Fermentation of municipal solid wastes

Izabela Konkol, Lesław Świerczek

30.06.2022

WASTEMAN ***Integrated Sustainable Waste Management Systems decreasing pollution discharges in the South Baltic area.***

A few words at the beginning..

According do UE directives biodegradable fraction of municipal solid wastes (MSW) had to be reduced!

Source separated organic fraction

provides a good quality substrate for biological proces like composting and anaerobic digestion.

Methane fermentation is an attractive treatment startegy for generating energy and mitigating the problem of disposal.

As a result of mentioned procesess it is possible to ensure the circulation of N and P or their recovery!

Circular economy is the basis!

Management of selected fractions of MSW

Our research was carried out on the possibility of managing selected fraction of organic waste

generated by Waste Management Plant through

methane fermentation.

During the research, physicochemical methods of substrate processing were also used in order to intensify the production of biogas and methane.

Methane fermentation

Model substrate

Fish
Potatoes
Bananas
Tomatoes
Lettuce
Juice
Buns
Flowers and papers

54 % TS

90 % VSS

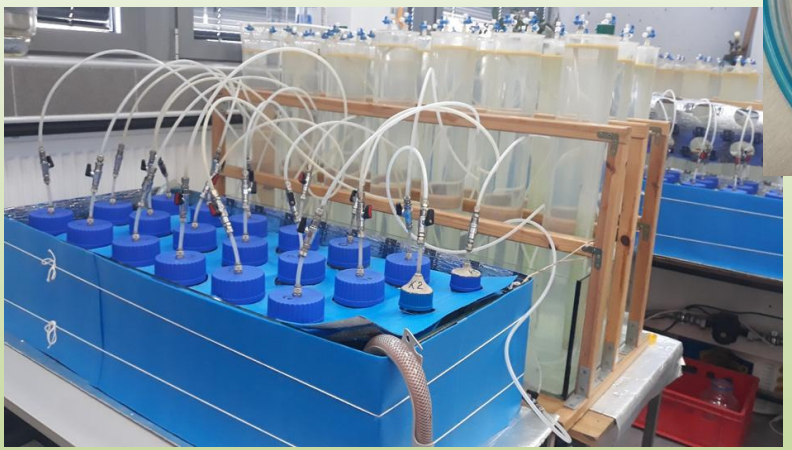
Apple
Lemon
Bread
Butter
Cream
Milk
White cheese
Yogurt
Eggs
Meat with bones
Sousages, cold cuts

Methane fermentation

The model substrate was subjected to fermentation tests after:

- acidic pretreatment, pH=4, 24h
- thermo-acidic pretreatment, pH=4, 100℃, 1h
- untreated.

Fermentation system



Thermal reactor

Methane fermentation of selected streams

The following mixtures of substrates were prepared for the fermentation studies:

- Mixture of leachate from landfill 1: 1 (by mass),
- Leachate from the composting plant,
- Source separated kitchen waste,
- Source separated kitchen waste + 1: 1 composting effluent (bulk),
- Source separated kitchen waste + composting plant leachate + landfill leachate 1: 1: 1.

Methane fermentation of selected streams

Source separated KW
Model KW
Source separated KW + leachate

Inhibition in case landiff leachate!

Substrate	Biogas yield [m3/t VSS]	Methane yield [m^3/t VSS]	Methane content [%]
Landfill leachate	< control	< control	-
Composting hall leachate	660.78	403.33	61.0
Source separated kitchen wastes	681.07	344.63	50.6
MODEL Source separated kitchen wastes	861.79	524.30	60.0
Source separated kitchen wastes + composting hall leachate	684.64	369.01	53.9
Source separated kitchen wastes + composting hall leachate + landfill leachate	641.30	324.66	50.7

Effective microorganisms effect

The agent contains naturally occurring microorganisms in the environment (lactic acid bacteria, yeast, phototrophic bacteria) in various proportions, which show a synergistic effect.

No differrence for wheat straw

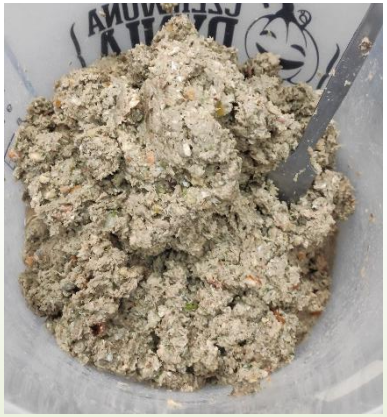
Acidic and fruity smell in case of EM

EM effect – real scale tests

On site experiments:

- Container tests – green waste and organic fraction of MSW (20-80 mm)
- compost pile tests

Preparation of fertilizer for glasshouse experiments

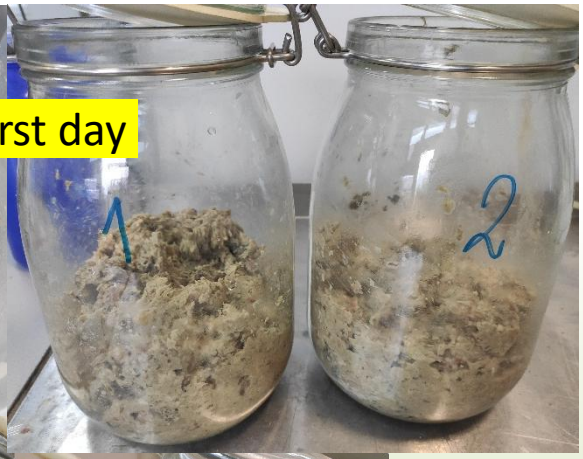


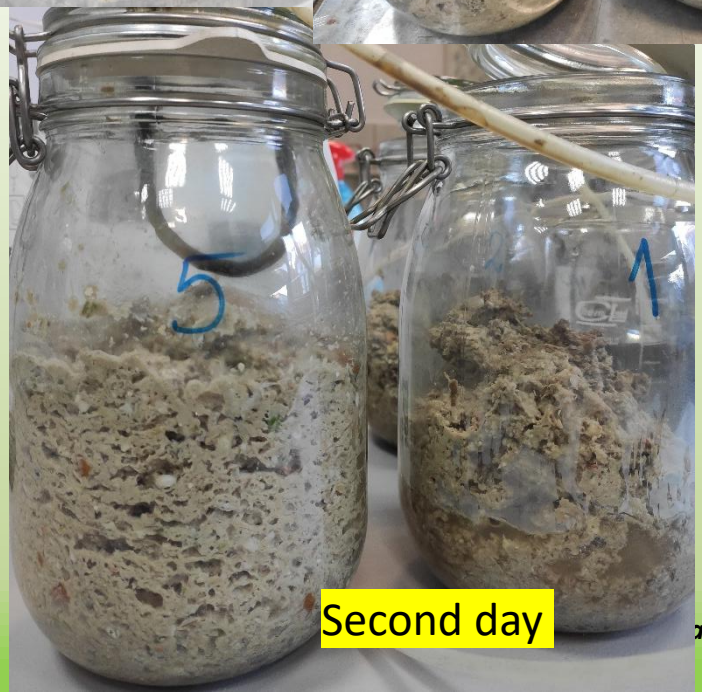
Fertilizers:

- Model waste treated + 1 dose of EM,
- Model waste, decayed (after 12 days), + 2 doses of EM,
- Model wastes, (decayed, after 12 days), sterylization (1h, 70℃) + 1 dose of EM
- Model wastes, decayed after 12 days, sterylization (1h, 70℃)
- Model wastes, decayed after 12 days, sterylization (1h, 70℃), fermentation 21 days

Preparation of fertilizer for glasshouse experiments

First day





Second day

Fourth day

Twelfth day

Kartuzy Waste Water Treatment Plant

As a result of the lakes cleaning in the Kartuzy county, the sediment extracted from the bottom of the lake is transported to the wastewater treatment plant.

This sediment, from some parts of the lake, has the status of a hazardous waste because it contains phenol compounds and polycyclic aromatic hydrocarbons (PAH's).

Since it is a hazardous waste, it must be sent to an incinerator plant.

Kartuzy Waste Water Treatment Plant

The experiment was carried out in the barrel.
The sediment, with water and effective microbes was areated.

After 4 weeks of experiment, 6 from 7 PAH's were reduced by 80-95% - 3 of them were below acceptable level!

After 6 weeks all PAH's were reduced below 1 mg/kg TS.

Thank you for your attention.