



Cosubstrate strategy for enhancing biomass degradation during low- thermal pre-treatment

H. Byliński, A.Kasinath, M. Szopińska, A. Remiszewska – Skwarek,
A. Łuczkiwicz, S. Fudala – Książek



AGRICULTURAL WASTE

Agricultural waste (AW) - unwanted or unsalable materials produced from many agricultural operations directly related to the growing of crops or raising of animals.



AGRICULTURAL WASTE

Agricultural waste (AW) - unwanted or unsalable materials produced from many agricultural operations directly related to the growing of crops or raising of animals.

The main component of AW:

- **animal waste,**
- **food processing waste,**
- **crop waste,**
- **hazardous agricultural waste such as insecticides, pesticides and herbicides.**



AGRICULTURAL WASTE TREATING

substrate pre-treatment of AW
before anaerobic digestion

mechanical



chemical



ultrasound



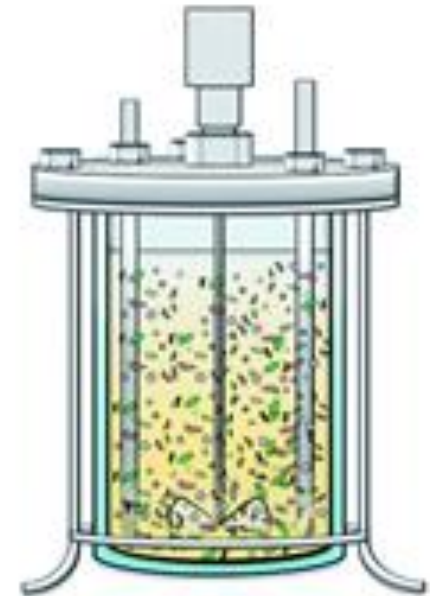
thermal





THERMAL PRE-TREATMENT

- **low-thermal pre-treatment (<100°C, usually from 40 to 90°C)**
- **aerobic condition (in order to avoid biogas production)**
- **mixing of substrate (in order to distribution oxygen and heating energy)**





AIM OF THE WORK

**The aim of the work was investigation of LT-PT
of various types of agricultural waste for
enhancing biomass degradation.**





LOW-THERMAL PRE-PRE-TREATMENT (LT-PT)

SUBSTRATES USED IN THIS STUDY:

- cow dung + corn (70/30)
- distillery with beet pellet (80/20)



LOW-THERMAL PRE-TREATMENT (LT-PT)

SUBSTRATES USED IN THIS STUDY:

- cow dung + corn (70/30)
- distillery with beet pellet (80/20)

**low thermal pre-treatment reactors –
laboratory scale**





LOW-THERMAL PRE-PRE-TREATMENT (LT-PT)

Experimental condition:

- ❖ temperature: 45°C /50°C /55°C/60°C
- ❖ duration time: 0h/24h/48h
- ❖ mixing frequency: 30Hz
- ❖ O₂ concentration: >0,2 mg/L

**low thermal pre-treatment reactors –
laboratory scale**





Agricultural waste sample analysis



Centrifugation

(50,00g/10 000
RPM/ 30 min)



Filtration

(0.45 um pore size
membrane filters)



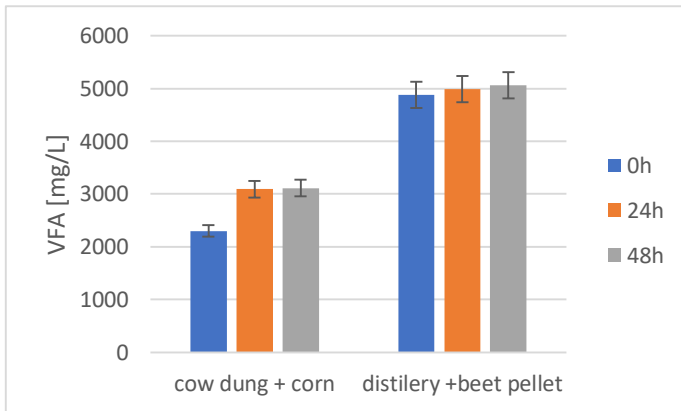
Cuvette test analysis

(Spectrophotometer
DR3900 Hach
Poland)

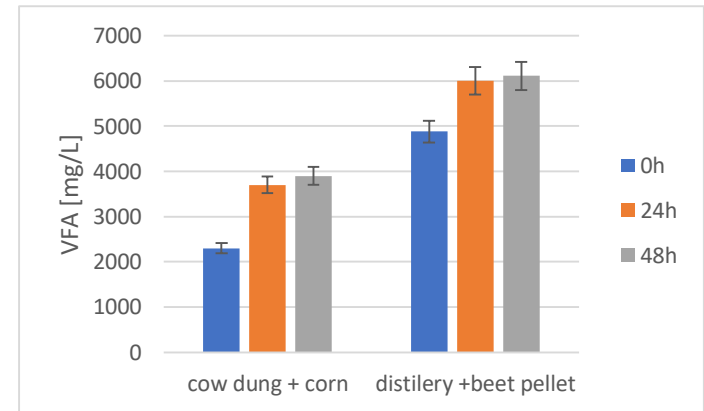


VFAs concentrations

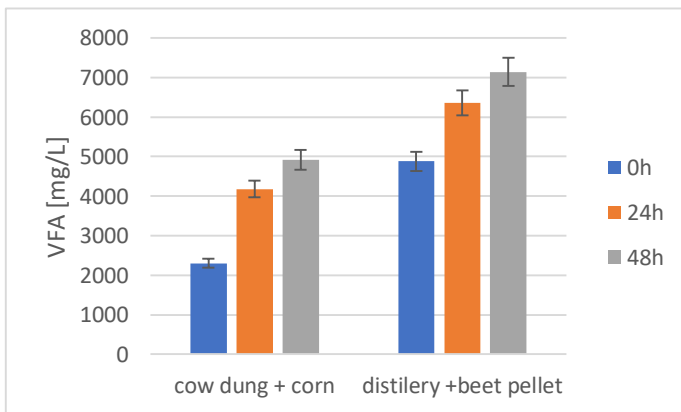
45°C



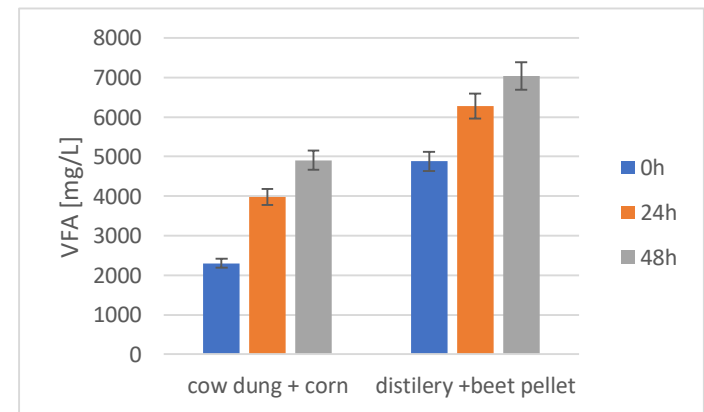
50°C



55°C



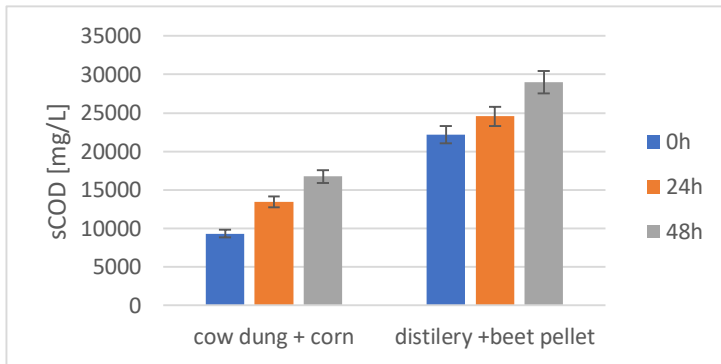
60°C



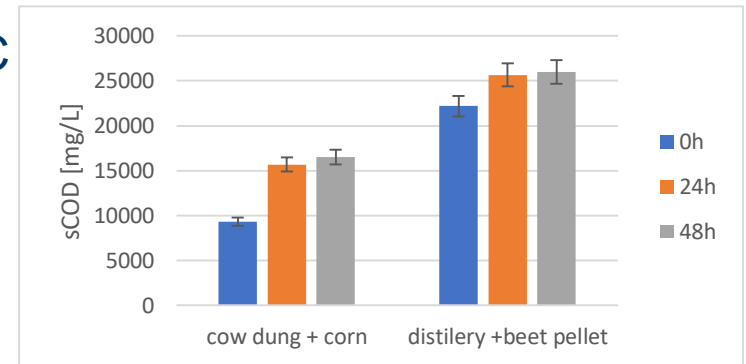


sCOD concentrations

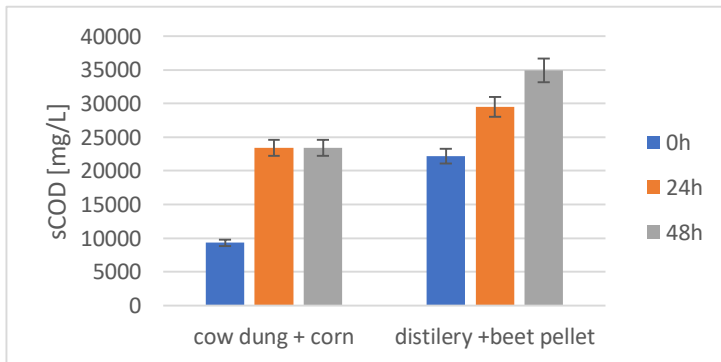
45°C



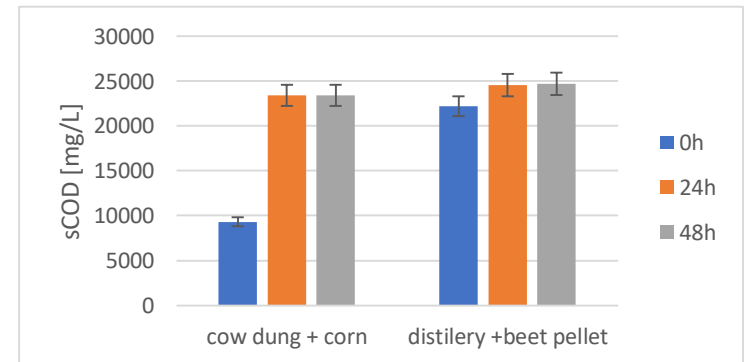
50°C



55°C



60°C





Disintegration degree (DD)

$$DD = \frac{sCOD_{treated} - sCOD_0}{TCOD - sCOD_0} \times 100\%$$

DD – disintegration degree [%]

$sCOD_{treated}$ – value of sCOD in AW samples after LT-PT [mg/L]

$sCOD_0$ – value of sCOD in AW prior to LT-PT [mg/L]

TCOD – total COD value obtained from chemical disintegration [mg/L]



Disintegration degree (DD)

cow dung + corn

	45°C	50°C	55°C	60°C
24h	19,1%	18,4%	49,2%	49,9%
48h	29,1%	31,2%	51,7%	52,0%



highest DD values
for 55°C and 60°C
both after 24h and
48h

distillery + beet pellet

	45°C	50°C	55°C	60°C
24h	10,7%	14,5%	28,5%	11,5%
48h	25,0%	17,9%	46,4%	13,2%



highest DD value
for 55°C after 48h



LT-PT is a promising method used for agricultural wastes for enhancing biomass degradation

optimal condition of LT-PT of AW: temperature 55°C, duration time 48h)

presented technology will be adopted to technological scale

future research – testing other substrates using presented technology LT-PT

future research – testing LT-PT combined with enzymatic hydrolysis



ACKNOWLEDGEMENTS



The National Centre
for Research and Development

This study was supported by the DEZMETAN project entitled 'Development of technology for substrate preparation used in methane co-fermentation using disintegration methods', funded by the European Regional Development Fund, 4.1 'Research and development', 4.1.2 'Regional Science and Research Agendas' of the Intelligent Development Operational Program 2014–2020, POIR.04.01.02-00-0022/17–00





GDAŃSK UNIVERSITY
OF TECHNOLOGY

INVITATION

11th IWA International Symposium on Waste Management Problems in Agro-Industry

26-28 OCTOBER 2022
GDAŃSK, POLAND



CALL FOR ABSTRACTS

www.iwa-agro2022.org



GDAŃSK UNIVERSITY OF TECHNOLOGY



HISTORY IS WISDOM
FUTURE IS CHALLENGE



THANK YOU FOR YOUR ATTENTION

9th International Conference on Sustainable Solid Waste Management Corfu, Greece, 15 - 18 JUNE