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Evaluating the Effectiveness of the C-EcoForHome Composter for Indoor Biowaste Processing in Educational Institutions

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Abstract

Indoor biowaste treatment using small-scale composters has proven effective for processing organic waste and recovering valuable resources. This study evaluated the performance of the handmade C-EcoForHome composter, supplemented with an inoculant, in processing biowaste generated at five educational institutions in Split. During the biowaste treatment, key parameters were monitored, including temperature, compost heap height, moisture content, dry and volatile matter, carbon and nitrogen content, pH, and electrical conductivity. The collected leachates were analysed for volume, pH, electrical conductivity, and turbidity. Pre-composts were subsequently matured in two soil types, where the same physicochemical parameters were assessed to evaluate further stabilisation. Fourier-transform infrared (FTIR) spectroscopy was used to evaluate compositional changes in the biowaste resulting from composting conditions, and to analyse the produced water-dominated leachates. The results showed that the C-EcoForHome composter effectively processed biowaste in institutional settings, producing stable pre-composts with only minor variations compared to the initial substrate composition. Anaerobic fermentation caused acidification, ion release, and partial stabilisation of organic matter, while soil maturation further contributed to drying and consolidation. Indoor small-scale biowaste treatment represents a sustainable, low-maintenance solution for biowaste management, producing nutrient-rich pre-compost suitable for soil amendment.

Keywords

Pre-compost, anaerobic fermentation, leachate, physicochemical characterisation, FTIR analysis

1 Introduction

The increasing generation of organic waste in urban areas has become a major environmental and public health challenge, highlighting the urgent need for sustainable waste management solutions.[1] Traditional disposal methods such as landfilling and incineration contribute to greenhouse gas emissions, environmental pollution, and the loss of valuable organic resources.[2] In densely populated Croatian urban centres, biowaste collection is challenged by limited space, logistical constraints, and odour emissions, making large-scale collection impractical.[3] Due to the growing need for sustainable waste management, indoor biowaste treatment using small-scale composters has emerged as an effective and practical solution.[2] Controlled indoor systems enable the decomposition of organic matter under regulated conditions, reducing odours, minimising operational challenges, and producing nutrient-rich pre-compost suitable for soil amendment.[4] These systems also facilitate decentralised biowaste management, which is particularly advantageous in schools, kindergartens, and other institutions where frequent collection may be difficult.[5] By converting organic residues into valuable products, indoor treatment not only supports circular economy principles but also reduces dependence on chemical fertilisers and

promotes sustainable resource recovery.[6,7] Indoor small-scale biowaste treatment therefore offers a low-maintenance, efficient, and environmentally friendly solution for institutions, addressing local collection and handling challenges. Institutional and educational buildings, which also generate organic waste, can serve as models for proper waste management practices when appropriate treatment systems are implemented.[8]

Previous studies have demonstrated the potential of anaerobic pretreatment to enhance stabilisation and nutrient retention.[9] However, research on compact, user-friendly composters implemented across multiple institutions (particularly studies assessing pre-compost properties, leachate characteristics, and soil maturation) remains limited. For example, *Arrigoni et al.* studied small-scale composting systems under cold conditions using animal by-products and leachate recycling, providing insights into leachate management and organic matter stabilisation. Although focused on specific conditions, the study provides insight into the complexity of leachate management and organic matter stabilisation in small systems.[10] *Junior and Mahler* evaluated two small composting systems in institutional settings. The systems maintained thermophilic conditions for more than 20 days without significant CH_4 emissions or leachate production, and were found suitable for small to medium-sized waste generators. Such systems can be applied in industrial kitchens, residential complexes, shopping centres, and other small- to medium-sized waste generators.[11] *Álvarez-Alonso et al.* implemented a composting system at the University of Navarra campus, monitoring the process and the final compost to ensure reproducibility and quality.[12]

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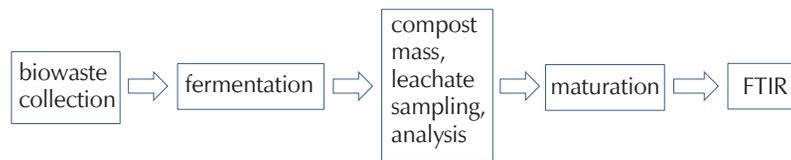 Email: jradic@ktf-split.hr

Fig. 1 – Experimental flow diagram
Slika 1 – Dijagram tijeka eksperimenta

The novelty of the present study lies in the implementation of the handmade C-EcoForHome composter in five educational institutions in Split, enabling a practical assessment of indoor biowaste management. The study monitors the transformation of biowaste into pre-compost under anaerobic conditions, evaluates leachate dynamics, and examines soil maturation, providing insights into decentralised, low-maintenance, and sustainable biowaste treatment that can be scaled or adapted to urban institutional settings.

2 Experimental

The experimental procedure comprised several stages, including biowaste collection, anaerobic fermentation using the C-EcoForHome composter, compost mass and leachate sampling and analysis, pre-compost maturation in two soil types, and physicochemical as well as spectroscopic characterisation of the obtained materials. A basic schematic overview of the experimental workflow is presented in Fig. 1.

2.1 Initial biowaste collection

The initial biowaste was collected from five different educational institutions: Iskrica Kindergarten, Skalice Primary School in Split, Škmer Association, Kliper Institution, and the Commercial School in Split. The compositions and total masses of the collected biowaste are summarised in Table 1.

2.2 Indoor biowaste treatment

Indoor biowaste treatment was carried out in all participating educational institutions using the C-EcoForHome composter, with the addition of an anaerobic microbial inoculum. The commercial inoculant Compost Help contained lactic acid bacteria, photosynthetic bacteria, yeast, wheat bran flour, molasses, and water. The collected biowaste was shredded into pieces of approximately 5 cm and placed in the composter in successive layers. After each layer of biowaste, a layer of the anaerobic inoculant and a small amount of water were added to moisten the substrate and activate the microorganisms. Each layer was then pressed to expel air, thereby ensuring anaerobic conditions. This step was essential to prevent oxygen penetration, maintain the proper moisture level, and promote efficient microbial activity during the treatment process. Fig. 2 shows the C-EcoForHome composter and the appearance of the compost piles inoculated with anaerobic microorganisms at different educational institutions.

The biowaste treatment process was carried out in each educational institution over a period of three to four weeks to produce pre-compost. Manual sampling of the compost mass and leachate was performed periodically throughout the treatment process.

2.3 Compost mass analysis

The following parameters were measured for each compost pile: height, temperature, pH, electrical conductivity, moisture content, dry matter, volatile matter, carbon content, nitrogen content, and the C/N ratio. All analyses were conducted according to standard methods.[13]

Table 1 – Composition and total mass of collected biowaste
Tablica 1 – Sastav i ukupna masa prikupljenog biootpada

Institution	Biowaste composition	Mass/g	Compost pile height/cm
Iskrica Kindergarten	Raw leftover leafy vegetables (lettuce), raw leftover vegetables (green beans, zucchini, asparagus, elderberries), raw leftover fruits (apple, banana)	2214.4	33.0
Skalice Primary School	Carrot, orange, cucumber peel, leek, onion, grass, banana peel, cabbage, potato peel, coffee grounds, tea bags	5032.0	31.0
Škmer Association	Raw vegetable scraps (carrot, parsley, celery, banana peel, young chard, lettuce), citrus peels (orange, lemon), fruit peels (strawberry, apple), tropical fruit peels (pineapple, kiwi)	3875.0	31.5
Kliper Institution	Potato residues, mixed fruit peels (apple, orange, lemon), banana peels	3452.0	26.5
Commercial School, Split	Potato residues, carrot residues, leafy vegetables, tomato residues, other vegetables, raw fruit (apple, banana, orange, lemon, pear), fruit peels, coffee grounds	3484.0	24.5

Fig. 2 – C-EcoForHome composter (a), and compost piles in: b) Škmer Association; c) Kliper Institution; d) Commercial School; e) Iskrica Kindergarten; f) Skalice Primary School

Slika 2 – Prikaz C-EcoForHome kompostera (a) i kompostnih hrpa u različitim odgojno-obrazovnim ustanovama: b) Udruga Škmer; c) Ustanova Kliper; d) Obrtnička škola; e) Dječji vrtić Iskrica; f) Osnovna škola Skalice

2.4 Leachate analysis

The following parameters were analysed for the collected leachates: volume, pH, electrical conductivity and turbidity.

2.5 Maturation of pre-compost

For further maturation, the obtained pre-composts were mixed with 50 g of compost and 100 g of soil. Two different soils were used: Soil 1, previously used in agriculture and treated with agricultural inputs, and Soil 2, which had not been used for agricultural purposes. The mixtures were regularly homogenised throughout the maturation period. After 15 days, the following parameters were measured for each mixture: pH, electrical conductivity, moisture content, dry matter, volatile matter, carbon and nitrogen content, and the C/N ratio. All analyses were performed according to standard methods.

2.6. Fourier transform infrared spectroscopy

Fourier transform infrared (FTIR) spectra of solid dry ground samples, including the initial biowaste, pre-composts from different educational institutions, and the correspond-

ing final leachates, were recorded using a Spectrum Two spectrometer (Perkin-Elmer, USA) employing the Universal Attenuated Total Reflectance (UATR) technique. Measurements were conducted over a wavenumber range of 4000–400 cm^{-1}, with a resolution of 4 cm^{-1} and 10 scans at 25 °C. A diamond crystal was used as the ATR reflection element.

Due to the complex nature of the samples, direct assignment of specific bands to the individual functional groups was challenging, as each spectrum represented a superposition of IR absorptions from all compounds present. Therefore, the analysis was primarily focused on the comparative spectral differences between samples and the identification of the absorption bands that could be connected to the composting.

3 Results and discussion

3.1 Analysis of biowaste during fermentation and maturation

Changes in the biowaste properties during anaerobic treatment were closely monitored to evaluate the progress of fermentation. Fig. 3 shows the variations in (a) biowaste mass and (b) pH throughout the anaerobic fermentation process.
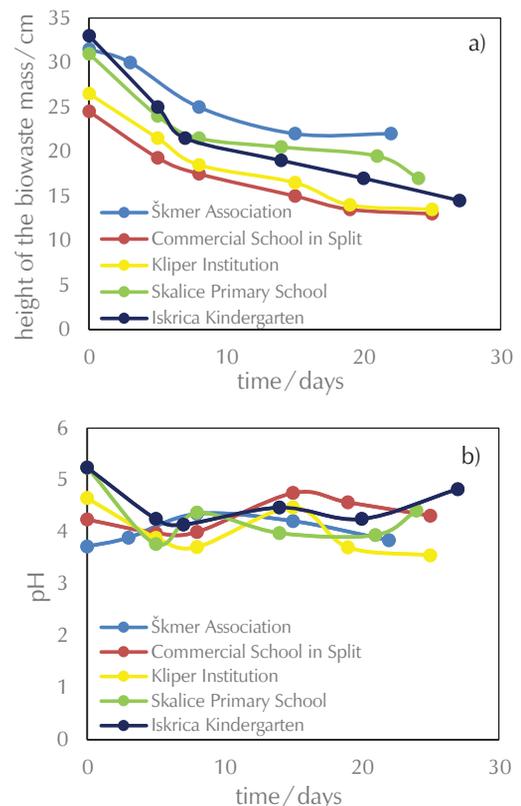

Fig. 3 – Change in (a) biowaste mass, and (b) pH, during anaerobic fermentation

Slika 3 – Grafički prikaz promjene mase biootpada (a) i pH (b) tijekom procesa anaerobne fermentacije

The reduction in biowaste mass was evident (Fig. 2a) in all educational institutions. A decline in pH values was noticeable during the first 5–10 days, except in the Škmer Association (Fig. 2b), as one third of the total biowaste mass consisted of orange and lemon peel. The pH values fluctuated within the range of 3.71–5.24. Under anaerobic conditions, the initial decrease in pH indicated active fermentation of organic matter, primarily through the production of organic acids from readily degradable carbohydrates. Subsequent oscillations of pH around the initial values reflected a dynamic balance between acid production and consumption by acid-tolerant microorganisms, as well as buffering by naturally occurring basic compounds such as ammonium and mineral salts. This quasi-steady-state pH demonstrated ongoing microbial activity and stabilisation processes within the pre-compost. These results are consistent with previous findings.[14,15]

To further characterise the transformation, the physicochemical parameters of the initial biowaste, the obtained pre-compost and the soils used for maturation were analysed before and after the maturation period with pre-compost addition. The results of this analysis are summarised in Table 2.

Table 2 – Comparison of physicochemical parameters of the initial biowaste, the obtained pre-compost, and the soil used for maturation before and after maturation with pre-compost addition

Tablica 2 – Usporedba fizikalno-kemijskih parametara početnog biootpada, dobivenog prekomposta, tla korištenog za zrenje prije i nakon zrenja uz dodatak prekomposta

Samples		pH	$G/\mu S\,cm^{-1}$	$w(H_2O)/\%$	$w(DM)/\%$	$w(VM)/\%$	$w(C)/\%$	$w(N)/\%$	C/N ratio
Škmer Association	*Initial biowaste*	3.72	291	79.04	20.04	96.42	53.59	1.23	43.76
Commercial School		4.24	320	82.89	17.11	92.92	51.61	1.99	25.99
Kliper Institution		4.65	298	83.70	16.30	90.28	50.12	1.21	41.34
Skalice Primary School		5.24	423	85.09	14.91	92.40	51.34	1.45	35.36
Iskrica Kindergarten		5.24	294	79.20	20.80	91.73	50.90	2.57	19.85
Pre-comp Škmer Association	*Fermentation*	3.84	743	76.08	23.92	93.87	52.15	1.85	28.21
Pre-comp Commercial School		4.32	1241	73.34	26.66	93.67	52.04	3.28	15.87
Pre-comp Kliper Institution		3.71	840	69.60	30.40	94.51	52.46	0.96	54.71
Pre-comp Skalice Primary School		4.41	903	74.27	25.73	92.64	51.46	1.66	30.92
Pre-comp Iskrica Kindergarten		4.82	1530	75.64	24.36	89.11	49.50	2.21	22.36
Soil 1	*Pre-compost maturation*	8.13	144	24.28	75.72	14.33	7.96	0.51	15.67
Soil 2		8.95	75	7.41	92.59	8.78	4.88	0.23	31.63
Soil 1 + Pre-comp Škmer Association		8.43	172	25.96	74.04	18.27	10.11	0.64	15.80
Soil 2 + Pre-comp. Škmer Association		8.64	145	14.84	85.16	9.30	5.17	0.33	15.55
Soil 1 + Pre-comp. Commercial School		8.10	206	13.88	86.12	15.08	8.37	0.51	16.28
Soil 2 + Pre-comp. Commercial School		8.81	186	4.59	95.41	10.38	5.86	0.26	23.01
Soil 1 + Pre-comp. Kliper Institution		8.85	128	10.32	89.68	17.15	9.71	0.40	24.11
Soil 2 + Pre-comp. Kliper Institution		8.77	110	4.08	95.92	13.26	7.37	0.29	25.14
Soil 1 + Pre-comp. Skalice Primary School		8.50	223	28.08	71.92	13.87	7.70	0.54	14.20
Soil 2 + Pre-comp. Skalice Primary School		8.83	134	10.74	89.26	8.73	4.85	0.32	15.14
Soil 1 + Pre-comp. Iskrica Kindergarten		7.70	316	28.98	71.02	13.90	7.69	0.61	12.56
Soil 2 + Pre-comp. Iskrica Kindergarten		8.92	180	14.95	85.05	9.90	5.50	0.30	18.11

pH – pH values, G – el. conductivity in $\mu S\,cm^{-1}$, $w(H_2O)$ – moisture content in %, $w(DM)$ – dry matter content in %; $w(VM)$ – volatile matter content in percentage, $w(C)$, carbon content in percentage, C/N ratio – ratio of carbon and nitrogen

Table 3 – Comparison of physicochemical parameters of compost leachate
Tablica 3 – Usporedba fizikalno-kemijskih parametara procjedne otopine komposta

Samples	Volume of collected leachate / ml	pH	El. conductivity / mS cm^{-1}	Turbidity / NTU
Škmer Association	–	–	–	–
Commercial School	125	3.99	21.60	469
Kliper Institution	575	4.15	22.35	187
Skalice Primary School	362	4.52	21.46	430
Iskrica Kindergarten	74	4.30	24.70	340

Note: Škmer Association – the amount of leachate produced was minimal, *i.e.* insufficient for analysis

After anaerobic fermentation, electrical conductivity increased significantly in all pre-composts, suggesting the release of soluble salts and ions (*e.g.*, potassium, calcium, ammonium, and magnesium) as cellular structures degraded. This enrichment indicated a higher mineralisation rate of the organic matter and the transformation of insoluble components into soluble forms, which may later serve as plant-available nutrients.[16] Moisture content decreased while the proportion of dry matter increased, reflecting water loss due to microbial metabolism and partial evaporation. This shift led to a higher concentration of solids within the mass. Volatile matter and carbon content remained relatively stable, ranging from 89.11 to 94.51 %, and 49.50 to 52.46 %, respectively. This indicated that, although water content decreased, the organic fraction had not undergone significant mineralisation within the observed timeframe. Instead, most of the easily degradable substrates were converted into intermediate organic compounds, demonstrating that the organic matter underwent partial, but not complete, mineralisation during the process.[17]

Nitrogen content increased in most pre-composts, except for Kliper Institution and Iskrica Kindergarten, suggesting microbial growth and nitrogen assimilation during fermentation. The observed increase may be related to the breakdown of proteins and amino acids, as well as the accumulation of microbial biomass. In contrast, in the Kliper Institution and Iskrica Kindergarten samples, the relative nitrogen content did not increase, which may have been due to differences in the initial biowaste composition (*e.g.*, higher potato content and lower protein-rich material), resulting in slower nitrogen cycling. The C/N ratio decreased in all pre-composts except in these two cases. This decrease reflected the preferential consumption of carbon-rich compounds and nitrogen retention, thereby creating conditions favourable for further stabilisation of organic matter.[18]

After mixing the pre-compost with soils for maturation, further changes were observed. Although the pre-composts initially had higher moisture content (69.60–76.08 %) than the soils (24.28 % for Soil 1 and 7.41 % for Soil 2), the overall moisture content of the mixtures decreased significantly after 15 days of maturation at a pre-compost to soil ratio of 1 : 6. This reduction was mainly due to the lack of moisture adjustment during maturation and possible evaporation under ambient conditions. As a result, the dry matter fraction increased, indicating further stabilisation and concentration of solids. Volatile matter and carbon content in the mixtures showed only slight variations compared to the initial values in the parent soils (14.33 and 8.78 % for Soil 1 and Soil 2, respectively). This indicated that, during the short maturation period, degradation of more recalcitrant organic compounds was limited, and the overall carbon content remained relatively stable. These results are consistent with expectations, as significant changes in carbon content typically require longer maturation times.

3.2 Analysis of leachate produced during biowaste treatment

The physicochemical properties of the leachates generated during the biowaste treatment process were analysed to assess the release of soluble compounds and changes in composition over time. Table 3 summarises the comparison of key parameters, including pH, electrical conductivity, moisture, dry matter, volatile matter, carbon and nitrogen content, and C/N ratio, for the leachates obtained from the different compost samples.

The results presented in Table 3 show that substrates from different educational institutions produced varying volumes of leachate, attributable to differences in their initial composition, particularly the ratio of fruits, vegetables, and moisture-rich materials. Biowaste with a higher proportion of fresh fruits and vegetables generally released more liquid during anaerobic treatment. The pH values of the leachates were slightly acidic, consistent with the production of organic acids (*e.g.*, lactic, acetic, and citric acid) during the early stages of microbial degradation. This acidification reflected active microbial metabolism and the breakdown of easily degradable carbohydrates. High electrical conductivity values indicated an increased concentration of soluble ions such as potassium, calcium, magnesium, and ammonium, which are typically released during the decomposition of plant tissues and proteins. Such enrichment of dissolved minerals suggested that leachates may act as nutrient-rich solutions, although their direct application would require careful management due to potential phytotoxicity at higher concentrations. In addition, the elevated turbidity of the leachates suggested the presence of suspended organic and inorganic particles, likely orig-

inating from incomplete degradation of solid matter or colloidal fractions. This high turbidity, combined with the acidic nature and ionic strength of the liquid, indicated a complex matrix that reflected both the composition of the original biowaste and the progress of anaerobic microbial activity.

3.3. FTIR analysis

In our previous study that included differently treated initial biowaste, detailed FTIR analysis revealed the complex composition of solid samples due to the large number of different organic molecules (carbohydrates, proteins, oils etc.) typically found in bioorganic materials.[9] The initial biowastes in this study were more diverse and complex than those in our previous study, but still exhibited the same overall FTIR spectrum because of their comparable compositions that gave more or less similar absorption bands with a difference in intensities caused by differences in concentration, Fig. 4. Pre-compost samples from all institutions exhibited similar FTIR spectra; however, compared with the initial biowastes, several additional absorption bands were observed that were not previously present or were not clearly visible.

A vibration peak at 3009 cm⁻¹ in the FTIR spectra of the pre-composts was primarily attributed to the vibration of C=C bonds in unsaturated compounds, such as fatty acids found in vegetable oils.[19,20] As compost matures, microbial activity or oxidation is expected to break down these complex molecules, which may cause a decrease in peak intensity. In this investigation, the composting conditions promoted the extraction of fatty acids from the biowaste, making this absorption peak more pronounced in

all pre-compost samples. It should be emphasised that the anaerobic conditions applied in this study did not provide sufficient oxidative conditions to break down these compounds, nor sufficient time for microbial activity. Future investigations should therefore analyse the progression of this process with the compost maturation time. The vibration band at 1735 cm⁻¹ corresponded to the carbonyl functional group, indicating the presence of esters observed both in the initial biowaste and the pre-compost. Additionally, the absorption peak detected at 1710 cm⁻¹ indicated carbonyl groups likely originating from aldehydes, ketones or carboxylic acids formed during the biotransformation of the organic matter in the biowastes, Fig. 4. This finding provides evidence of intermediate product formation during the anaerobic digestion of biomass.[21]

The spectra of the liquid samples and the pre-compost leachates from different institutions are shown in Fig. 5. The composition of the leachates was dominated by water, but a noticeable absorption region from 1500 to 900 cm⁻¹, not attributable to water, was also observed. This region, although with less pronounced intensity, was detected and explained in our previous study.[9]

The observed absorption bands can be attributed to the composting conditions and the chemical reactions occurring during anaerobic digestion, acidification processes such as hydrolysis and fermentation, which produce soluble organic compounds and short-chain organic acids.[22] The increased concentration of these soluble organic compounds suggests that these leachates could potentially serve as fertilisers; however, this requires further investigation, as mentioned previously. While they may contain valuable nutrients, they could also carry potential contaminants, such as heavy metals. If properly treated, these leachates could become a valuable source of liquid fertiliser.
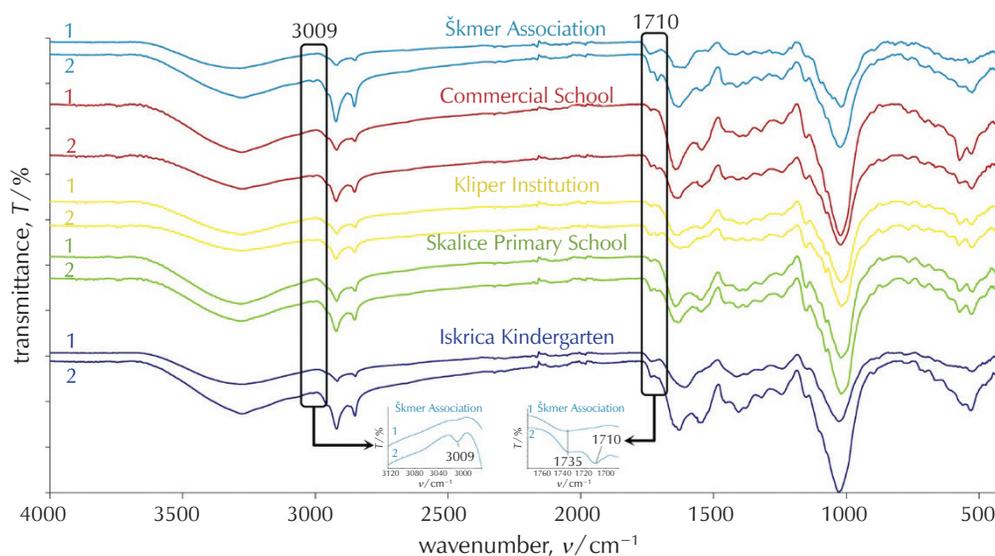

Fig. 4 — FTIR spectra of initial biowastes from different institutions (label 1) and their pre-composts (label 2)

Slika 4 — FTIR spektri početnih biomasa iz različitih institucija (oznaka 1) i njihovi prekomposti (oznaka 2)
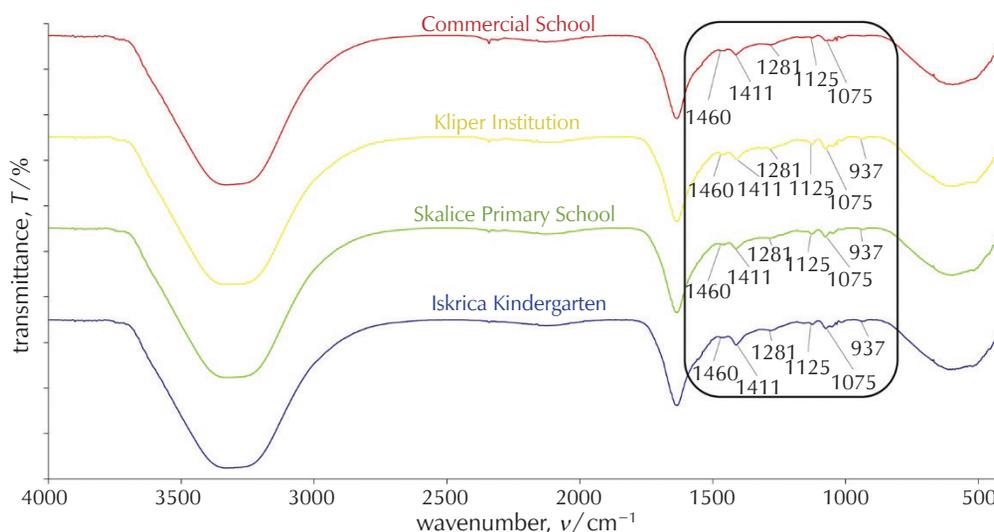
Fig. 5 – FTIR spectra of pre-compost leachates from different institutions
Slika 5 – FTIR spektri procjednih voda prekomposta različitih institucija

4 Conclusion

Biowaste fermentation in the handmade C-EcoForHome composter proved to be an effective method for managing biowaste in various educational institutions. The process produced pre-composts with satisfactory physicochemical properties, which were further matured in soil. Only minor variations were observed in the properties of the resulting pre-composts compared to the initial biowaste composition, demonstrating the robustness of this treatment method. As no mixing is required during anaerobic fermentation, this approach offers a simple and sustainable strategy for biowaste management in educational institutions. Physicochemical analyses confirmed that anaerobic fermentation effectively initiated the transformation of biowaste into pre-compost, as shown by acidification, ion release, and partial stabilisation of organic matter. Subsequent soil maturation contributed to drying, consolidation, and further stabilisation of the mixtures while preserving most of the carbon content. Leachate analysis showed that properties of the liquid fraction, such as pH, electrical conductivity, and turbidity, were strongly influenced by substrate composition and microbial activity, highlighting the need for monitoring when considering potential environmental or agricultural applications. FTIR analysis confirmed anaerobic biotransformation of the biowastes and the potential of the leachates as liquid fertilisers.

The results of this study confirmed that the simple, low-cost design of the C-EcoForHome composter makes it suitable for educational institutions, small households, restaurants, and community centres, encouraging wider adoption of decentralised biowaste treatment. Its implementation supports circular economy principles by reducing organic waste generation, lowering disposal costs, and promoting environmental awareness among pre-schoolers, pupils, students, and staff. Although this study primarily focused on evaluating the composter's performance, the findings may cautiously indicate potential for future assessment of the pre-compost's agronomic quality and its possible certification as a soil amendment product.

References
Literatura

1. *M. Ayilara, O. Olanrewaju, O. Babalola, O. Odeyemi*, Waste Management through Composting: Challenges and Potentials, Sustainability **12** (2020) 4456, doi: https://doi.org/10.3390/su12114456.

2. *E. E. Manea, C. Bumbac, L. R. Dinu, M. Bumbac, C. M. Nicolescu*, Composting as a Sustainable Solution for Organic Solid Waste Management: Current Practices and Potential Improvements, Sustainability **16** (2024) 6329, doi: https://doi.org/10.3390/su16156329.

3. *I. Smoljko, J. Sedlar*, A Comparative Analysis of Target Scenarios for Municipal Waste Reduction in Croatia's Leading Tourist Towns, Recycling **9** (2024) 75, doi: https://doi.org/10.3390/recycling9050075.

4. *R. Barrena, A. Sánchez*, Home Composting: A Review of Scientific Advances, in: 1st Int. Electron. Conf. Process. Process. Syst. Innov., MDPI, Basel Switzerland, 2022, p. 35, doi: https://doi.org/10.3390/ECP2022-12625.

5. *M. García-Prats, D. González, J. Moral-Vico, C. Madrid-López, A. Sánchez*, Implementing Community Composting in Primary Schools: First Experiences at Universitat Autònoma de Barcelona, Spain, in: ECP 2023, MDPI, Basel Switzerland, 2023, p. 37, doi: https://doi.org/10.3390/ECP2023-14730.

6. *K. Trivedi*, Household Compost: A Sustainable Way of Transforming Kitchen and Garden Waste into Organic fertilizer for Residential Garden, Indian J. Home Sci. **36** (2024) 159–169.

7. *A. L. Craveiro, M. T. Santos, A. Rodrigues*, Implementing Composting and Awareness Campaigns in a Higher Education Institution to Promote Circularity, Sustainability **17** (2025) 8446, doi: https://doi.org/10.3390/su17188446.

8. *Y. Coelho de Freitas, A. M. Nicolau Korres, F. A. Veronez*, Organic Waste Management in Educational Institutions: A Systematic Review, in: Handb. Sustain. Sci. Futur., Springer In-

ternational Publishing, Cham, 2023, pp. 1–17, doi: https://doi.org/10.1007/978-3-030-68074-9_85-1.

9. *M. Buljac, E. Dadić, Z. Jukić, J. Radić, S. Perinović Jozić, N. Vukojević Medvidović*, Indoor Pretreatment of Biowaste Using the Bokashi Method, Kem. Ind. **73** (2024) 129–138, doi: https://doi.org/10.15255/KUI.2023.047.

10. *J. P. Arrigoni, G. Paladino, L. A. Garibaldi, E. Hedenström, W. Zhang, F. Laos*, Performance of small-scale composting in low ambient temperatures: Effects of adding animal by-products and recycling leachates, Waste Manag. Bull. **2** (2024) 309–317, doi: https://doi.org/10.1016/j.wmb.2024.09.003.

11. *R. G. de S. Lima Jr., C. F. Mahler*, Evaluation of New Small-Scale Composting Practices with Energy Recovery, Detritus (2020) 3–10, doi: https://doi.org/10.31025/2611-4135/2020.13908.

12. *C. Álvarez-Alonso, M. D. Pérez-Murcia, E. Martínez-Sabater, I. Irigoyen, J. Sánchez-Arizmendiarrieta, R. Plana, M. López, I. Nogués, M. Á. Bustamante*, Integrated Biowaste Management by Composting at a University Campus: Process Monitoring and Quality Assessment, Appl. Sci. **15** (2025) 2910, doi: https://doi.org/10.3390/app15062910.

13. *A. E. Greenberg, L. S. Clesceri, A. D. Eaton* (eds.) Standard methods for the examination of water and wastewater, 18th ed., American Public Health Association, Washington, DC 20005, 1992.

14. *X. Wang, G. You, C. Liu, Y. Sun*, Bioaugmentation strategies in co-composting anaerobically digested food waste with agricultural by-products: Enhancing fertilizer quality and microbial communities, Ecotoxicol. Environ. Saf. **290** (2025) 117539, doi: https://doi.org/10.1016/j.ecoenv.2024.117539.

15. *C. Lin, N. K. Cheruiyot, X.-T. Bui, H. H. Ngo*, Composting and its application in bioremediation of organic contaminants, Bioengineered. **13** (2022) 1073–1089, doi: https://doi.org/10.1080/21655979.2021.2017624.

16. *M. Gondek, D. C. Weindorf, C. Thiel, G. Kleinheinz*, Soluble Salts in Compost and Their Effects on Soil and Plants: A Review, Compost Sci. Util. **28** (2020) 59–75, doi: https://doi.org/10.1080/1065657X.2020.1772906.

17. *H. Yesil, A. E. Tugtas, A. Bayrakdar, B. Calli*, Anaerobic fermentation of organic solid wastes: volatile fatty acid production and separation, Water Sci. Technol. **69** (2014) 2132–2138, doi: https://doi.org/10.2166/wst.2014.132.

18. *W. Zhang, T. Kong, W. Xing, R. Li, T. Yang, N. Yao, D. Lv*, Links between carbon/nitrogen ratio, synergy and microbial characteristics of long-term semi-continuous anaerobic co-digestion of food waste, cattle manure and corn straw, Bioresour. Technol. **343** (2022) 126094, doi: https://doi.org/10.1016/j.biortech.2021.126094.

19. *B. Yahuaca-Juárez, H. E. Martínez-Flores, J. A. Huerta-Ruelas, R. C. Pless, P. A. Vázquez-Landaverde, R. Tello Santillán*, Oil Oxidation in Corn Flour from Grains Processed with Alkaline Cooking by Use of Peroxide Value, UV and FTIR, Plant Foods Hum. Nutr. **68** (2013) 65–71, doi: https://doi.org/10.1007/s11130-012-0332-y.

20. *V. Barra, E. Piacenza, S. Amata, S. Martino, F. Vitale, D. F. Chillura Martino, S. Buscemi, C. Rizzo, A. Palumbo Piccionello*, Easily synthesized soybean oil bio-based material for wastewater treatment, Sustain. Mater. Technol. **43** (2025) e01216, doi: https://doi.org/10.1016/j.susmat.2024.e01216.

21. *E. Smidt, J. Tintner, K. Böhm, E. Binner*, Transformation of Biogenic Waste Materials through Anaerobic digestion and Subsequent Composting of the Residues – A Case Study, in: A.S. Ferrer (Ed.), Compost III. Dyn. Soil, Dyn. Plant 5 (Special Issue 2), Global Science Books, 2011, pp. 63–69.

22. *L. Metcalf, H. P. Eddy*, Wastewater Engineering–Treatment and Reuse, 4th Ed., McGraw-Hill, New York, 2003.

SAŽETAK

Ispitivanje učinkovitosti C-EcoForHome kompostera za obradu biootpada u zatvorenim prostorima odgojno-obrazovnih ustanova

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Obrada biootpada u zatvorenom prostoru (engl. *indoor biowaste treatment)* uporabom malih kompostera pokazuje se učinkovitom metodom za obradu organskog otpada i povrat resursa. U ovom je radu ispitana učinkovitost ručno izrađenog C-EcoForHome kompostera, obogaćenog inokulantom, u obradi biootpada nastalog u pet odgojno-obrazovnih ustanova u Splitu. Tijekom obrade biootpada praćeni su ključni parametri, uključujući temperaturu, visinu kompostne hrpe, maseni udio vlage, suhe i hlapljive tvari, sadržaj ugljika i dušika, pH vrijednost te električnu vodljivost. Prikupljenoj procjednoj vodi analiziran je volumen, pH vrijednost, električna vodljivost i mutnoća. Prekomposti su potom dozrijevali u dvjema vrstama tla, pri čemu su isti fizikalno-kemijski parametri ponovno ispitani radi praćenja dodatne stabilizacije. FTIR spektroskopijom provedena je analiza promjene sastava biootpada zbog utjecaja kompostiranja te analiza nastalih procjednih voda u kojima dominira voda. Rezultati su pokazali da C-EcoForHome komposter učinkovito obrađuje biootpad u odgojno-obrazovnim ustanovama proizvodeći stabilne prekomposte s minimalnim varijacijama u odnosu na početni sastav biootpada. Anaerobna fermentacija dovela je do acidifikacije, otpuštanja iona i djelomične stabilizacije organske tvari, dok je dozrijevanje u tlu dodatno pridonijelo sušenju i konsolidaciji materijala. "Indoor" obrada biootpada u malom mjerilu omogućuje održivo, ekonomski prihvatljivo rješenje za upravljanje biootpadom proizvodeći hranjivi prekompost prikladan za poboljšanje tla.

Ključne riječi
Prekompost, anaerobna fermentacija, procjedna voda, fizikalno-kemijska karakterizacija, FTIR analiza