

4. Conclusions

The meso-thermophilic aerobic anaerobic treatment of organic wastewater sludge provides a sustainable, low energy, and cost-effective solution for municipal wastewater management. The method ensures efficient dehydration, odor control, and nutrient recovery while eliminating the need for chemical additives. The resulting stabilized sludge meets safety standards for agricultural reuse, offering an environmentally responsible option consistent with circular economy principles. Further research will focus on scaling up the technology and optimizing operational parameters under real-world conditions.

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OPTIMISATION OF A MICROWAVE PRETREATMENT OF ORANGE WASTES FOR IMPROVING BIODEGRADABILITY

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Among the various organic wastes generated by food industry, the residues from orange juice production constitute a significant technological and environmental problem. During the juice processing, more than half of fruit becomes a waste, which consists of seeds, fibres and peels. Due to significant organic content and high humidity, their properties deteriorate quickly; moreover, they contain essential oils that might hinder biological processes. Another problematic factor is the presence of lignocellulose that constitutes a complex structure which makes their further use difficult. On the other hand, orange wastes indicate a potential for energy production in the anaerobic digestion process. Therefore, this type of waste should be pre-treated to improve biomass structure, making it more susceptible to bioconversion. The pre-treatment strategy should reduce biomass crystallinity, eliminate lignin, prevent sugar degradation, and should not contribute to the formation of inhibitors. Additionally, the energy aspect should be considered.

Currently, among various physical methods microwave irradiation gains more attention. Numerous studies has confirmed the effectiveness in breaking the complex lignocellulose structure, thus improving biomass availability for microbial action in biological processes. This technique presents several advantages, such as high specificity for selective heating and rapid processing. As compared to other pre-treatment methods, microwave irradiation generates fewer inhibitors of biological processes and indicates significant flexibility due to the ease of combining with other methods. However, there are still few installations operating on a technical scale. This is mainly due to the large investment costs.

The work presents optimisation studies pertaining to the microwave pre-treatment of orange wastes for improving biodegradability. Microwave pre-treatment was conducted using an Advanced Microwave Digestion System provided by ETHOS EASY equipped with two 950 W magnetrons for a total of 1900 W. The adopted operational parameters were as follows: temperature of $T = 50^{\circ}\text{C}$, input power of $P = 900\text{ W}$. The following time intervals were evaluated: 0, 3, 5, 10, 20 and 30 min, which corresponded to the following energy use of 37.7, 62.8, 125.6, 251.2, and 376.7 MJ/kg, respectively.

The obtained results indicated that use of microwave pre-treatment led to destruction of organic matter expressed as COD (chemical oxygen demand), TS (total solids) and TOC (total organic carbon). With regard to COD, this parameter was reduced by 10-15%, TS by 8-12%. In the case of TOC, a minor effect was observed. Simultaneously, solubilisation was noted, the increases of sCOD (soluble chemical oxygen demand) and DOC were observed. The sCOD parameter was enhanced by 14-33%, whereas DOC by 8-18%. Additionally, the biodegradability index expressed as the DOC/TOC ratio was also improved by 8 – 17%, as a result of microwave pre-treatment. Among all the cases considered, the most favourable effect was recorded for a time of 5 minutes. Therein, the highest improvement in biodegradability was achieved with the lowest energy consumption.

POLLUTION OF STORMWATER FROM URBAN AREAS: RESEARCH, MONITORING, AND NEW MEASUREMENT METHODS

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Water is a key element of life on Earth. As a good solvent, it provides organisms with essential nutrients and minerals. Although 2.5% of the Earth's water resources consist of freshwater, only about 1% is suitable for consumption. Therefore, the rational management of water resources is of great importance—particularly in urban environments, where limited resources or uneven temporal distribution make a well-organized water and wastewater management system essential. The water and sewage system is one of the pillars of environmental management in cities. It includes, among others, water supply and sewage networks, wastewater treatment plants, water treatment stations, retention tanks, and installations for the drainage and retention of stormwater.

These components directly affect the condition of aquatic environments, and their improper functioning—such as failures or leaks—can lead to contamination of available water resources. Stormwater drainage systems form an important part of urban infrastructure, responsible for removing rainwater and meltwater. Their main task is to ensure the safe and rapid removal of water from the surfaces of urban catchments, thus preventing local flooding and urban inundation. These waters flow from roofs, roads, squares, sidewalks, parking lots, and industrial areas, carrying