

Monitoring activities on plastics
and compostable bioplastics in
organic recycling plants
Summary report

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Agreement among Assobioplastiche, CIC, CONAI and Corepla

Milan, 9 October 2017





Agreement among Assobioplastiche, CIC, CONAI and Corepla

AGREEMENT OBJECTIVES

- ▶ The aim of the Programme Agreement is to encourage and promote the best environmental management of biodegradable and compostable plastic packaging

DURATION

- ▶ 2 years as from June 10th 2015
- ▶ The agreement was extended to 31.12.2017

ACTIVITIES

- ▶ (...) **supporting the CIC in its monitoring, research and testing activities in the organic recycling sector**, focusing particularly on the quality of the organic waste sent to composting plants, on the opportunities and potential operational criticalities for the various plant engineering solutions already in place and on the solutions arising from the increasing inclusion of biodegradable and compostable plastic packaging;



INITIATIVES - TASKS

1. nationwide communication and dissemination of the concept of biodegradable and compostable plastic packaging;
2. **monitoring of the biodegradable and compostable plastic-packaging chain;**
3. development of studies and projects for the management, recovery and recycling of biodegradable and compostable plastics;
4. organisation of- and participation in- events, seminars and conferences on biodegradable and compostable plastics.

TASK 2

monitoring of the biodegradable and
compostable plastic packaging chain





Task 2: Description of activities

- ▶ Task 2.1 - MONITORING OF ORGANIC RECYCLING PLANTS
- ▶ Task 2.2 - MONITORING RELATING TO THE BEHAVIOUR OF PLASTICS - that are IN COMPLIANCE WITH STANDARD EN 13432 - IN AEROBIC AND ANAEROBIC BIOLOGICAL REACTORS
 - ▶ a) Lab Scale digestion and composting
 - ▶ b) Full Scale digestion and composting
- ▶ Task 2.3 - SUPPORT FOR MONITORING OF Waste Composition Analysis IN 16 PLASTICS SORTING AND RECYCLING PLANTS

TASK 2.1

Monitoring of Organic Recycling Plants



TASK 2.1

Monitoring of Organic Recycling Plants

<http://www.dicheplastica6.it/the-project/>

LET'S FIND OUT ABOUT TWO INNOVATIVE MATERIALS.

DICHEPLASTICA6

PLASTICS AND BIOPLASTICS - TWO RESOURCES WE NEED TO KNOW ABOUT

WHAT IS PLASTIC? WHAT IS BIOPLASTIC?
HERE'S WHAT UNITES THEM AND WHAT SEPARATES THEM.





Task 2.1 - Description

► **STAKEHOLDERS INVOLVED: CIC**

► **OBJECTIVES:**

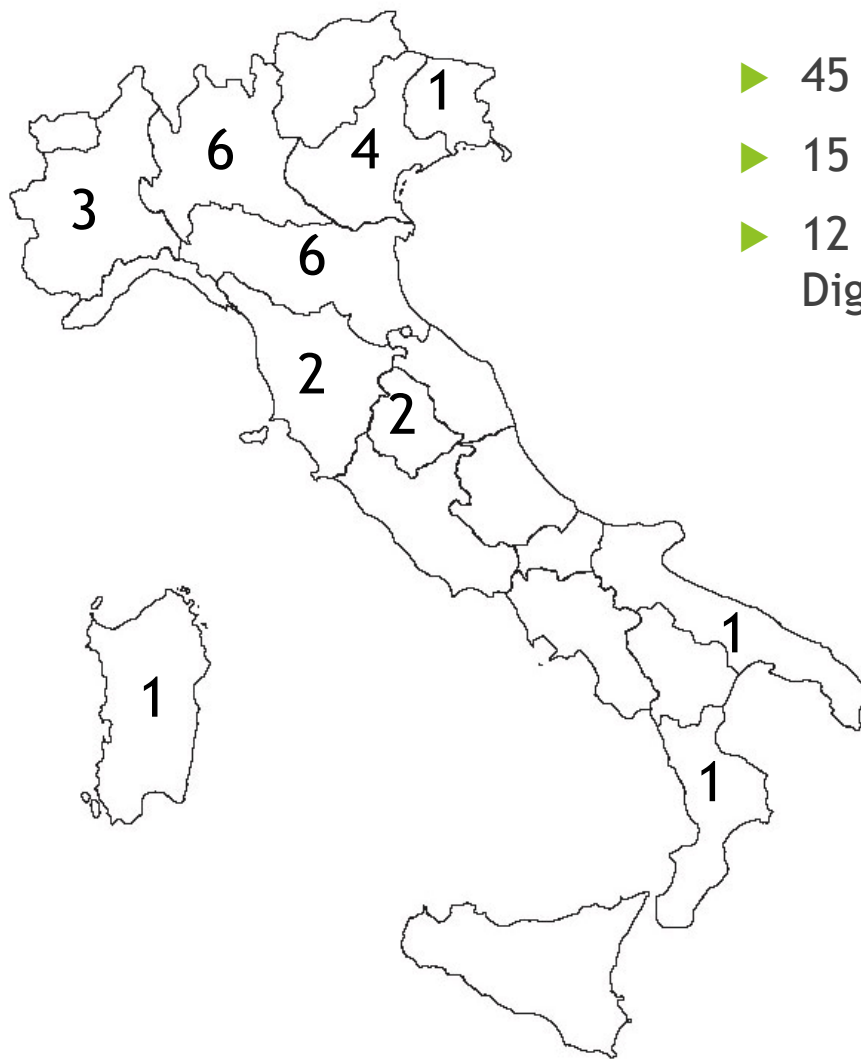
1. *To analyse the evolution of plastics and bioplastics throughout the recycling process;*
2. *To estimate the amount of plastics and bioplastics handled in composting plants or in integrated anaerobic digestion and composting plants;*
3. *To assess the effectiveness of the mechanical refining processes carried out by recycling plants for the sorting of plastics*
4. *Survey on the acceptance of items made of compostable bioplastics*

► **DURATION:**

1. January 2016 - June 2017 (18 months)
2. July 2017 - December 2017 (6 months extension)



Task 2.1 - Monitored Plants



- ▶ 45 Monitoring activities
- ▶ 15 Composting Plants
- ▶ 12 Composting & Anaerobic Digestion Plants

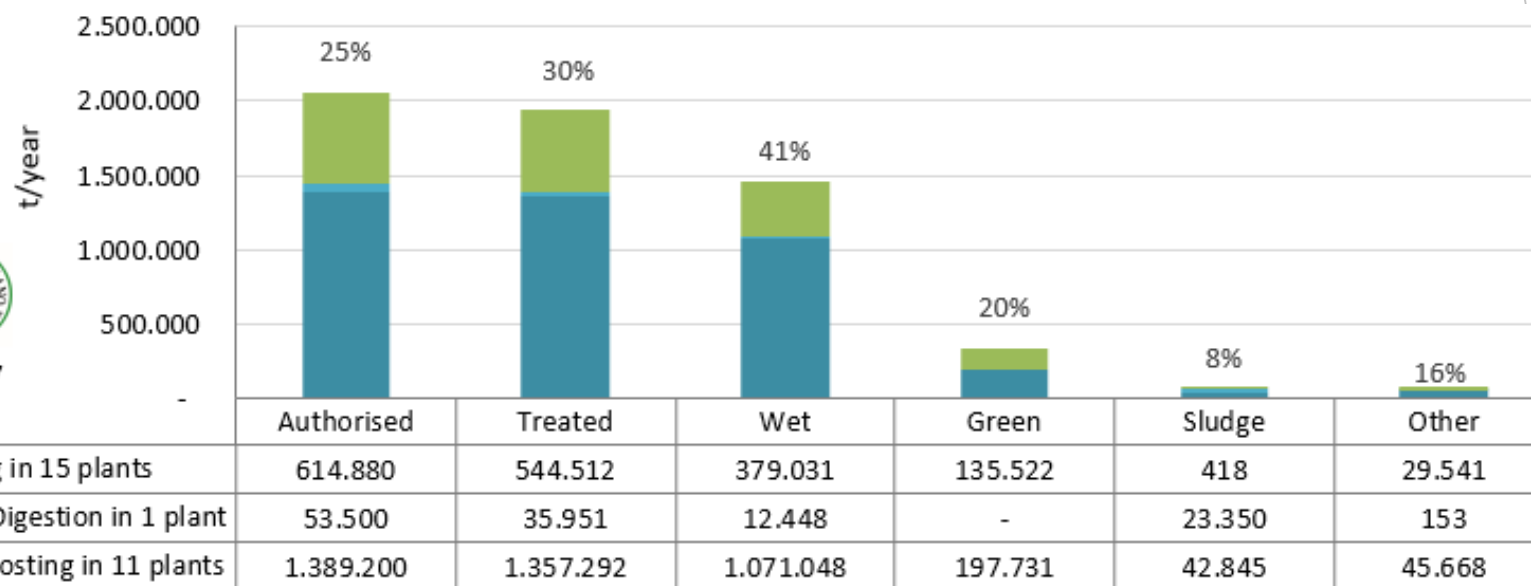


Plants involved

PLANT CODE	GEOGRAPHICAL LOCATION	PLANT TYPE	AUTHORISED CAPACITY (t/y)
AF	South and Islands	C	45.000
BI	South and Islands	C	15.000
BK	North	C	20.240
BR	Centre	C	100.000
C	North	C	88.500
H	Centre	C	25.000
I	North	C	28.500
J	South and Islands	C	30.000
L	North	C	28.600
RD	North	C	28.000
RE	North	C	37.400
RF	North	C	35.000
T	North	C	45.640
W	Centre	C	33.000
X	Centre	C	55.000
AP	North	AD	280.000
BV	Centre	AD	50.000
CA	Centre	AD	40.000
G	North	AD	485.000
M	North	AD	90.000
O	Centre	AD	57.000
RB	Centre	AD	43.200
RC	North	AD	70.000
RG	North	D	53.500
RX	Centre	AD	75.000
SB	North	AD	68.000
ZA	North	AD	131.000
		TOT	2.057.580

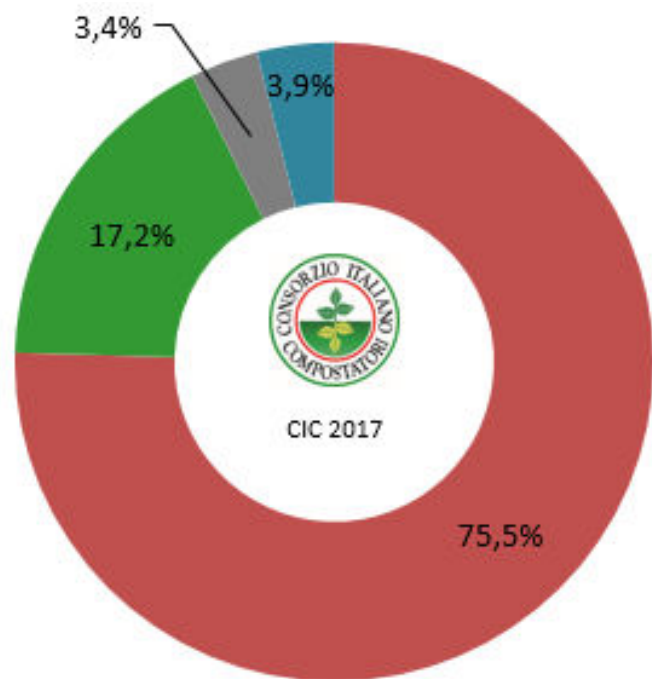


Task 2.1 - Representativeness of the Monitored Plants





Waste treated in the monitored plants



- Wet
- Green
- Sludge
- Other

- ▶ 27 plants
- ▶ 1.94 mln t/year treated
- ▶ 92.7% organic waste (foodwaste + greenwaste)



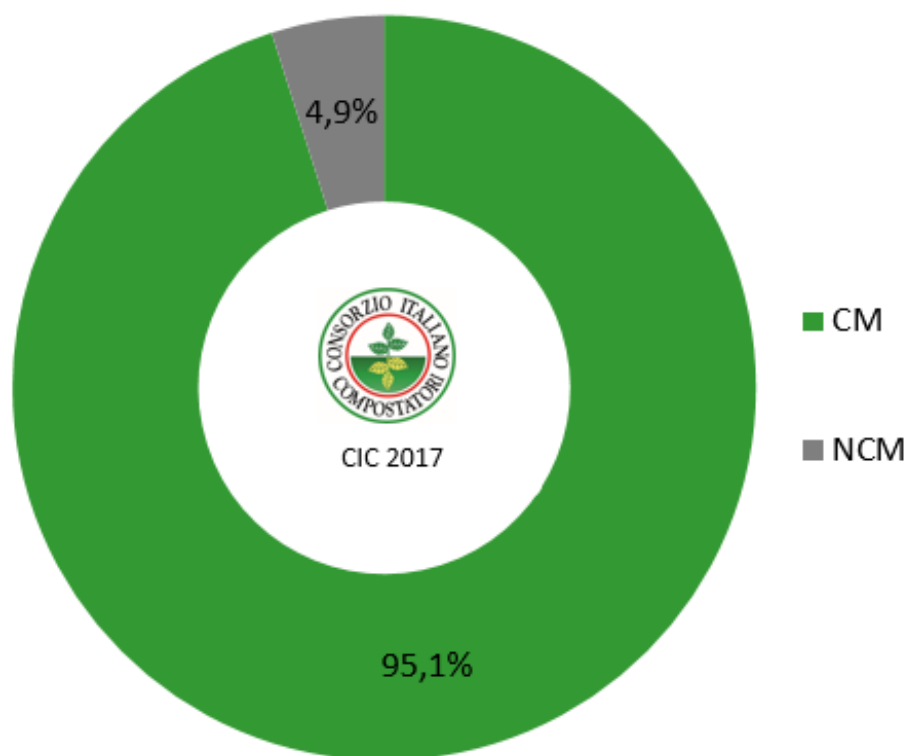
Waste composition analysis of organic waste

- ▶ **MC = Compostable Materials**, compostable fraction: organic waste (meat, eggs, cheese, fruit, vegetables, ligneocellulosic parts, etc.), paper (bags, tissues, napkins), compostable bioplastic (film and rigid)
- ▶ **NMC = No Compostable Materials**, fraction not suitable for composting: plastic in its various forms (film, bottles, tubs, tops, etc.), glass, metals, fabrics, nappies, coffee pods, etc.





No Compostable Material (NCM) in OFMSW (4 mln t/year)



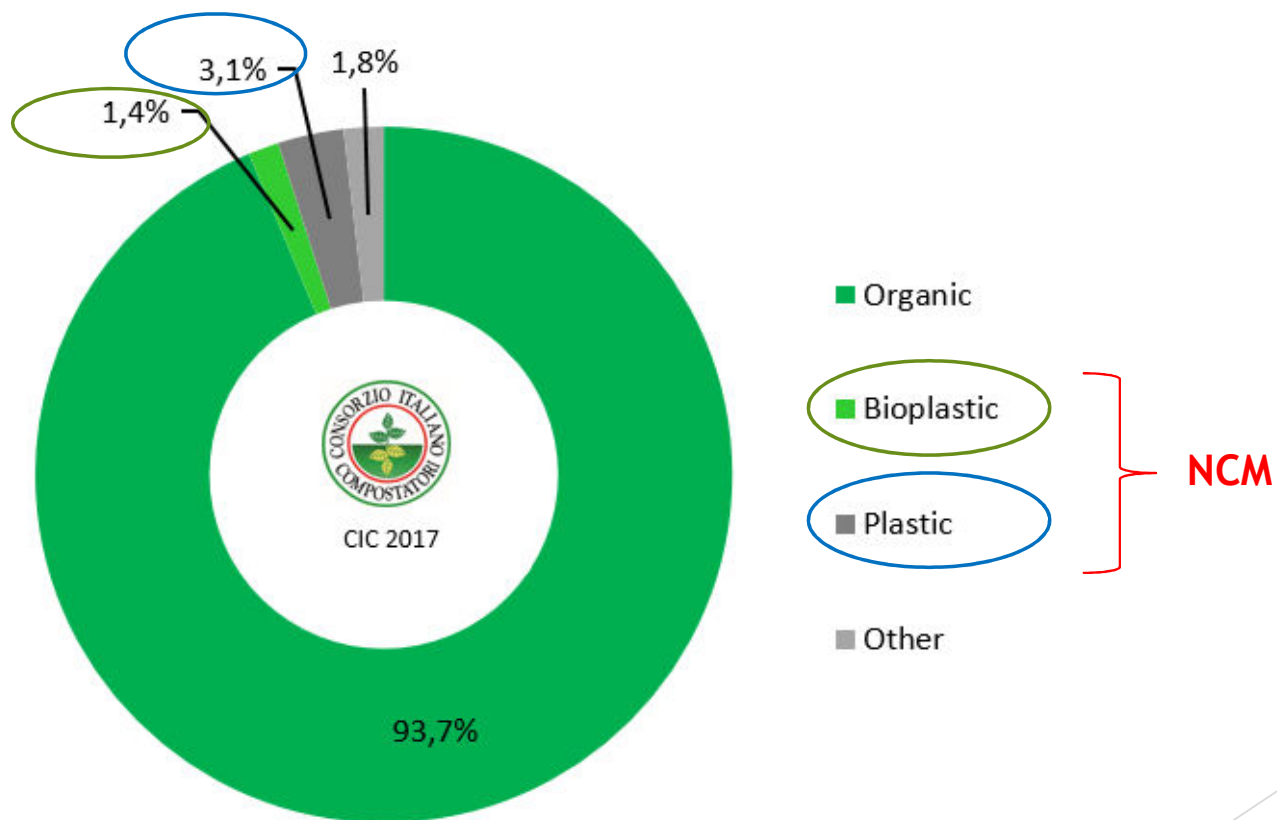


Purity of the foodwaste fraction depending on the type of collection scheme

TYPE OF COLLECTION	AVERAGE MC (% f.m.)	MIN MC (% f.m)	MAX MC (%f.m)
Door-to-Door	95.5%	89.7%	98.4%
Mixed	93.1%	89.8%	95.2%
Street	89.7%	81.9%	97.9%

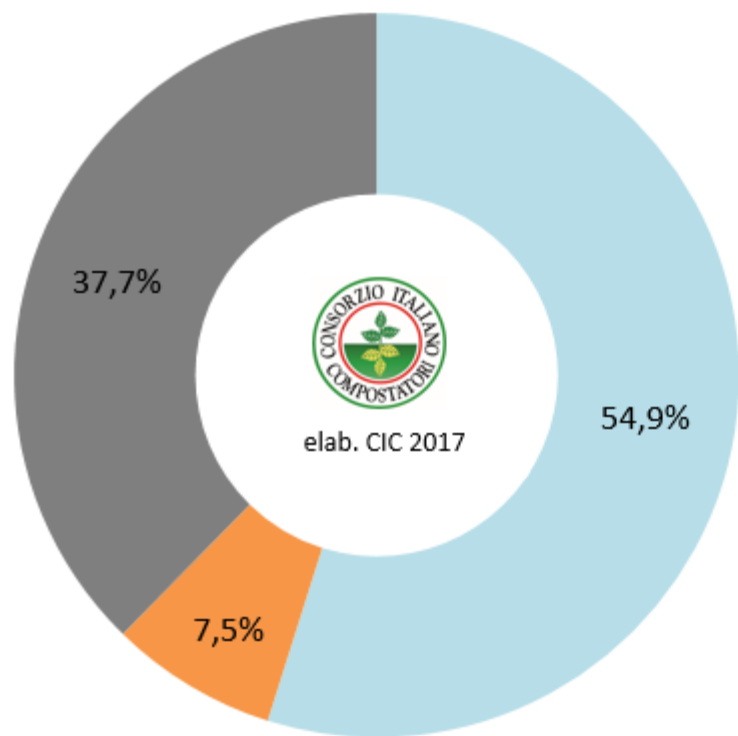


Plastic and Bioplastic in OFMSW





Characterisation of NCM in OFMSW

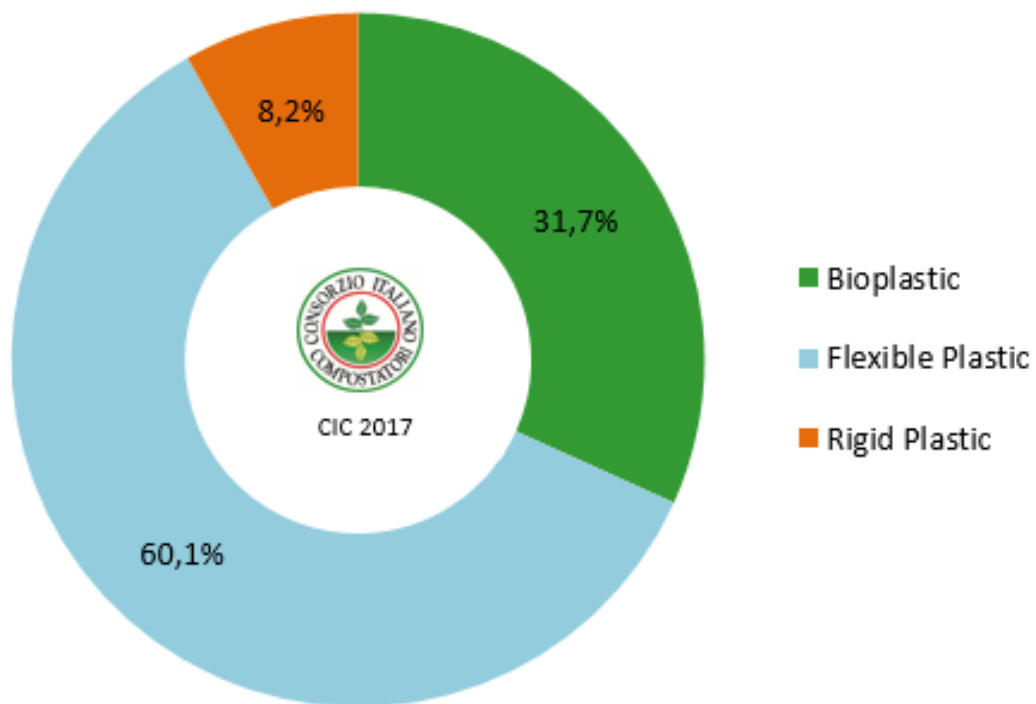


- Flexible plastic
- Rigid plastic
- Other



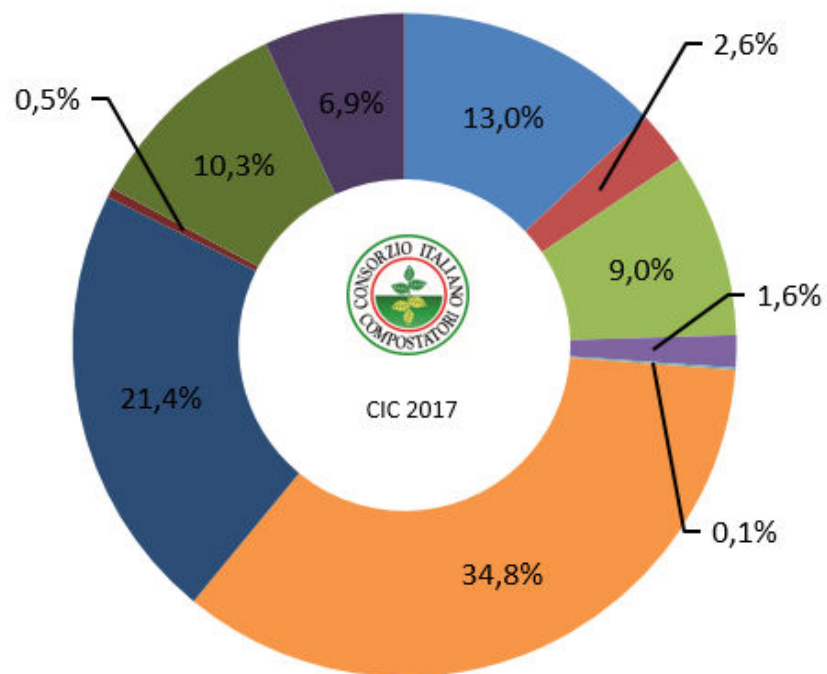


Plastics and bioplastics in the foodwaste (% f.m.)





Bags used for separate collection of foodwaste (n°)



- Plastic carrier
- Specific plastic
- Plastic for fruit and vegetables
- Oxo plastic carrier
- Specific Oxo plastic
- Bioplastic carrier
- Specific bioplastic
- Paper
- Large plastic (20-30L)
- Large plastic (80-100L)

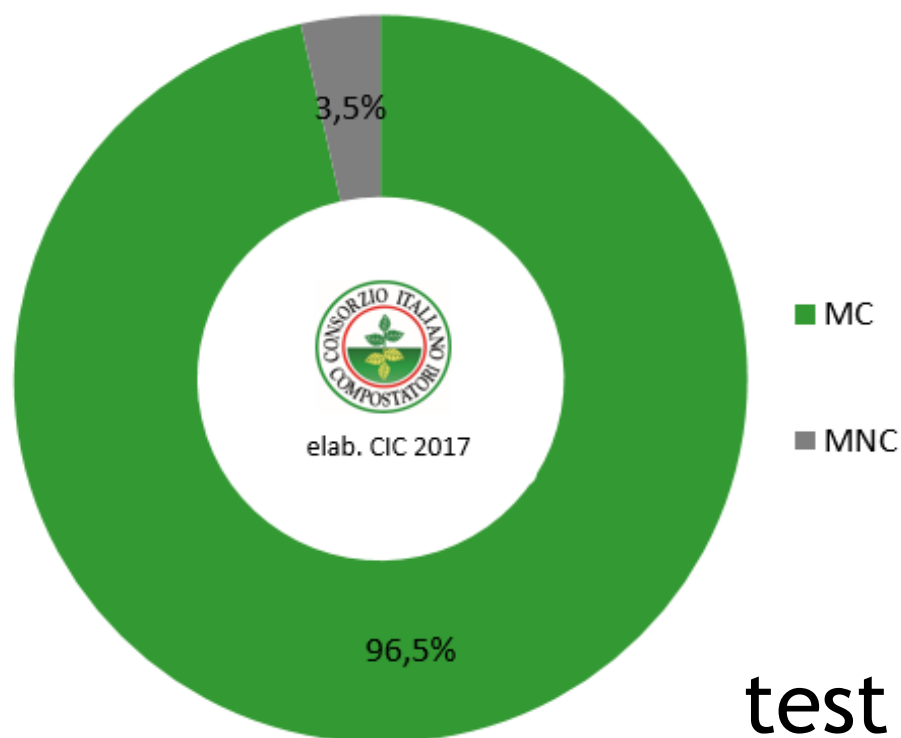
56.7% COMPOSTABLE



TYPE OF BAGS USED FOR SEPARATED WASTE COLLECTION	WEIGHTED AVERAGE	SUBTOTAL
Biodegradable and compostable plastic shopping bags	34,76%	56,65%
Biodegradable and compostable plastic bags for organic waste collection	21,41%	
Paper bags	0,47%	
Plastic shopping bags	13,00%	43,35%
Plastic bags for organic waste collection	2,55%	
Fruit/vegetable bags	8,97%	
OXO-biodegradable/plastic additive shopping bags	1,57%	
OXO-biodegradable/plastic additive bags for organic waste collection	0,10%	
Large plastic bags (20-30L)	10,29%	
Large plastic bags (80-100L)	6,87%	



MNC of green waste (1.8 mln t/year)



test ongoing...



Humidity of plastic and bioplastic packaging contained in OFMSW

Packaging	AVG (%)	STANDARD ERROR ON THE AVG (%)	STANDARD DEVIATION (%)
Bioplastic	45.5%	0.8%	9.4%
Flexible plastic	42.6%	2.3%	10.1%
Rigid Plastic	19.8%	3.8%	10.8%

TASK 2.2

Monitoring of the Behaviour of Plastic - in Compliance with Standard EN13432 - in Aerobic and Anaerobic Biological Reactors

- a) Lab Scale
- b) Full Scale





Task 2.2 a) Lab Scale- Description

- ▶ **STAKEHOLDERS INVOLVED: CIC -CRPA**
- ▶ **MESOPHILIC AND THERMOPHILIC ANAEROBIC DIGESTION (UP TO 30 and UP TO 60 DAYS)**
- ▶ **POST COMPOSTING OF THE DIGESTATE (42 DAYS) IN THE AEROBIC STAGE IN PILES MIXED WITH GREEN WASTE**
- ▶ **ASSESSMENT OF DISINTEGRABILITY**



CONCLUSIONS OF THE ANAEROBIC DIGESTION STAGE

- ▶ LAB SCALE
- ▶ The BMP tests showed an average anaerobic degradability of the volatile solids of the bioplastics subject to testing of **9.3 ± 1.4%**
- ▶ ANAEROBIC DIGESTION TESTS: The mass balances of the organic substance showed no evidence of degradability of the volatile solids of the bioplastics in continuous mesophilic testing (38 °C).
- ▶ ANAEROBIC DIGESTION TESTS: Conversely, the mass balances of the tests in thermophilic conditions (53 °C) showed a 13.3% degradability of the volatile solids of the bioplastics. This value confirms the 9.3% degradability observed in the BMP tests.

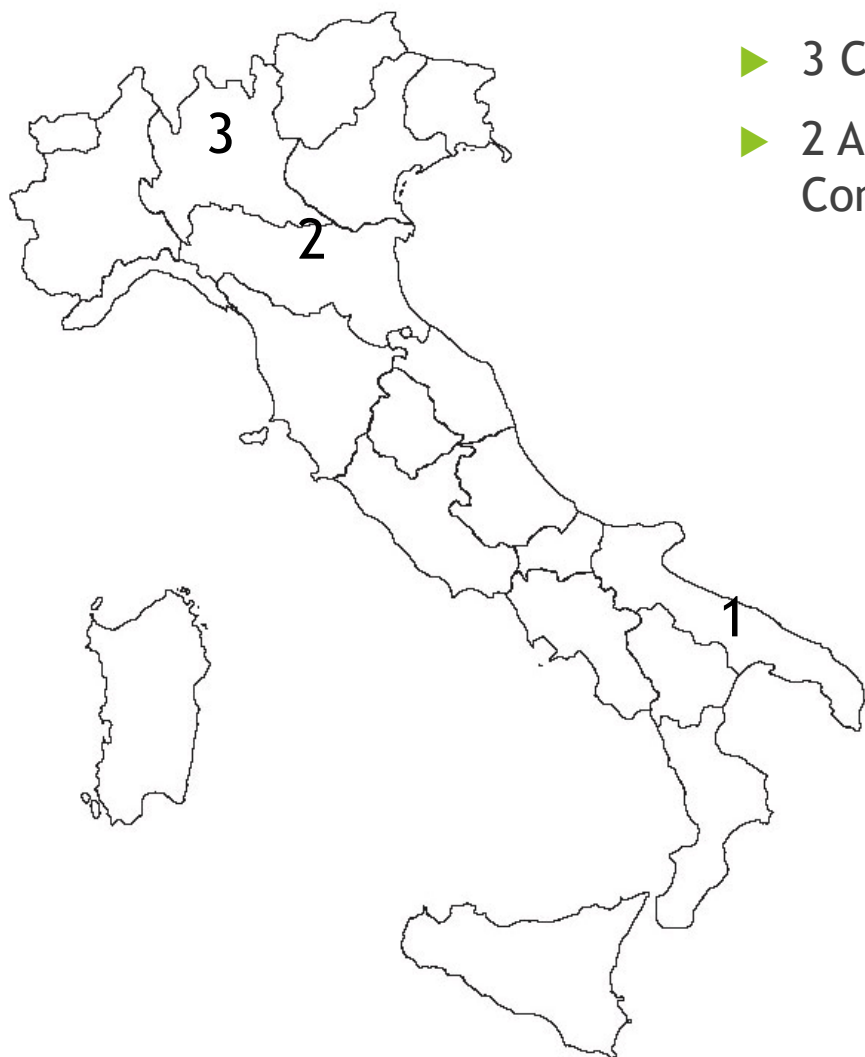


CONCLUSIONS OF THE POST COMPOSTING STAGE

- ▶ POST COMPOSTING OF THE DIGESTATE
- ▶ 42 days of the aerobic stage of the digestate mixed with green waste
- ▶ The post composting aerobic test demonstrated the capacity of the aerobic biological processes to **completely disintegrate/break down the fragments of flexible and rigid compostable and biodegradable plastics** (compliant with UNI EN 13432) contained in the digestate derived from Lab Scale anaerobic digestion treatment
- ▶ the bioplastics contained in the thermophilic digestates (at both 30 and 60 days) showed a faster degradation rate than the two mesophilic digestates



Task 2.2 b)- FULL SCALE- Plants Involved



- ▶ 3 Composting Plants
- ▶ 2 Anaerobic Digestion & Composting Plants



Experimental setup

- ▶ Testing plants: 3 composting, 2 AD & composting
- ▶ Material to be tested: bioplastic certified according to CIC UNI EN 13432
- ▶ Bioplastic amounts: 1% and 3% of total treated organic waste
- ▶ Bioplastic type: rigid and flexible
- ▶ TESTS:
 - a) Flexible 1%
 - b) Flexible 3%
 - c) Rigid 1%
 - d) Rigid 3%
 - e) **(for one plant) bioplastic delivered to the plant together with the OFMSW**



Full Scale Test Plants

- ▶ PLANT 1)

63 days total: 23 days in anaerobic digestion and 44 days in composting

- ▶ PLANT 2)

63 days of composting

- ▶ PLANT 3)

55 days total: 29 days in anaerobic digestion and 26 days in composting

- ▶ PLANT 4)

65 days of composting

- ▶ **PLANT 5)**

14 days of biological stabilisation of the rejects deriving from pre-treatment of OFMSW



Results of the efficacy of degradation of bioplastics in the monitored plants

Test	% average degradation
1% (equivalent to 60,000 t of Bioplastic)	96.0 %
3% (equivalent to 180,000 t of Bioplastic)	94.8%

The work involved 12 employees and senior experts + around 10 external consultants

Thank you

Massimo Centemero with all the CIC technical staff

CIC - Consorzio Italiano Compostatori
(Italian Composting and biogas Association)

www.compost.it

