solutions treatments opportunities

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ANAEROBIC DIGESTION SLUDGE COMPOSTING
Assessment of the Star-up process

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LEAF LINKING LANDSCAPE, ENVIRONMENT, AGRICULTURE AND FOOD

Instituto Politécnico de Viseu

CENTRO DE ESTUDOS EM EDUCAÇÃO, TECNOLOGIAS E SAÚDE Unidade de I&D do Instituto Politécnico de Viseu

INTRODUCTION

PERSU 2020

Goal

Reduction up to 35% of Biodegradable Municipal Waste deposition in landfill

(regarding the production of 1995)

Measures to be implemented

- Divert organic wastes from municipal landfills;
- Divert the recyclable wastes from municipal landfills;
- Decrease of wastes deposition on landfill;
- Progressive eradication of industrial non-hazardous waste deposition in Municipal Waste landfills.

INTRODUCTION

European waste management policy

Organic wastes valorisation goal of 65% until 2020

Mechanical Biological Treatment (MBT) for recycling the MSW organic fraction

Source: http://advaitaa.in/green_energy/mbt_plant.html

Source: https://www.biocycle.net/2008/10/22/mechanical-biological-treatment-trends/

Biodegradable organic fraction valorisation

Anaerobic digestion → Composting process of the digested sludge

INTRODUCTION

Composting

Mineralised Materials
(CO_2, H_2O, NH_4^+)

Stabilised Organic Matter
(mostly humic substances)

Compost

- Soil remediation
- Wastewater treatment
- Enhance plant growth
- Positive effect on physical, chemical and biological properties of soils
- Calorific value to be used as fuel

INTRODUCTION

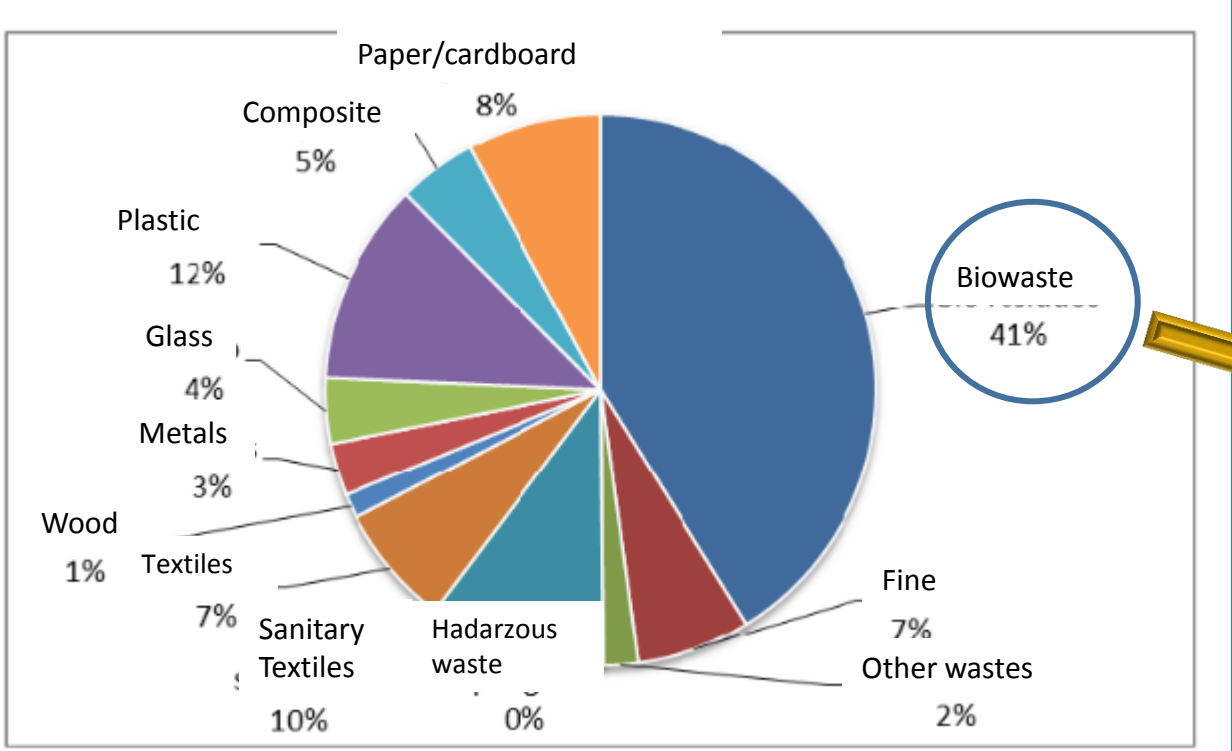
PURPOSE

- Follow the star-up of the composting process of a municipal MBT unit.
- Evaluate the agronomic value and the energetic potential of the final compost

METHODOLOGY

Study Case

Municipal Solid Waste (MSW)

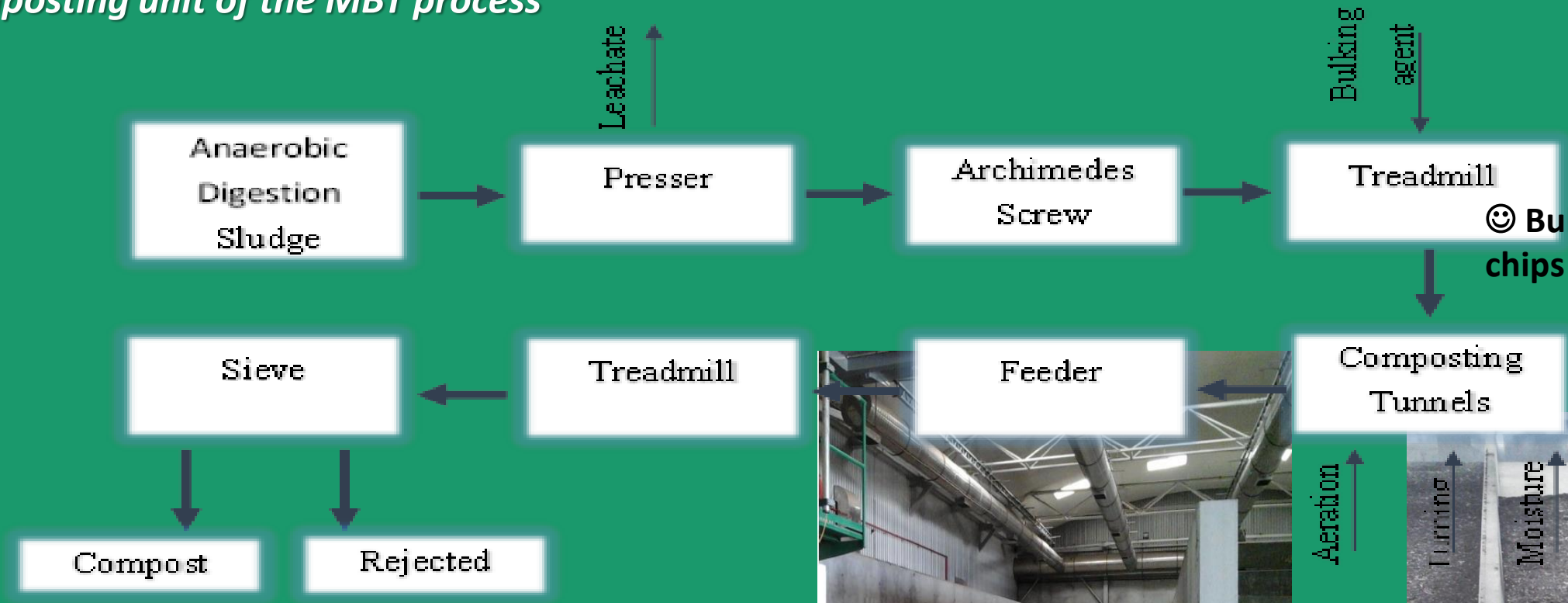


130000 ton/year

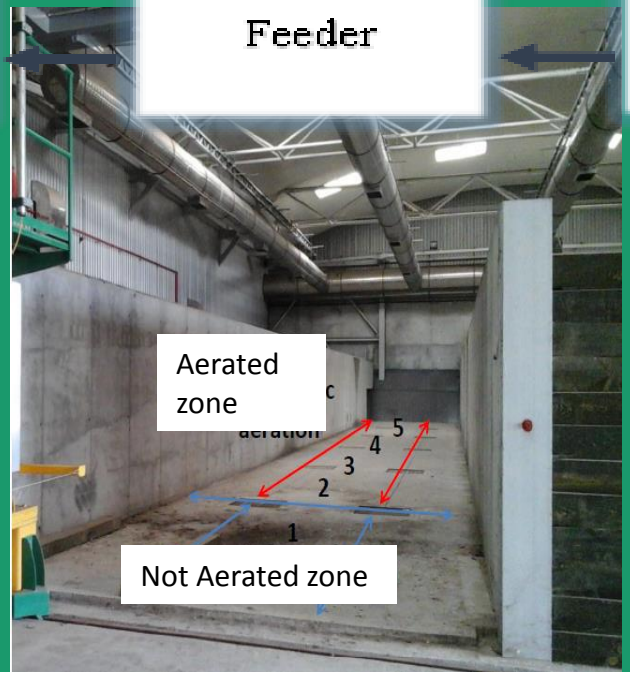
MBT process

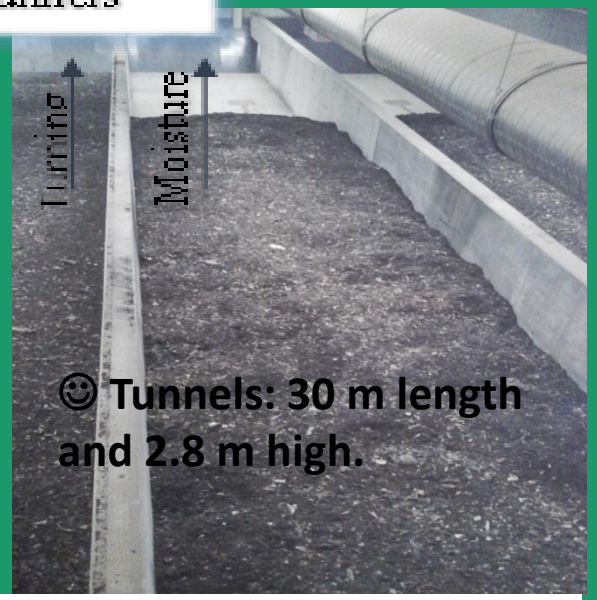
METHODOLOGY

Composting unit of the MBT process



☺ Bulking agent- wood chips (60:40)





☺ Tunnels: 30 m length and 2.8 m high.

☺ Mechanically turned at regular intervals

☺ Aeration => mechanical device located at the bottom of the tunnels.

The air flow ranged between 30% and 100%☺

METHODOLOGY

Composting Process

Process Characterization

10 weeks:

T1 - beginning of the composting process

T10 - end of the process /final compost

→ Daily => Dry Matter
Temperature

Additional process characterization

T1 - T4 - T10

→ EC – Electric Conductivity
OM – Organic Matter
TN – Total Nitrogen
TC – Total Carbon

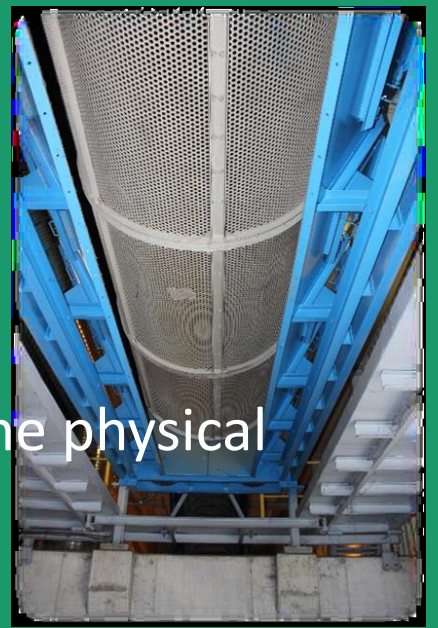
Compost characterization

Sieved

+

separate the bulking agent and some physical contaminants

← GI – Germination Index (Cress seeds)
Stability Class
HHV – Higher Heating Value



RESULTS

Anaerobic Sludge Characterization

Sample	pH	EC	OM	Moisture	TN	TC	C/N
		mS/cm	% dm	%	% dm	%	
Digestion Sludge	7.8±0.1	2.24±0.15	33.4±3.2	38.4±1.6	1.04±0.09	16.7±1.5	16.1

EC – Electric Conductivity; OM – Organic Matter; TN – Total Nitrogen; TC – Total Carbon; dm – dry matter

RESULTS

Organic Waste Valorisation Process

Indicators of composting process state

Time (weeks)	Temperature (°C)						Dry Mater (%)	Aeration (%)
	1	2	3	4	5	Average		
T1	30.3±2.9	30.9±0.8	26.1±2.6	30.4±2.3	33.5±0.9	29.4±0.8	59.3±2.4	100
T2	37.2±1.9	19.6±0.9	17.3±0.9	21.7±0.9	17.4±0.9	25.7±0.1	58.3±1.8	100
T3	51.8±1.3	17.6±1.4	14.9±0.3	24.3±1.6	16.0±0.4	24.9±0.7	63.1±1.7	100
T4	34.1±0.6	16.8±0.8	15.8±0.7	16.5±0.4	14.9±0.3	19.6±0.3	63.0±0.5	WA
T5	52.1±0.8	21.3±1.6	18.7±0.5	20.0±1.7	16.0±0.3	25.6±0.6	64.0±0.3	WA
T6	50.9±2.3	25.6±0.9	20.8±0.9	20.9±1.1	16.9±0.4	27.0±0.2	66.6±1.8	30
T7	50.1±2.3	40.0±1.1	25.3±0.4	30.5±1.2	18.9±0.3	33.0±0.1	66.1±1.3	30
T8	39.1±2.3	31.2±0.9	28.7±0.4	38.7±1.2	24.3±0.3	32.4±0.1	58.4±1.0	30
T9	23.4±1.1	28.9±0.9	29.2±0.4	24.2±1.2	19.9±0.3	25.1±0.1	65.5±0.8	30
T10	18.7±1.3	22.3±2.3	23.1±2.8	20.1±0.4	19.3±0.1	20.8±0.1	65.6±0.2	30

WA – Without aeration

RESULTS

Evolution of Composting Process

Sample	pH	EC	OM	TN	TC	C/N
		mS/cm	% dm	% dm	%	
T1	8.0±0.1	2.5±0.1	30.1±3.5	0.93±0.17	15.0±1.8	16.2
T4	8.0±0.1	2.1±0.1	29.8±0.3	0.90±0.90	16.9±0.7	18.8
T10	8.0±0.0	1.7±0.1	31.7±1.3	1.08±1.36	15.8±0.2	14.6

EC – Electric Conductivity; OM – Organic Matter; TN – Total Nitrogen; TC – Total Carbon; dm – dry matter

RESULTS

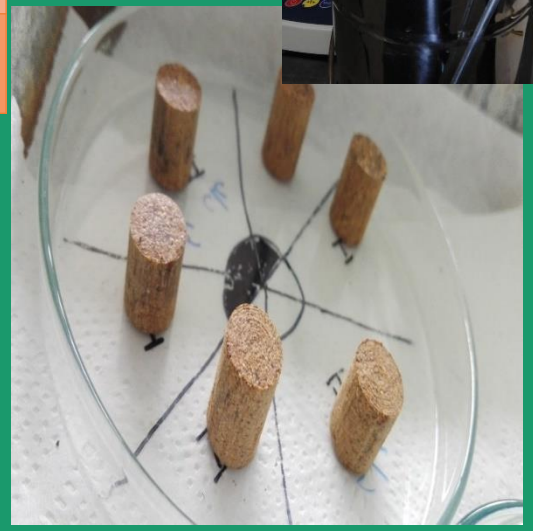
Compost Characterization

Sample	GI	Stability Class	HHV
	%		MJ/kg
T4	ND	ND	5
T10	133±4	V	7

GI –Germination Index; HHV – Higher Heating Value;
ND –not determined

+

35% of inerts (20mm-1mm)



CONCLUSIONS

☼ Biological treatments of the studied MBT unit seem to be effective methods for producing stabilized organic end-products, ensuring their maximum benefit for agriculture.

☼ The properties of final compost indicate that it had standard quality for the parameters analysed.

☼ The process can be further improved through operating conditions optimization, namely, aeration.

GRATA

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"You must be the change you wish to be in the world."
- Mahatma Gandhi