Implications of bio-waste quality in the recycling processes, and the role of compostable items

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Italian Composting and Biogas Association

CIC is a non-profit organization with

151 members:

- **95 Ordinary Members**

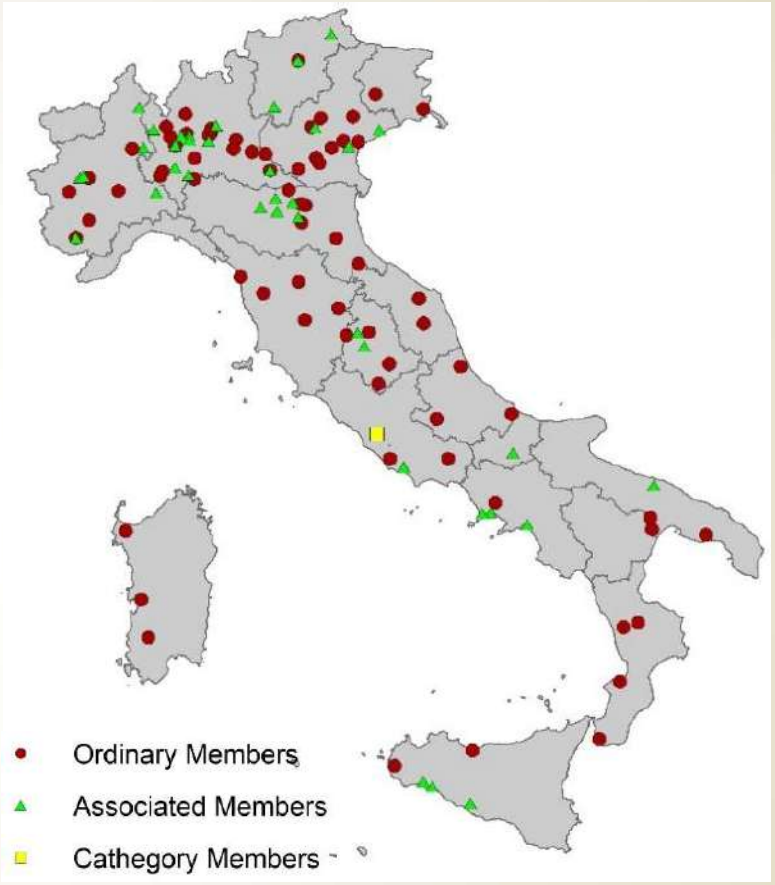
(Operators of AD and/or composting plants)

- **54 Associated Members**

(Consultancies, Enterprises, Labs, Public and research entities etc.)

- **2 General Category Members**

(Associations)

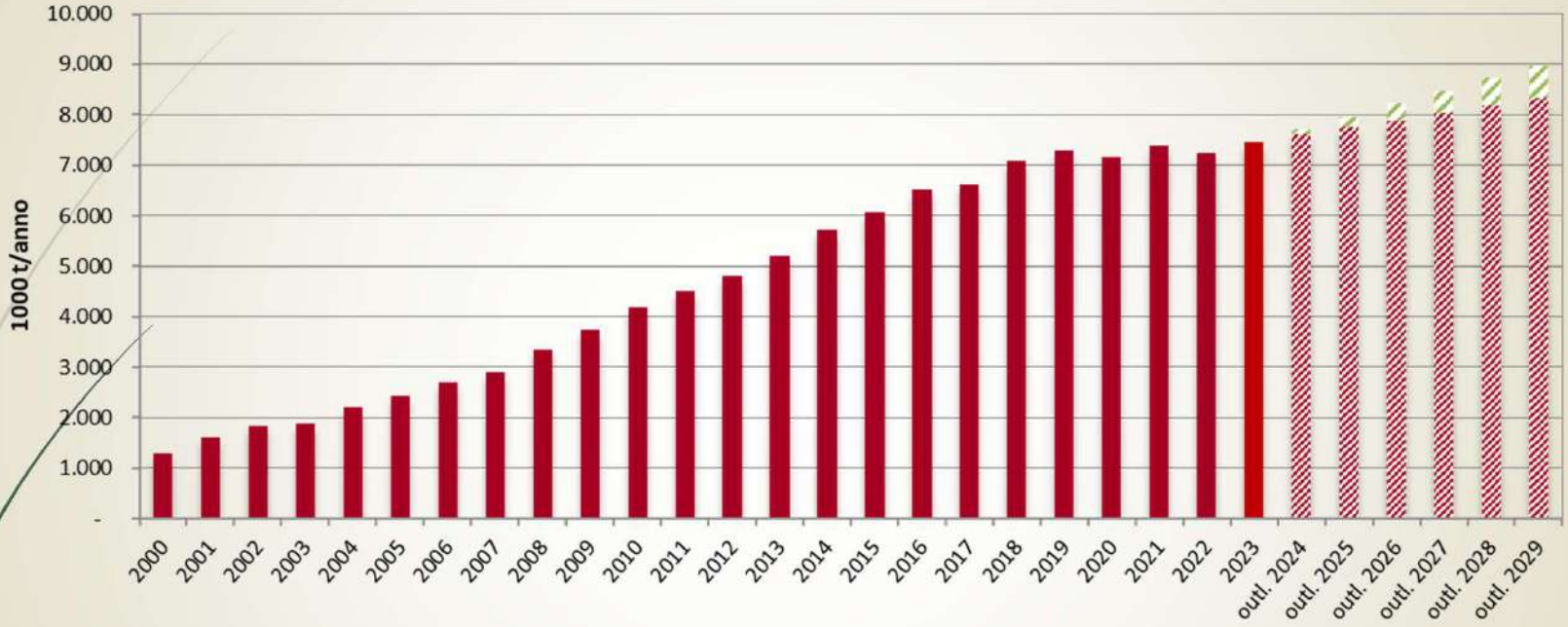


Contents of this webinar

- Bio-waste management in Italy: quick state of the art
- Bio-waste quality
- Separate collection versus recycling: implications of bio-waste quality in bio-waste management
- The role of compostable items in the separate collection and recycling streams

The separate collection of bio-waste in Italy

(elaboration CIC from ISPRA data)



outlook: 8.3 – 9,0 Mt/y (142-153 Kg/inhab/y)

Food and garden waste are collected separately

(year 2023. Source: ISPRA)

5.495.000 t

Food-waste

93,1 Kg/inhab

1.976.000 t

Green (Garden) waste

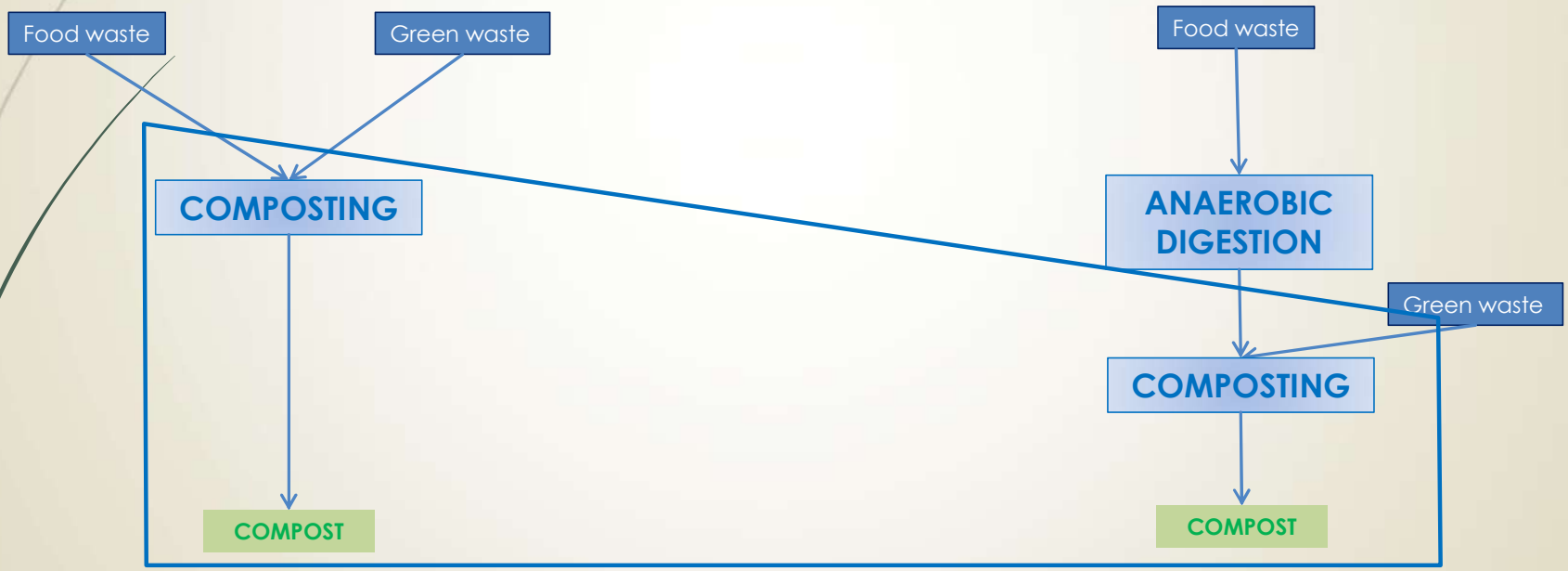
33,5 kg/inhab

7.471.000 t

Bio-waste

126,6 Kg/inh → >38% of MSW sep. coll

Main technological approaches to the recycling step



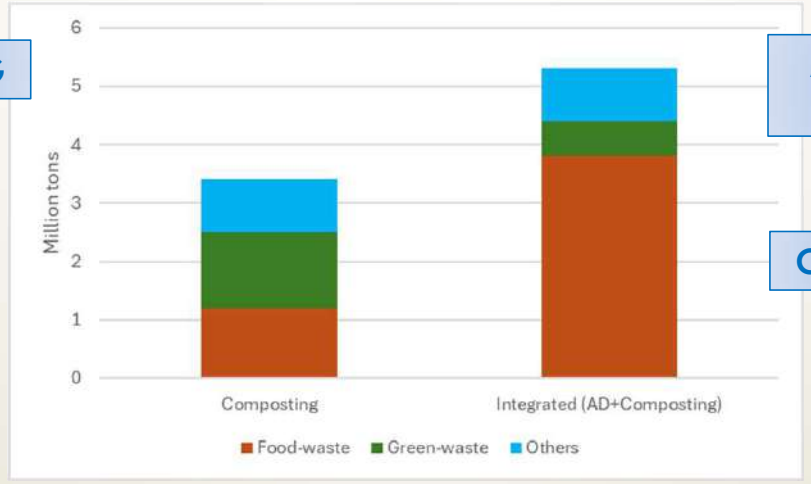
Main technological approaches to the recycling step

Food waste

Green waste

COMPOSTING

COMPOST



Food waste

ANAEROBIC DIGESTION

Green waste

COMPOSTING

COMPOST

Recycling products
(source Ispra, year 2023)

- **12.328.000 t/y**
  Throughput capacity
- **8.746.000 t**
  waste treated in 2023

437 Mln m³
Biogas

- **199 Mln m³ Biomethane**
- **468 GWh e.e.**
- **81 GWh e.t**

Compost must fulfil national quality standards (currently under the D.lgs 75/2010)

Agronomical properties

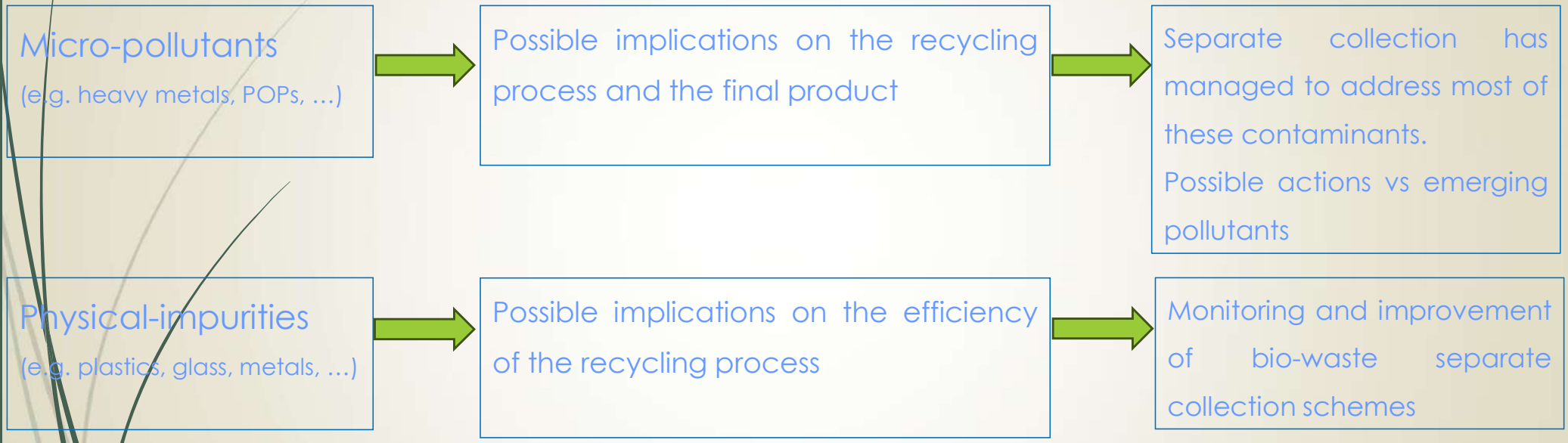
Environmental/health issues

Parametro	GC	BWC	SC
Moisture (%)	≤50	≤50	≤50
pH	6-8,5	6-8,8	6-8,8
C org (% dm)	≥20	≥20	≥20
Humic+Fulvic Acids (% dm)	≥2,5	≥7	≥7
N org (%Ntot (dm))	≥80	≥80	≥80
C/N	≤50	≤25	≤25
Cu (mg/kg dm)	≤230	≤230	≤230
Zn (mg/kg dm)	≤500	≤500	≤500
Pb (mg/kg dm)	≤140	≤140	≤140
Cd (mg/kg dm)	≤1,5	≤1,5	≤1,5
Ni (mg/kg dm)	≤100	≤100	≤100
Hg (mg/kg dm)	≤1,5	≤1,5	≤1,5
CrVI (mg/kg dm)	≤0,5	≤0,5	≤0,5
Tl (mg/kg dm)	≤2*	≤2*	≤2*
Plastics, glass, metals ≥ 2 mm (% dm)	≤0,5	≤0,5	≤0,5
Stones ≥ 5 mm (% dm)	≤5	≤5	≤5
Salmonella spp (MPN/25g)	Absence	Absence	Absence
E.coli (CFU/g)	≤1.000	≤1.000	≤1.000
Germination Index (dil. 30%) (%)	≥ 60	≥ 60	≥ 60
PCB (mg/kg dm)			<0,8**

•if seaweeds are included as one of the feedstocks
** to be established in the sewage sludge

GC = Green Compost
BWC = Bio-waste compost
SC = Sludge Compost

Quality of bio-waste: what does it mean and why do we care?

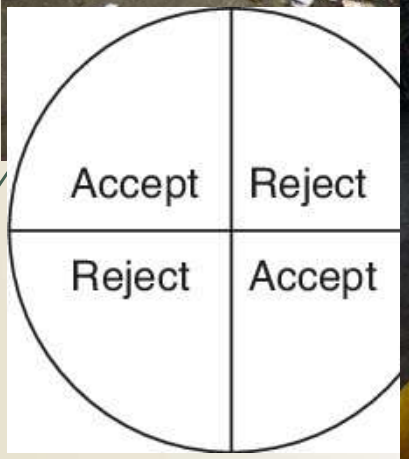


Assessment of bio-waste quality through composition analyses

Flexible plastic

Rigid plastic

Glass, metal, other NCM



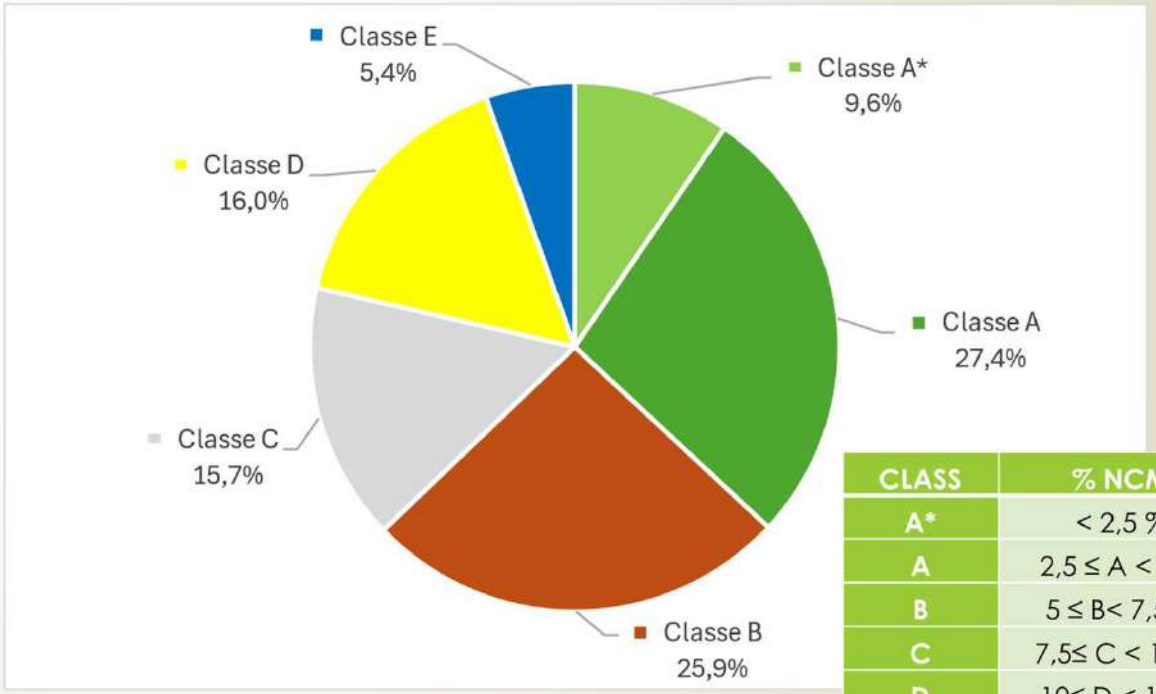
Several tonnes

Average composition and amount of non compostable fraction

based on 1346 samples analysed in 2022 (35% of food-waste treated)

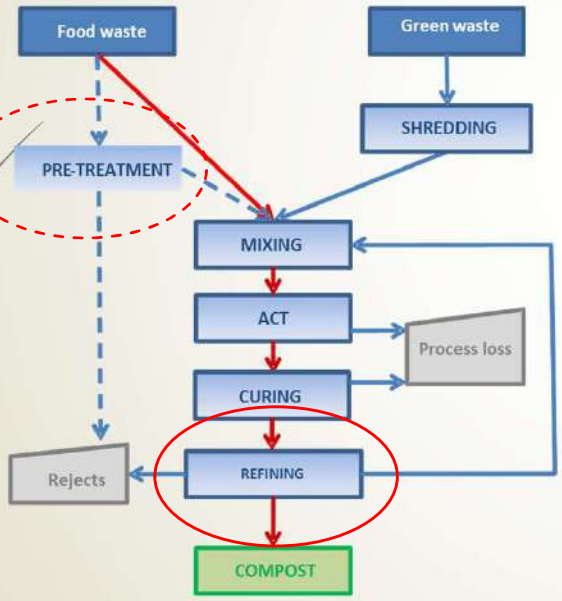
NCM composition: main fractions

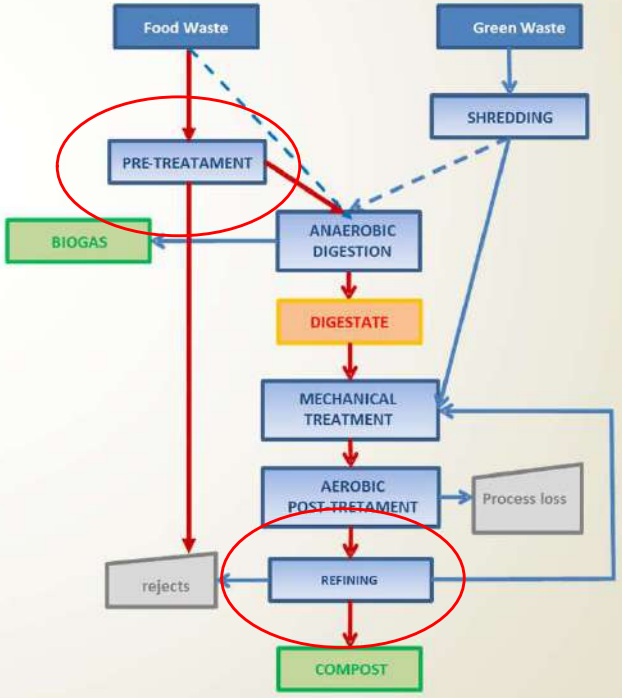
Fraction	% NCM
Plastic bags	21 %
Other plastics	24,3 %
Nappies	10,9 %
Pet litter	9,8 %
Other NCM	34,1 %



CLASS	% NCM
A*	< 2,5 %
A	2,5 ≤ A < 5 %
B	5 ≤ B< 7,5 %
C	7,5≤ C < 10 %
D	10≤ D < 15 %
E	≥ 15 %

Macro-impurities cause the generation of rejects





Pre-treatments

Bags opening - shredding

pulping, pressing, squeezing

Screening

Refining

Screening

Metals removal

Waste quality, a strongly influent parameter for recycling efficiency

Dragging effect	2,75

FOR EXAMPLE

5% NCM IN FOOD-WASTE

=

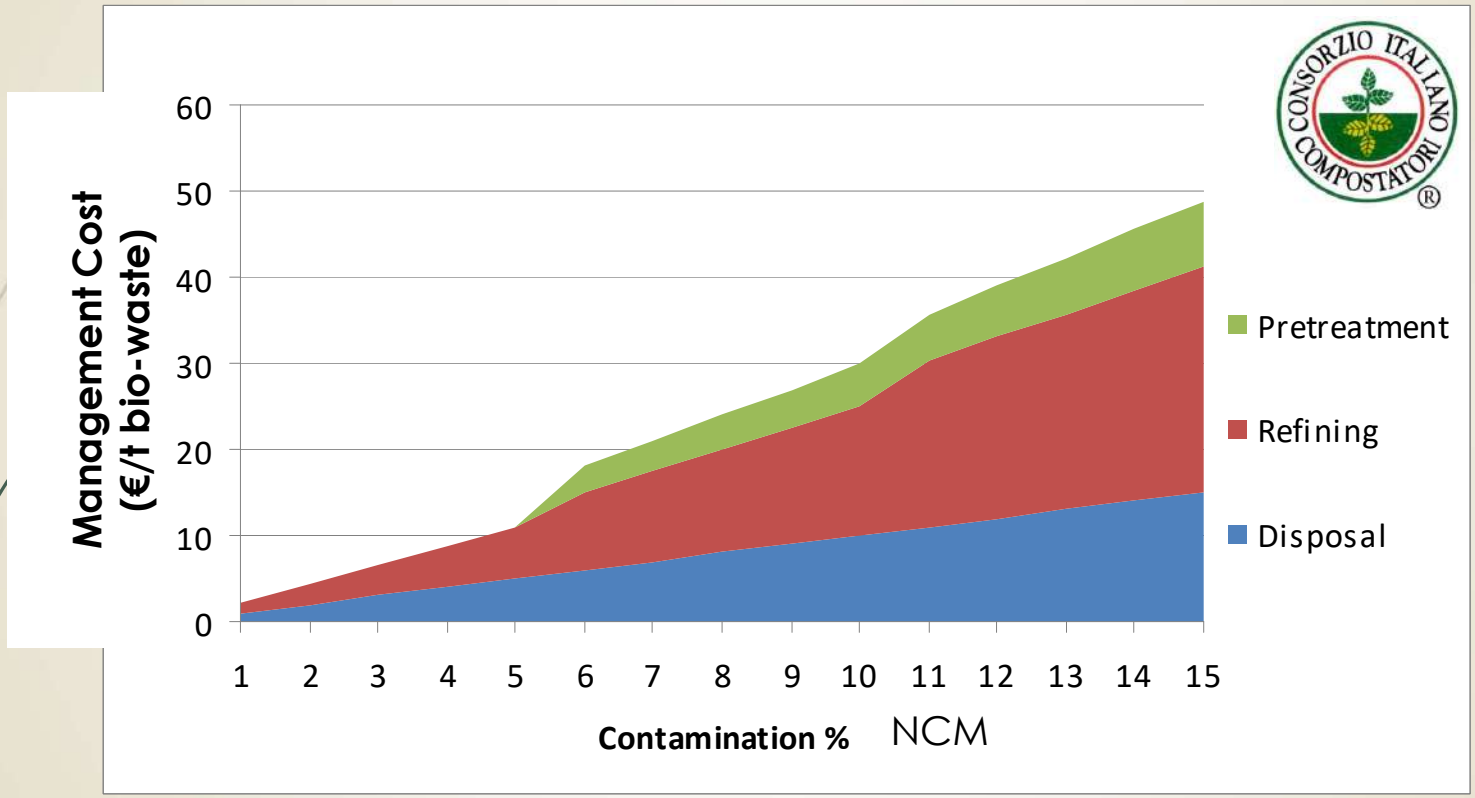
13,5% REJECTS TO DISPOSAL

Macro-impurities and regulatory/environmental implications

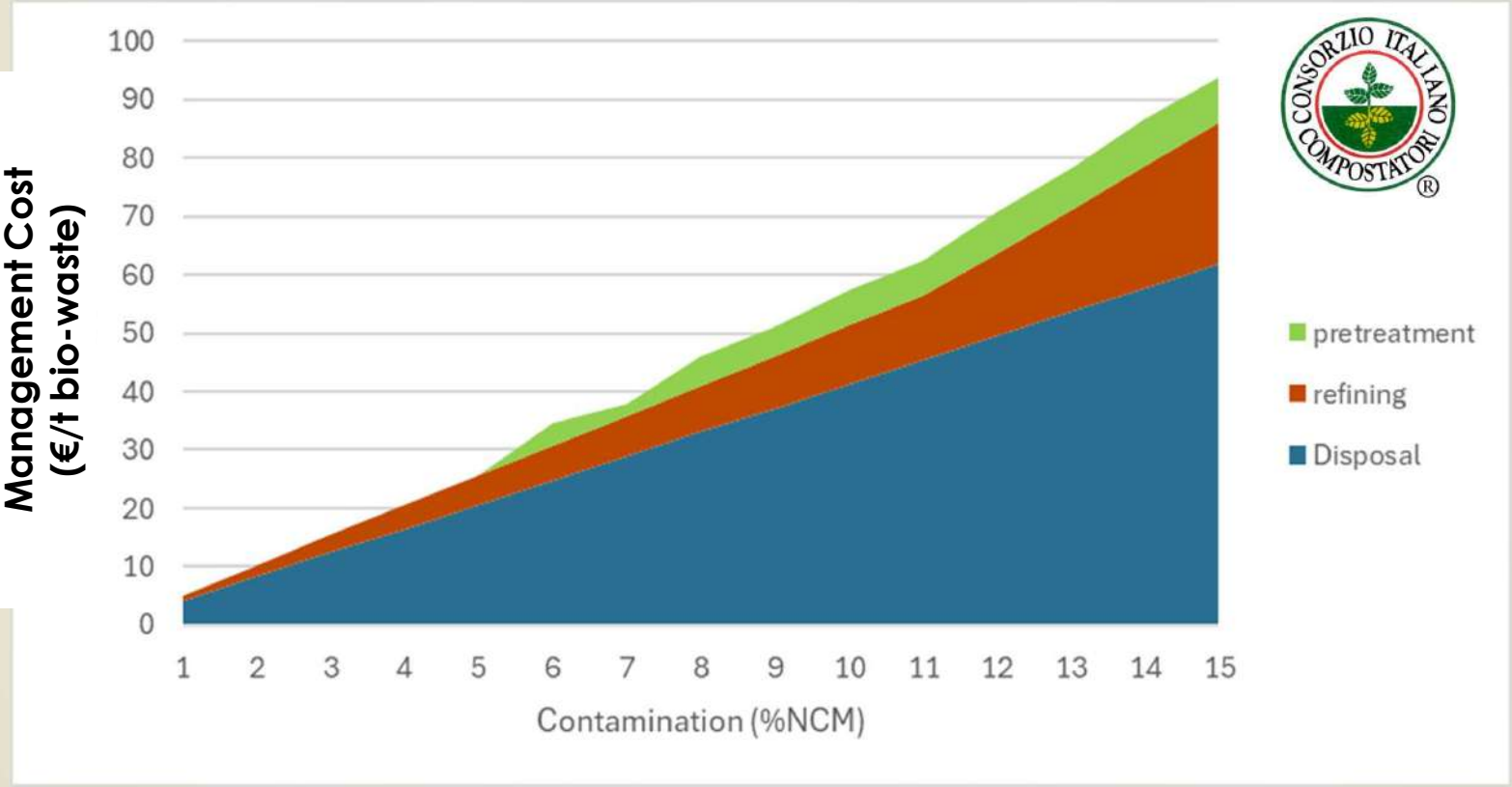
MSW Recycling Targets:

- 55% by the end of 2025
- 60% by the end of 2030
- 65% by the end of 2035

Macro-impurities and economic implications for the recycling process



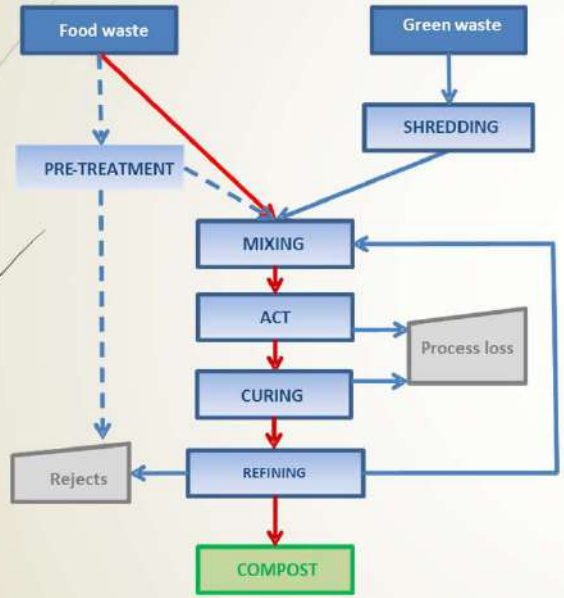
Macro-impurities and economic implications for the recycling process: current disposal costs



Italy and compostable items in a nutshell

- Since 2010, obligation of bio-waste separate collection by means of compostable bags only
- Since 2012, several restrictions and bans of plastic shoppers
- Relative growth of rigid compostable items, based on bioplastics or paper (cutlery, flatware, glasses, coffee pods, etc) in recent years, but flexible bioplastics exceed by far the rigid ones
- Bioplastics in food-waste around 3,2% f.w. (1,4% dm)
- Paper bags are locally prevalent, but at national level represent <0,5% compostable bags

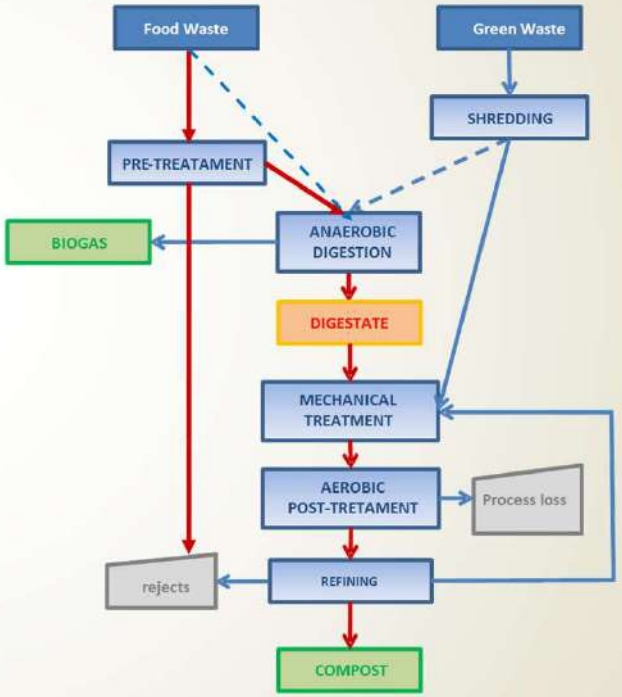
Italy and compostable items in a nutshell (2)



- Compostable bags have helped to reduce the presence of plastics, above all bags, in the separately collected food-waste
- The national bio-waste recycling system based on composting successfully manages compostable materials

Italy and compostable items in a nutshell (3)

- Compostable bags have helped to improve the quality of separately collected food-waste
- The national bio-waste recycling system based on composting successfully manages compostable materials
- AD has gained ground since early 2000s, and now exceed by far composting in the management of food-waste



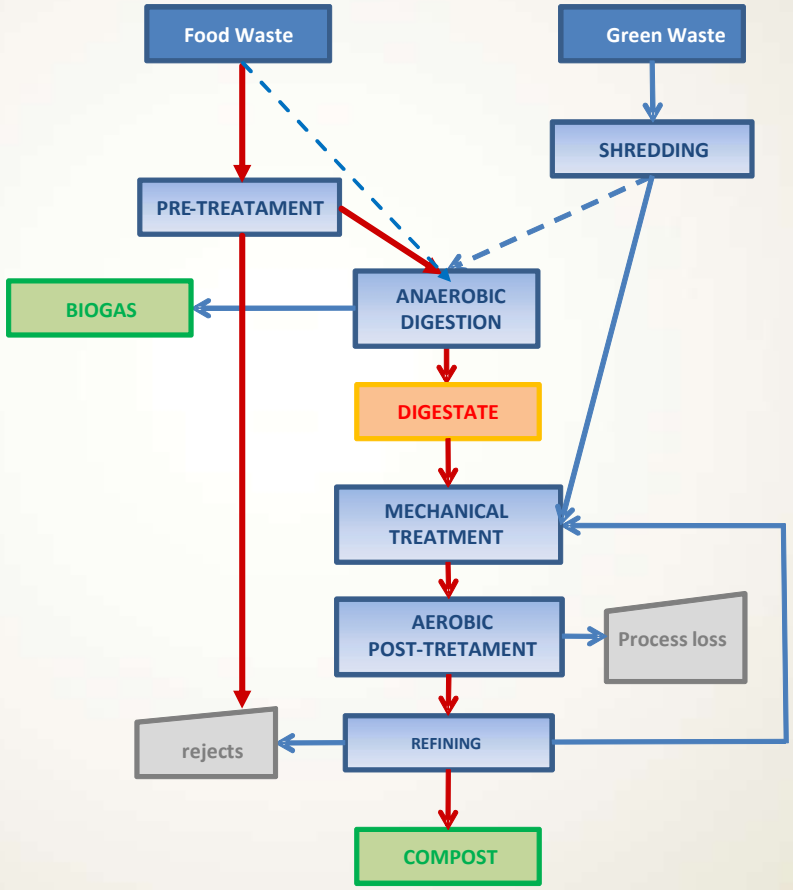
Anaerobic digestion: the growing option for bio-waste recycling

- ✓ Wet – Dry
- ✓ Mesophile – Thermophile
- ✓ Single stage – Multiple stage
- ✓ Continuous - Batch

Scarce degradation of compostable plastics currently on the market…

…but that's not the main point!

Bio-waste anaerobic digestion



Average HRT
25days (15-40)

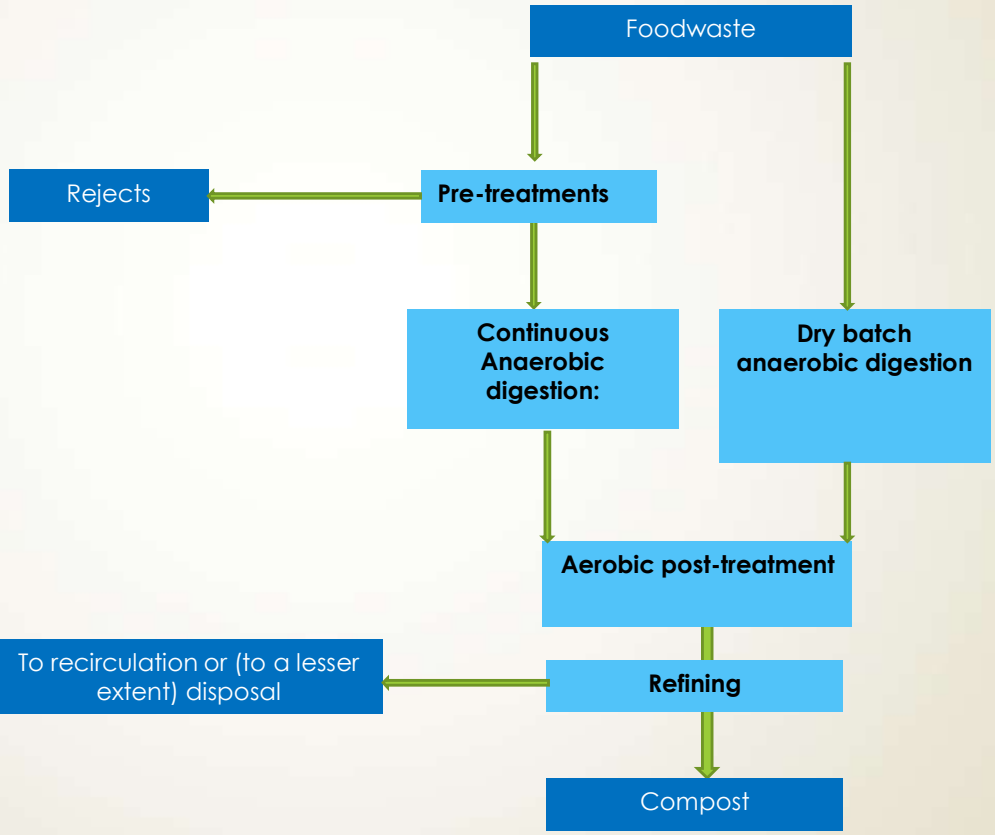
Average duration
55 days (40-70)

Overall average duration
80-90 days

Compostable items that undergo the whole process are likely to be degraded

Dealing with rejects

Rich in compostable items



Can rejects management can be turned into an opportunity?

A

B

C

Biostabilization biodrying thermal drying

sorting

Weight reduction, Lower impact

Non compostable fractionsl

compostable fraction

Food Waste

Green Waste

SHREDDING

PRE-TREATAMENT

BIOGAS

ANAEROBIC DIGESTION

DIGESTATE

MECHANICAL TREATMENT

AEROBIC POST-TRETAMENT

Process loss

rejects

REFINING

COMPOST

Conclusions

The Italian bio-waste management sector (separate collection and recycling) has grown over the last 30 years, covering now >90% of the resident population.

The quality of bio-waste, that focusses in particular on the minimisation of macro-impurities, is crucial both from an environmental, regulatory and an economic point of view (through the reduction of the rejects sent for disposal during the final recycling process).

Conclusions

The Italian bio-waste has delt with compostable items for more than 20 years; compostable bags in particular, replacing conventional plastic ones, have supported the improvement of bio-waste quality.

Composting technologies allow to completely degrade certified compostable items.

For several reasons, the introduction of the AD has changed the role of compostable items.

Thanks to the coupling of composting and AD, those compostable items that are not rejected during the pre-treatment step are completely degraded at the end of the aerobic phase.

Compostable items diverted from the biological process can be further processed in order to reduce the overall amount and impact of rejects, and to increase the recycling efficiency

LIFE BIOBEST

Guiding the mainstreaming of best biowaste recycling practices in Europe

2,5-year project, start date 1/1/23

CALL LIFE 2021-PREP-NATURA NATURE AND BIODIVERSITY

Co-funded by the European Union

LIFE Preparatory Projects - Projects addressing ad hoc Legislative and Policy Priorities (PLP)

LIFE BIOBEST outcomes

- **Set of 4 Guidelines on:**
  - **separate collection**
  - **governance and economic incentives**
  - **quality compost and digestate**
  - **effective communication**
- **Policy brief on regulatory issues**
- **Standards for biowaste entering organic recycling processes**
- **Assessment Matrix of Best Practices**
- Comprehensive EU guidance for effective bio-waste management in Europe
- BIOBEST Decision Support Web Tool

Thank you!