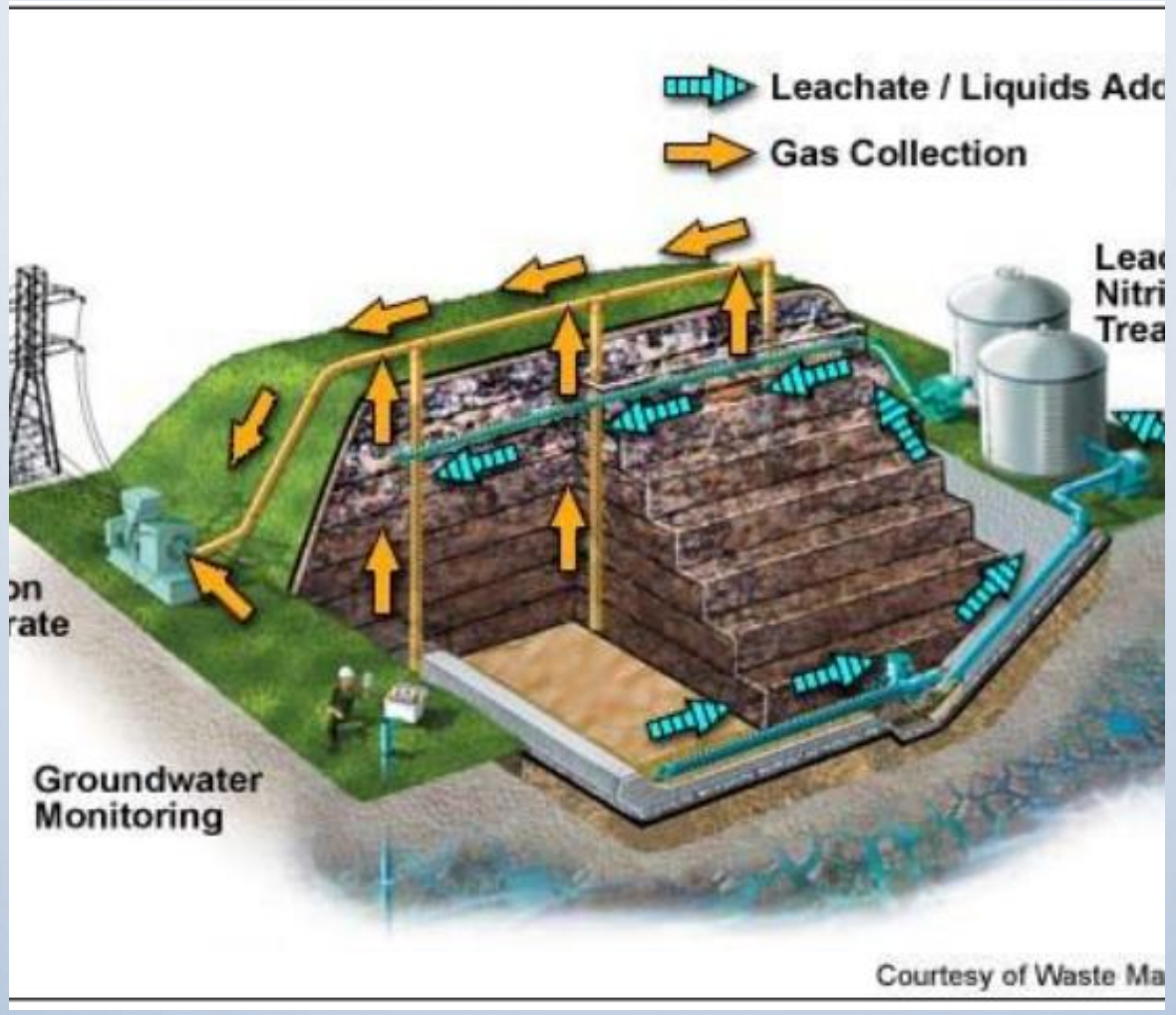
- Mechanical biological treatment of municipal solid waste in Croatia.
- Mechanical treatment: recovering recyclables
- Biological treatment: **biodrying.**
- There are **two active** waste management centers in Croatia so far.
- Methanogenic fraction (<25 mm).

**Waste Management Center Marišćina, Croatia**

Taken from: https://www.ekoplus.hr/mariscina.php

# 1. INTRODUCTION

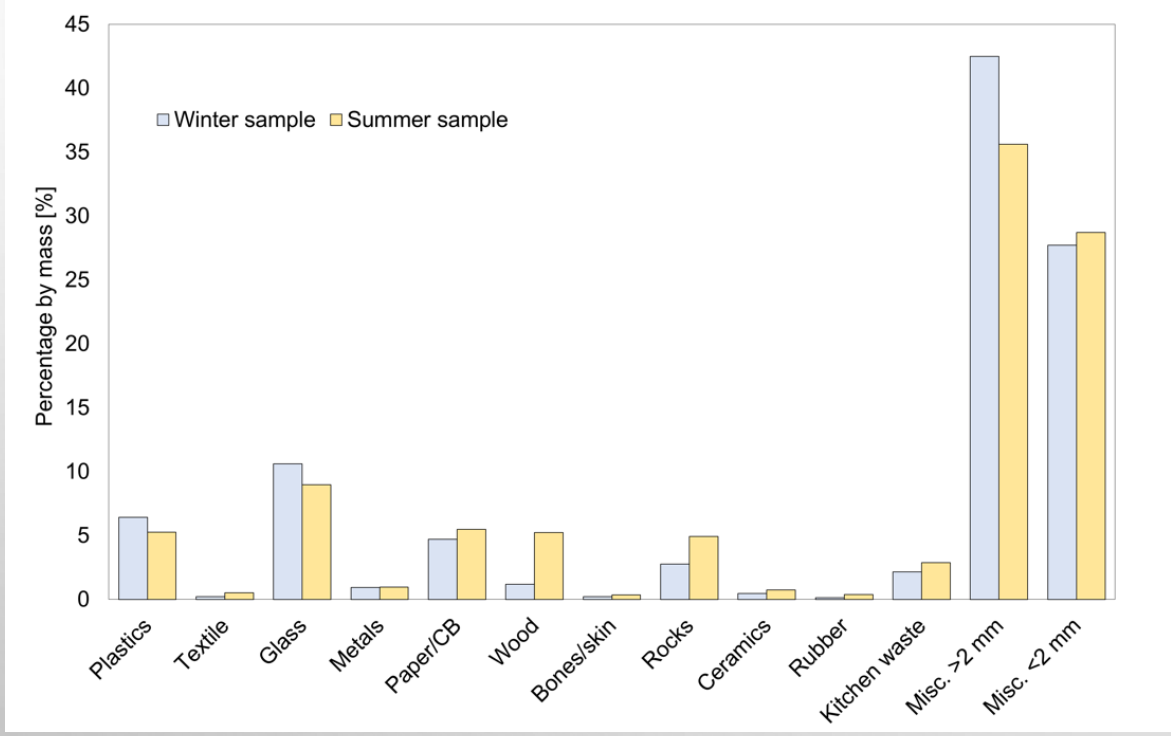
**BIOREACTOR LANDFILL**

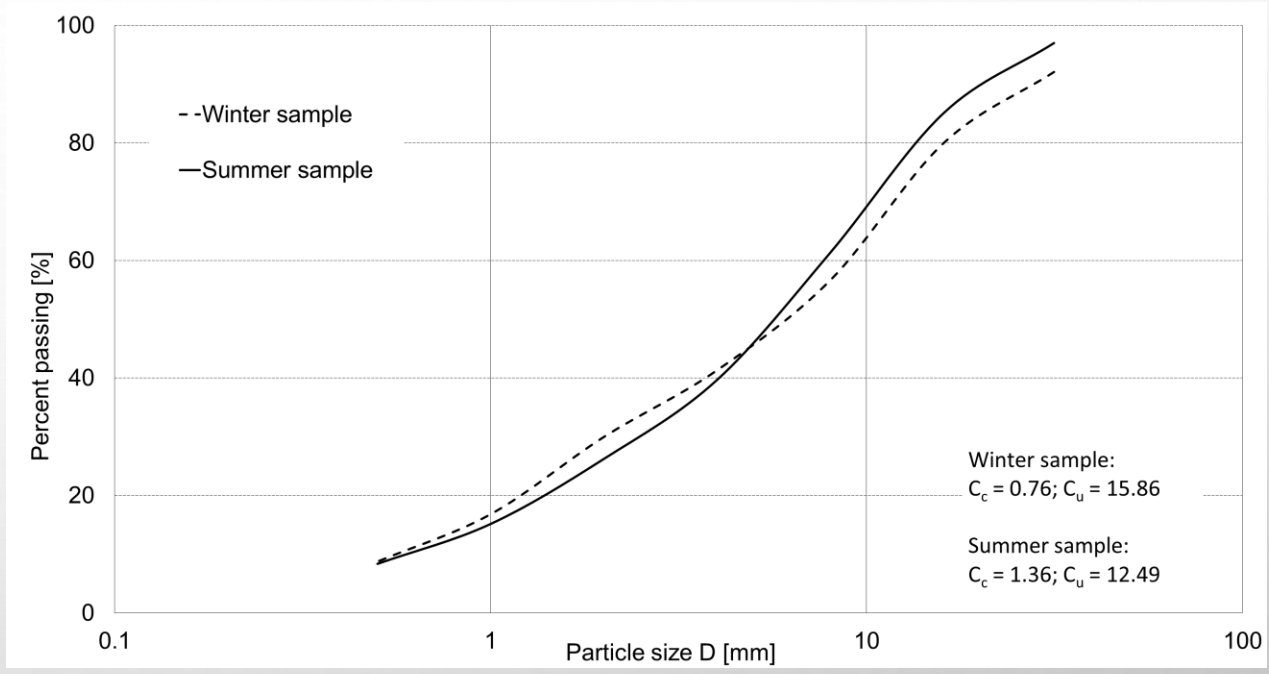



Taken from: Repa, E. W. (2003). Bioreactor landfills: a viable technology. NSWMA Research Bulletin 03-02

# 2. MATERIALS AND METHODS - SAMPLES

# 2. MATERIALS AND METHODS – BASIC GEOTECHNICAL PROPERTIES OF TESTED MATERIAL



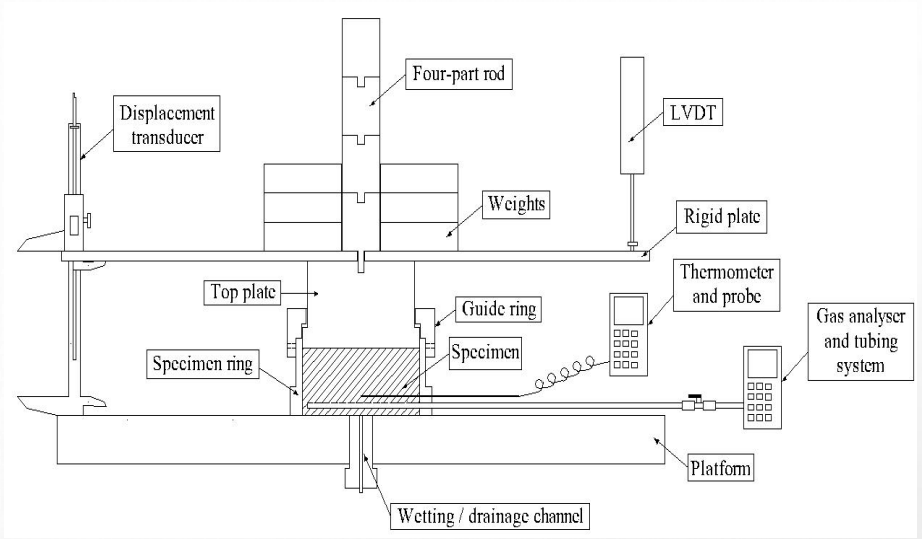




The average values of organic content by mass for the winter and summer samples were 51.6 % and 55.3 %, respectively.

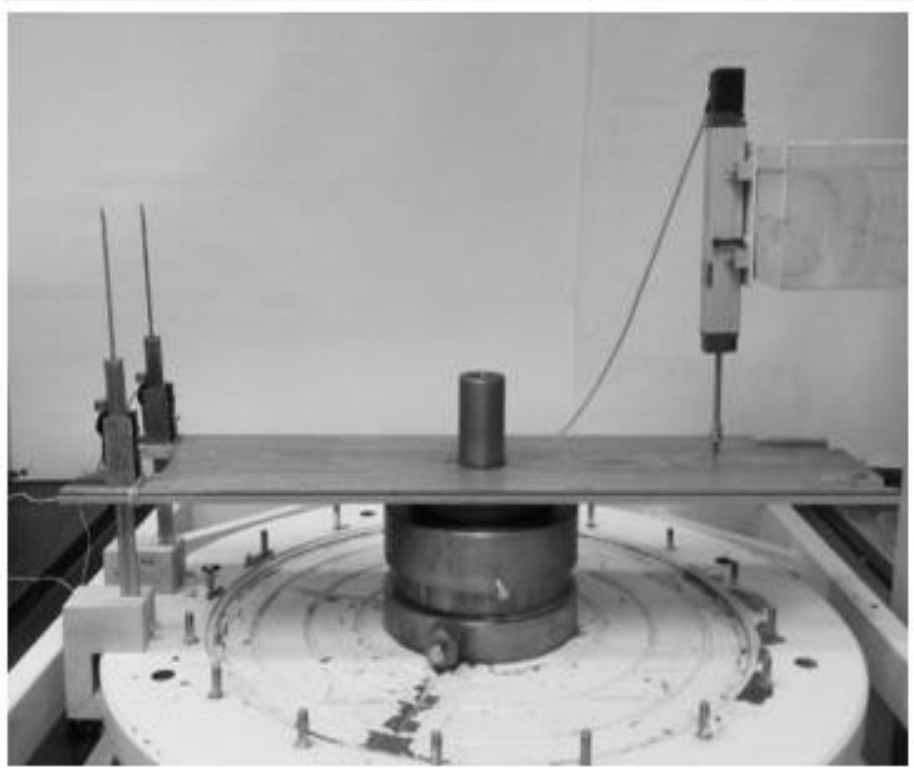
The average solid particle densities for the winter and summer ORRF samples were 1.89 g/cm$^3$ and 1.82 g/cm$^3$, respectively.

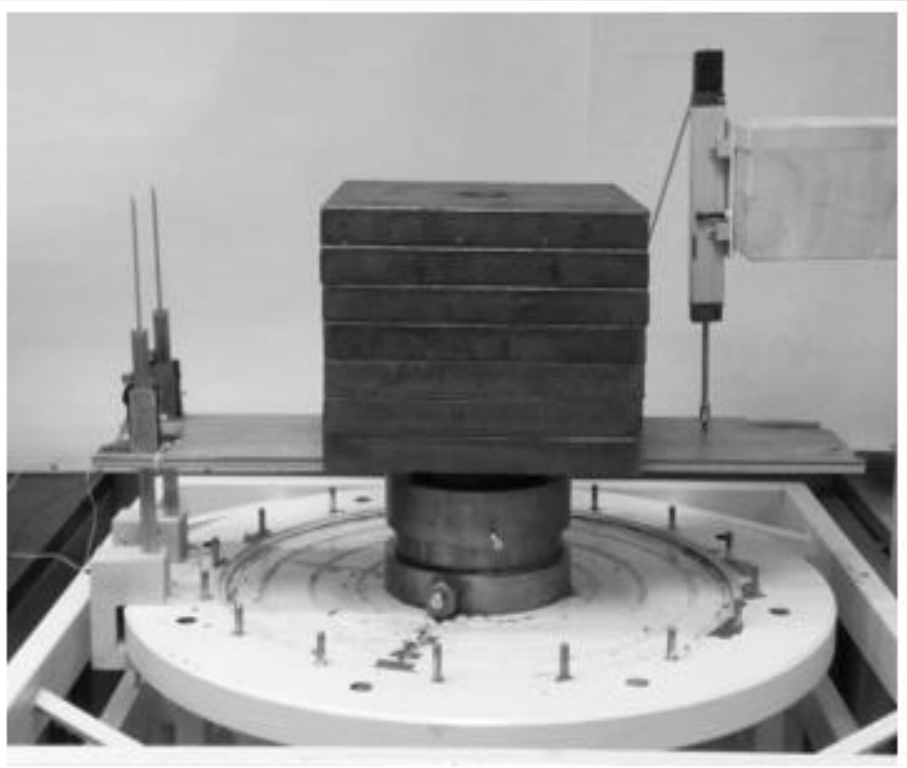
Based on the laboratory test results, it can be concluded that there was no significant difference between the winter and summer ORRF samples.

# 2. MATERIALS AND METHODS – EXPERIMENTAL PROCEDURE




- Four samples.
- Three shor-term test under various wet conditions (dry; wet; dry-wet)
- One long-term test under dry-wet conditions with landfill gass measurements.





# 2. MATERIALS AND METHODS – OEDOMETER TEST

# 2. MATERIALS AND METHODS – COMPRESSION PARAMETERS

$$C_c = \frac{-\Delta e}{\Delta log \sigma_v} \quad (1)$$

where $\Delta e$ is the corresponding change in the void ratio and $\Delta log\sigma_v$ is the corresponding increment of vertical stress.

$$C_\alpha = \frac{-\Delta e}{log\, t/t_m} \quad (2)$$

where $\Delta e$ is the corresponding change in the void ratio and $t_m$ is the reference time for mechanical creep.

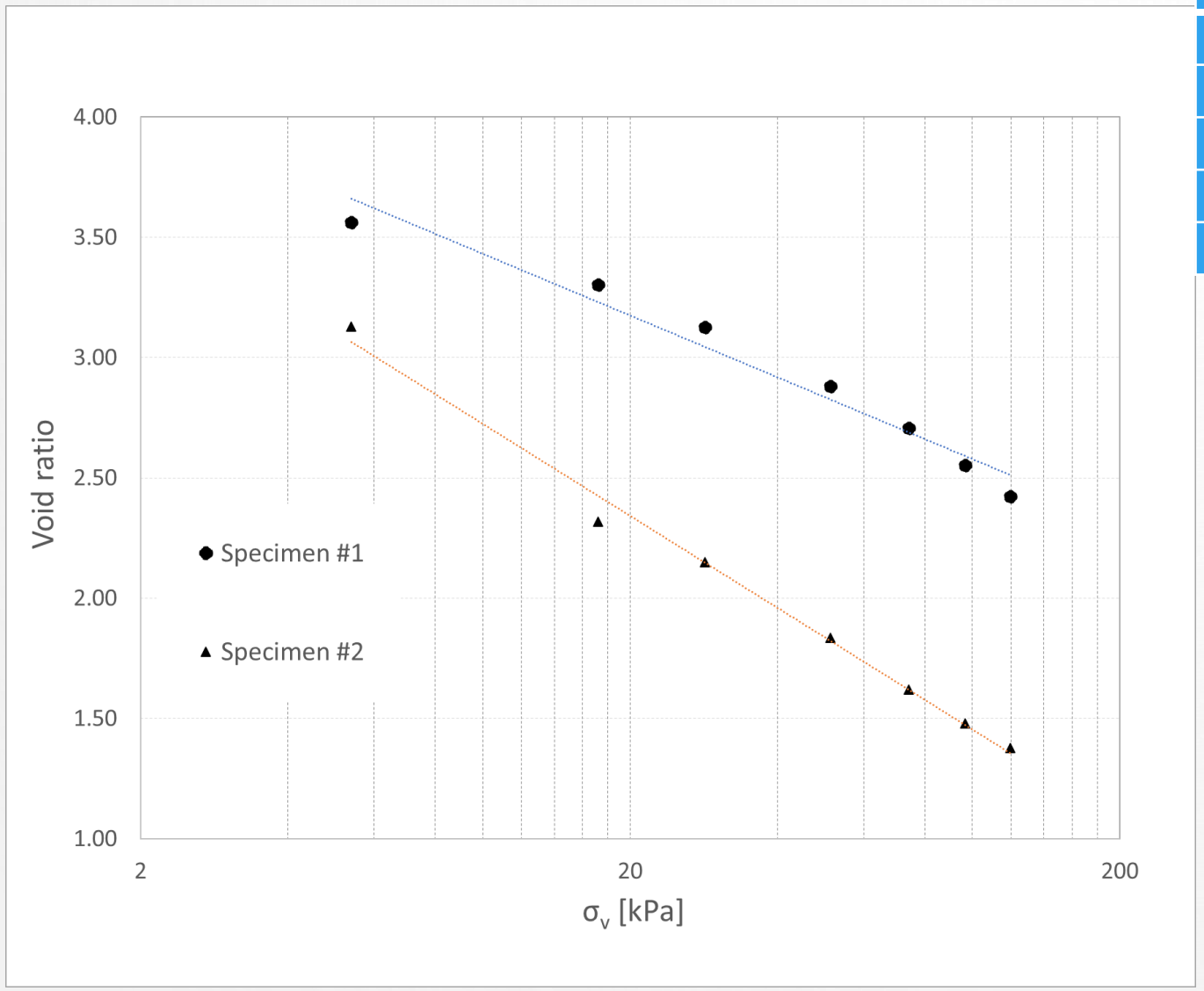
$$C_{\alpha B} = (1 + e_b)\frac{-\Delta \varepsilon}{log\, t/t_b} (3)$$

where $\Delta\varepsilon$ is the corresponding change in the vertical strain, $t_b$ is the reference time for the degradation-induced compression, and $e_b$ is the corresponding void ratio at the beginning of the degradation process.

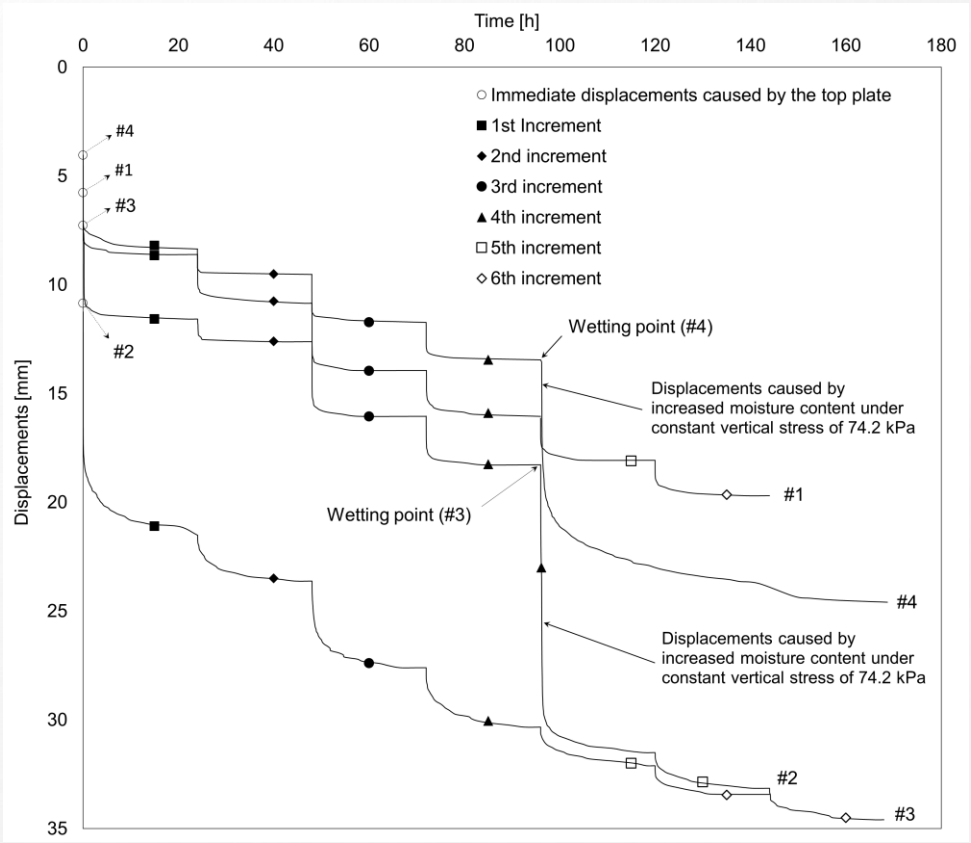
# 3. EXPERIMENTAL RESULTS – BASIC GEOTECHNICAL PROPERTIES AT THE END OF THE TEST

| Sample | $\rho$ ($g/cm^3$) | w (%) | $\rho_d$ ($g/cm^3$) | Void ratio |
|---|---|---|---|---|
| #1 | 0.55 | 0 | 0.55 | 2.42 |
| #2 | 1.25 | 57 | 0.80 | 1.38 |
| #3 | 1.31 | 57 | 0.83 | 1.27 |
| #4 | / - 0.91 | / - 68 | $0.65^{*}$ - $0.54^{**}$ | $1.79^{*}$ - $2.80^{**}$ |

# 5. EXPERIMENTAL RESULTS – SHORT TERM TESTS



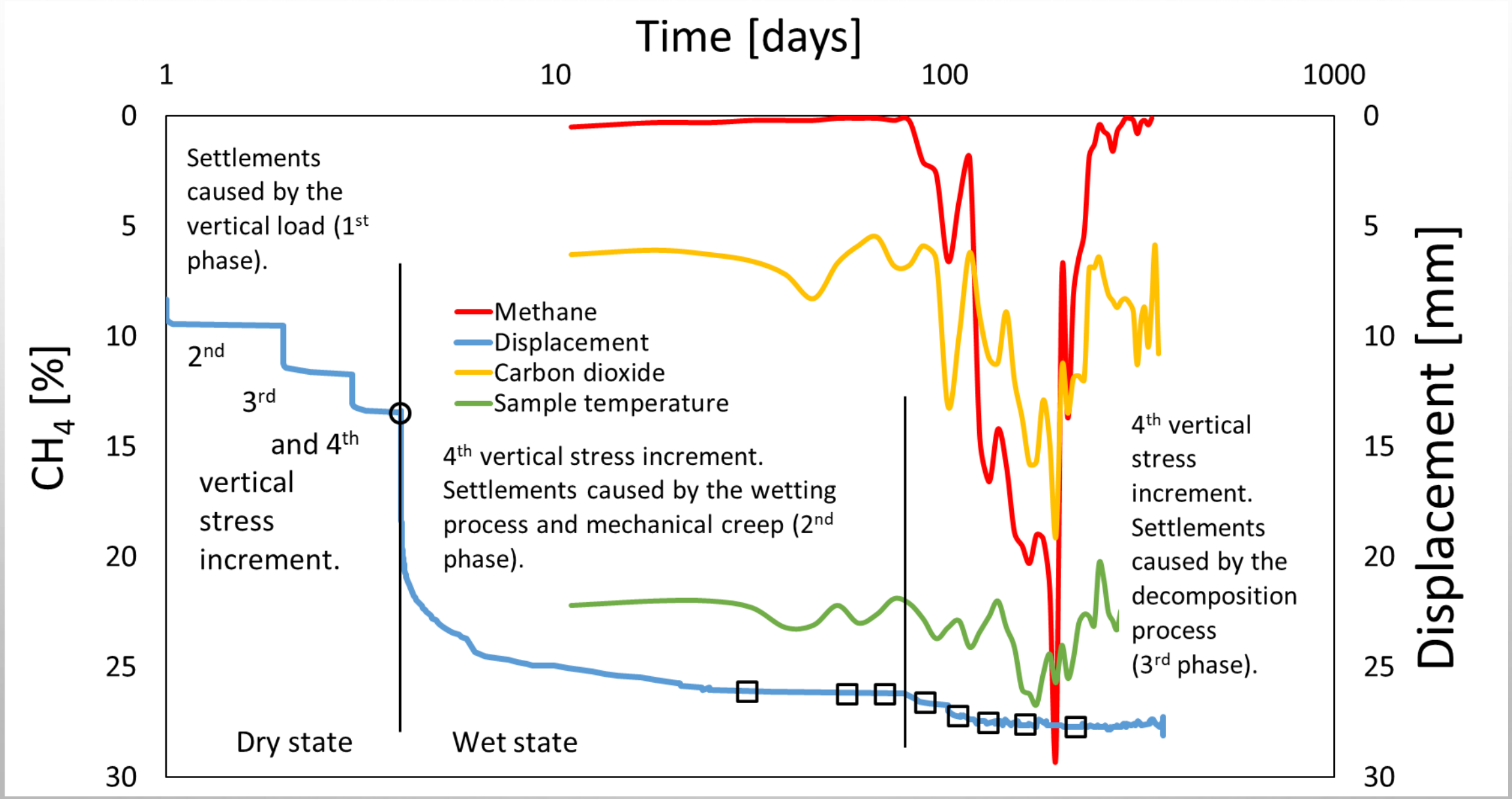

| Sample | $C_c$ | Stress range (kPa) |
|---|---|---|
| #1 | 0.85 | 5.29-119.5 |
| #2 | 1.27 | 5.29-119.5 |
| #3—dry state | 0.77 | 5.29-74.2 |
| #3—wet state | 1.16 | 96.68-119.5 |
| #4 | 0.60 | 5.29-74.2 |



# 5. EXPERIMENTAL RESULTS – SHORT TERM TESTS

| Sample | #1 | #2 | #3 | #4 |
|---|---|---|---|---|
| Stress increment | $C_\alpha$ [1] | $C_\alpha$ [1] | $C_\alpha$ [1] | $C_\alpha$ [1] |
| 1 | 0.0185 | 0.0815 | 0.0213 | 0.0335 |
| 2 | 0.0218 | 0.0393 | 0.0044 | 0.0054 |
| 3 | 0.0161 | 0.0569 | 0.0173 | 0.0129 |
| 4 | 0.0162 | 0.0468 | 0.0146 | 0.0114 |
| 4—wet | - | - | - | 0.0488* |
| 5 | 0.0171 | 0.0331 | 0.0257 | - |
| 6 | 0.0178 | 0.0241 | 0.0222 | - |

# 5. EXPERIMENTAL RESULTS – LONG TERM TEST



# 6. CONCLUSIONS

- THE CALCULATED IMMEDIATE COMPRESSION INDEX VALUES RANGED FROM 0.77 TO 1.27, FOR THE SHORT-TERM TEST SAMPLES #1, #2, AND #3, WHILE THE CALCULATED IMMEDIATE COMPRESSION INDEX VALUE FOR THE LONG-TERM TEST SAMPLE #4 WAS 0.60.

- BIODEGRADATION WAS VERIFIED BY METHANE GAS CONCENTRATION MEASUREMENTS CONDUCTED FOR THE DURATION OF THE LONG-TERM COMPRESSION TEST. THE CORRESPONDING BIOCOMPRESSION INDEX RETURNED A VALUE OF 0.122.

# THANK YOU FOR YOUR ATTENTION

Taken from: https://www.ekoplus.hr/mariscina.php

- **PROJECT NAME**:

Testing and modelling of mechanical behavior of biodryed waste as a waste-to-energy prerequisite

- **FUNDING**:

Croatian science foundation under the project UIP-2017-05-5157

- **DURATION OF THE PROJECT:**

01.01.2018 - 31.12.2022

- FOR MORE INFORMATION ABOUT THE RESEARCH ITSELF: http://wte.gfv.hr/index_en.html

HrZZ
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