

**FACT
SHEET**

NOV 2009

INDUSTRIAL COMPOSTING



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ANNEX A

Typical Feedstocks for Industrial Composting

ANNEX B

European Regulations and Drivers Relating to Organic Waste Management

Industrial composting is an established process for transforming biodegradable waste of biological origin into stable, sanitised products to be used in agriculture.

1. DESCRIPTION OF TECHNOLOGY

1.1 __ The Feedstock

Biowaste that can be treated by composting includes various organic materials that are defined in the EU waste catalogue (see Annex A):

1.2 __ The Process

Different technologies are available but the general process of composting is the same. It is a controlled process that can be divided into two distinct phases: active composting followed by curing.

The active composting phase lasts a minimum of 21 days. Under these conditions, microorganisms grow on organic waste, breaking it down to CO₂ and water and using it as a nutrient. Part of the energy is released into the surrounding environment as heat. During composting, organic waste is amassed in piles and, as a consequence, the total production of heat can be high. When the temperature of the composting pile increases,

the microbial populations shift: microbes adapted to ambient temperature (mesophiles) stop activity or even die and are replaced by microbes adapted to live at high temperature (thermophiles). In industrial composting facilities temperatures in the composting heaps range between 50°C and 60°C. For hygienisation purposes, temperatures need to remain above 60°C for at least one week, in order to eliminate pathogenic microorganisms.

During the curing phase the rate of decomposition declines to a slow and steady pace, and the compost matures at temperatures in the lower mesophilic range (< 40°C) with synthesis of humic substances.

1.3 __ The Technology

Composting plants are large-scale professional facilities dealing with significant amounts of organic waste. They assure optimal process conditions, fast degradation, good emission control and good compost quality. Under these conditions composting is a controlled biotechnological process and as a consequence the term "Industrial" (or municipal) composting is used, to distinguish it from "Home composting".

Important process parameters, which are controlled in industrial plants are: material structure (size of particles), moisture content, aeration (availability of oxygen), temperature, pH, carbon/nitrogen ratio. Final compost is subject to quality control analysis to verify if it meets the compost specifications. Common technologies include windrow composting, aerated static piles, tunnel composting and in vessel composting.

2. CURRENT DISTRIBUTION AND PROSPECTIVE OF TECHNOLOGY

The European Landfill Directive 1999/31/EC puts pressure on European states to meet given targets for the reduction of landfill disposal, by establishing alternate treatment of organic waste. At present, large-scale composting is the most widespread organic recovery option.

The collected and treated amounts of organic material differ much in the EU countries. In the EU15, approx. 35% resp. 17 million tpa¹ of the estimated total recoverable potential of the 49 million tpa bio- and green waste is

separately collected at present. This results in a compost production of around 9 million tpa.²

The total organic waste produced in the EU27 amounts to 110 million tonnes/year. The treatment capacity is 12 million tonnes and 8 million tonnes for biowaste and green-waste, respectively. 10 million tonnes of compost are produced each year (after J. Barth 2007)

Table 1.

Amount of Separately Collected and Composted Bio- and Green Waste in EU15³

Country	Sep. collected + treated organic waste [Million tpa]		Recovery potential of organic waste [Million tpa]		Theoretical potential ⁴
	Biowaste	Greenwaste	Biowaste	Greenwaste	
A (2000)	0,45	0,20	1,22	0,97	2,19
B Flanders (2000)	0,34	0,39			1,3
B Wallonia (1994)		0,12			0,16 in 2002
D (1999)		7,0			9,0
DK (1999)	0,037	0,65	0,1	0,66	0,76 in 2004
F (2000)	0,05	1,5	5,25	3,5	8,75
Fi (1998)		0,1			0,6
GR (1995)	–	–			1,8
I (1999)	1,5				9
IRE (1998)					0,44
Lux (1998)		0,03			0,06
NL (2001)	1,6	1,5	1,7	1,5	3,2
P (1995)		0,01			1,3
ES (2000)	0,03 (Catal.)	0,02 (Catal.)			6,6
SW (1999)	0,14	0,15	1,0	0,65	1,65
UK (2000)	0,039	1,0			3,2 in 2006
Sum	11,4	5,42			48,7
Treated Bio- + Greenwaste 16,9 M.tpa			Theoretical recovery potential 49 M.tpa		

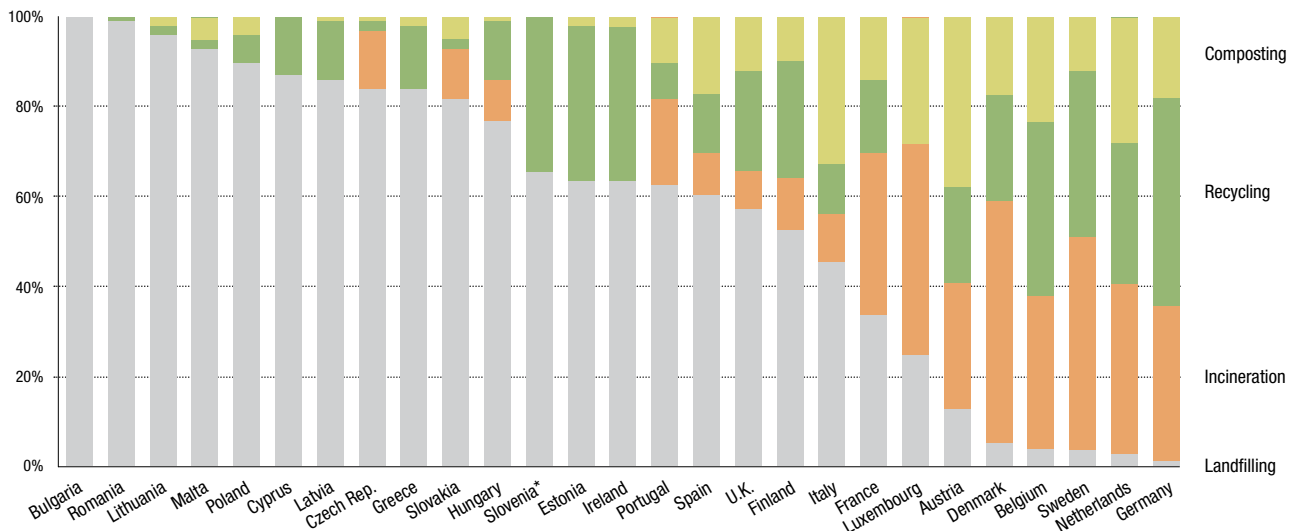
¹ tpa: tonnes per annum

² Source: European Compost Network - Website

³ European Compost Network - Website

⁴ In most or the European countries no statistical data about the home composting are available, so an estimation about full extent of the potential of organic waste is very difficult.

*Figure 1:
Current Situation of Waste Management Options in the EU27⁵*



3. LEGAL AND POLITICAL FRAMEWORK

Future development and prospective of industrial composting are linked to the EU policies on the biological treatment of organic waste. In particular,

the relevant drivers are listed below. See Annex B, for more extensive descriptions of the individual regulations.

- 3.1 _____ Directive 1999/31/EC on the Landfill of Waste
- 3.2 _____ Directive 2008/98/EC on Waste
- 3.3 _____ Directive 94/62/EC on Packaging and Packaging Waste
- 3.4 _____ COM(2008) 811 final – Green Paper on the Management of Bio-waste in the European Union
- 3.5 _____ Council Conclusions on the Green Paper on the management of bio-waste in the European Union (25 June 2009)
- 3.6 _____ COM(2002) 179 final – Towards a Thematic Strategy for Soil Protection
- 3.7 _____ First European Climate Change Programme (ECCP I) Launched June 2000

4. COMPOSTING AND BIOPLASTICS: STANDARDS, CERTIFICATION AND LABELLING

Compostable packaging and plastics can be defined as packaging and plastics which, when introduced into an industrial composting plant together with the other organic waste, are biodegraded and bring no inconvenience

neither for the process nor for the product and the environment. Currently, the compostability criteria for packaging and plastics are very well regulated at European and worldwide level.

⁵ Eurostat data 2007

4.1 __ Standards

4.1.1 EN 13432:2000 Packaging. Requirements for Packaging Recoverable Through Composting and Biodegradation. Test Scheme and Evaluation Criteria for the Final acceptance of Packaging

This is a harmonised European standard linked to the European Directive on Packaging and Packaging Waste (94/62/EC). It provides presumption

of conformity with the essential requirements of the Directive. It has been translated and implemented in all the European Member States.

4.1.2 EN 14995:2006 Plastics. Evaluation of Compostability. Test Scheme and Specifications.

Almost identical to EN13432. It broadens the scope to plastics when used in non-packaging applications. When plastics are used as packaging then

the EN 13432 applies.

4.1.3 ISO 17088:2008 Specifications for Compostable Plastics

Recently issued by ISO, it represents the international benchmark in the field of compostable plastics. The content is very similar to the EN 13432 and the

ASTM D 6400 (see next point). ISO 17088 is a very relevant reference in all those countries where no national standards have been introduced.

4.1.4 Other Relevant Standards

Other relevant standards addressing compostability are the American ASTM D 6400-04 – “Standard Specification for Compostable Plastics” and the

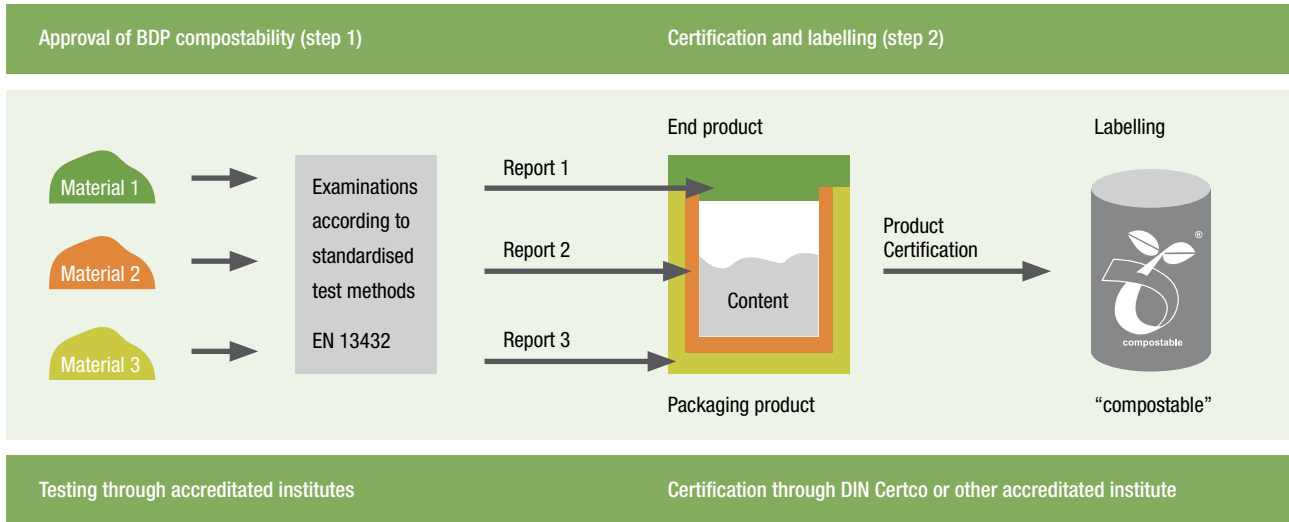
Canadian BNQ – 9011-911/2007 – “Compostable plastic bags”. Approach, criteria and contents are similar to the EN standards.

4.2 __ Certification and Labelling

To prove compliance with a standard, a material or product can be certified by a recognised independent third party, i.e. certification body.

Certification links the EN 13432 / EN 14995 testing standard to the protected quality label that allows the identification and proper handling

of compostable plastic products on the market. Product certification guarantees that not only the plastic is compostable but also all other components of the product, e.g. colours, labels, glues and – in case of packaging products – residuals of the content.



The certification of compostable products is a two step procedure: The extensive tests for the verification of the compostability in accordance with recognised test methods (EN 13432 / EN 14995) may only be carried out and documented by approved test laboratories. All test results and relevant documentation have to be submitted to the certifying body by the applicant






(manufacturer of the resin), the product will be included in a positive list. Products that pass may bear a recognised compostability logo.

Checks are carried out to ensure that the product being sold conforms with that submitted for certification.⁶

Table 2.
Certification Bodies, Standards and Logos

Certification Body	Reference Standard	Logo
DIN Certco (Germany)	EN 13432:2000	
AFOR (UK)	EN 13432:2000	
Keurmerkinstituut (Netherlands)	EN 13432:2000	
COBRO (Poland)	EN 13432:2000	
ABA (Australia)	EN 13432:2000	
Vincotte (Belgium)	EN 13432:2000	
Jätelaito-syhdistys (Finland)	EN 13432:2000	

⁶ www.european-bioplastics.org

Certification Body	Reference Standard	Logo
Certquality / CIC (Italy)	EN 13432:2000	
Avfall Norge (Norway)	EN 13432:2000	
BPI (USA)	ASTM D 6400-04	
BNQ (Canada)	BNQ 9011-911/2007	
JBPA (Japan)	Green Pla identification system	

The seedling logo (the first one in the above table) owned by European Bioplastics is licensed to different certification bodies and is being used in different countries. In general, logos are owned and managed by specific

organisations based in a specific location but can be accepted and used also in other countries.

5. INTERACTIONS BETWEEN COMPOSTABLE PLASTICS AND TECHNOLOGY

5.1 __ Thickness

Compostability of a given plastic is ascertained by testing biodegradability, disintegrability and absence of negative effects (ecotoxicity, metals etc.). In particular, disintegrability is verified by testing formed samples under composting conditions. In case the samples disintegrate, their original thickness is considered as the maximum allowable thickness to be used in the

final products. If, for instance, a material has been shown to disintegrate at 1 mm, products with a lower thickness will be considered as “disintegrable” without any need for further testing. However, a 1.1 mm product will need to be tested again, as disintegrability is not assured.

5.2 __ Screening Systems

Screening systems are applied in composting plants in order to remove possible contaminants .

There are two basic situations:

1. _____ Some composting plants do not screen the incoming biowaste for contaminants, but send it directly to composting, often after being shredded. The finished compost is sieved only at the rear end.

2. _____ Some composting plants are equipped with screening systems (mostly sieving) at the front end of the plant, designed with the aim to exclude the contaminants, among them also plastics. Since compostable plastics do not physically behave very differently from the traditional non-compostable plastics, the screening systems can exclude the compostable plastics from the composting process. To this respect, the following points need to be considered:

➔ In order to maximise the input of compostable materials, in many facilities the materials that have previously been sieved out undergo a second stage of manual sorting. In that case, compostable items provided with a well recognisable pattern (e.g. a specific printing/colour etc.), can be correctly identified by trained staff.

➔ In many facilities, despite the pre-screening system, contamination of the final product is still an issue. Depending on contamination rate, efficiency and intensity of the pre-screening, part of the plastic contaminants are usually still found in the composted material. Replacing these plastics with compostable ones would help solve the problem.

5.3 __ Processing Times and Use of Compost of Different Maturity Levels

Usually compost is used after having undergone both the active composting and the subsequent curing phase. In some cases, compost is used immediately after the active composting phase, prior to reaching full maturity (referred to as “fresh compost”). In this case, the compost is obtained after sieving while the oversize is generally put back into the process.

Certified compostable plastics that have not completely disintegrated after the active phase are also intercepted by the final sieving and recycled back into the composting process.

6. BENEFITS AND CHALLENGES

6.1 __ Benefits

➔ Better acceptance and higher participation in biowaste collection schemes (e.g. compostable bags and liners).

➔ Lower gate fees for composting compared to landfilling or incineration.

➔ Possibility to communicate to the public environmental messages about source separation, organic recovery and benefits of compost, (e.g. separation manuals on biowaste collection) leading to increased quality of source separation.

➔ Potential cost savings for municipalities delivering cleaner biowaste to composting facilities.⁹

➔ Reduction of contamination by non compostable plastics in the organic waste in composting facilities.⁷

➔ Technical advantages: a better balanced carbon to nitrogen ratio in the biowaste brought about by compostable bioplastics. Compostable bioplastics can also act as a bulking agent improving moisture management, aeration of the feedstock and odour control.

➔ Decreased need for intensive screening systems in composting plants with consequent reduction of related environmental and financial impacts.

➔ Lower contamination of the final compost.

➔ Alternative recovery option for products difficult to recycle because of the contamination by organic waste (e.g. food packaging, food service ware).⁸

➔ Additional alternative recovery option for those packaging types where recycling is difficult (e.g. multimaterial packaging).

⁷ Franz L., Germani F., Paradisi L., Bergamin L., Ceron A. – ORR-ARPAV “Influenza della purezza merceologica della FORSU sulla produzione degli scarti negli impianti di compostaggio e sulla qualità del compost finito”, Atti Ecomondo, 2004. (Regional Observatory for Composting, Environmental Protection Agency of Region Veneto - Influence of the quality of source separated organics on the production of residues and on compost quality in composting plants)

⁸ Razza, F. et al., Compostable cutlery and waste management: An LCA approach, Waste Management, Volume 29, Issue 4, April 2009, Pages 1424-1433

⁹ CIC, Position paper about the quality of the source separated organic feedstock, November 2008
CIC (Consorzio Italiano Compostatori, Italian Composting Association)

6.2 __ Challenges

- Increase of contamination of the organic feedstock: when introducing compostable products in biowaste collection and composting schemes, there is sometimes the danger of increasing contamination rates. Pilot projects dealing with the introduction, use and disposal of biodegradable and compostable items like the Kassel project¹⁰ have shown no changes of contamination rates in the biobin. Proper behaviour of the householders was linked to intensive communication during the project. In the long term, product identification, communication and labelling need to be monitored and managed adequately in order to avoid this risk.
- Exclusion from the composting system due to intensive screening: when the composting process is considered, a number of different pre-treatment methods and technologies are found. In some cases the first step of the process is represented by an intensive mechanical screening stage not able to distinguish whether a product is compostable or not. This can lead to an exclusion of compostable items meant to be recovered during the process instead.
- A lack of uniformity between waste management systems at local and national level is hindering the development of general policies and or legislation that could promote the use of certified compostable plastics.
- Need of further development of the industrial composting infrastructure in many countries

7. SUCCESSFUL CASES

- Cases related to applications like bags for organic waste collection have been mentioned before.
- Besides that, various retail chains are now offering compostable carrier bags at the check out counters. These bags can be reused at home for the collection of the kitchen waste. Several cities and communities from all over the world have introduced specific beneficial regulations for certified compostable bags.
- The use of compostable horticultural applications like pots, clips and strings used for growing tomatoes allows for a lower gate fee at composting plants in the Netherlands when the green waste from greenhouses is delivered. This is due to the lower treatment cost made possible by the use of compostable items and lower contamination of the feedstock.
- Compostable food service ware (e.g. catering waste from fast foods, coffee shops, canteens) is becoming popular at public events like concerts and festivals and represents a very interesting option for fast food chains as well.

¹⁰ Klaub, M.; Bidlingmaier, W. (2003): *The Kassel Project - Use and Recovery of Biodegradable Polymer Packaging*. Proc. of the 4th International Conference on Biological Processing of Organics: Advances for a Sustainable Society - ORBIT 2003 Perth, Australia. P. Pullammanappallil, ., McComb, L.F. Diaz, W. Bidlingmaier (Eds.), vol. 1, Perth, Australia, pp. 286-294.

ANNEX A

Typical Feedstocks for Industrial Composting ¹¹

Description	Waste EU-code	Notes
Kitchen and canteen waste (foodwaste)	20 01 08	from households, resaturants, canteens, bars, coffee-shops, hospital and school canteens, etc.
Waste from public markets	20 03 02	only biodegradable materials equivalent to codes n° 200108 and n° 200201
Garden and park waste (yardwaste)	20 02 01	from private gardens and public parks and areas, etc.
Wood waste	20 01 38	not containing dangerous substances no furniture and bulky household-waste

SOURCE:
 EU CODES ACCORDING TO COMMISSION DECISION
 N° 2001/118/EC

¹¹ E.Favoino, Handbook for local authorities on biowaste management, 2004. Publisher: Ministry of Environment – Slovak Republic

EUROPEAN REGULATIONS AND DRIVERS RELATING TO ORGANIC WASTE MANAGEMENT

3.1 __ Directive 1999/31/EC on the Landfill of Waste

In order to reduce production of methane (a powerful Greenhouse Gas) from landfills, it requires from the member states a reduction of the amount of biodegradable waste going to landfill to 35% of 1995 levels by 2016. The general framework is the new waste strategy: Making Europe a recycling society¹².

The recycling target for household waste can only be achieved including organic waste since this totals from 1/3 to 1/2 of the total municipal solid waste.

3.2 __ Directive 2008/98/EC on Waste (Waste Framework Directive)

The waste hierarchy, reinforced under the new Waste Framework Directive, includes composting as a method of recycling organic material as an alternative to disposal. The end product, compost, then becomes a useful soil conditioning and fertilising material which has the potential to replace lost carbon from the soil. Provisions are also made in the directive to ensure the

protection of soils, as well as water air and wildlife.¹³ The directive, among others, asks Member States to introduce measures supporting separate collection and appropriate treatment of bio-waste. The Commission is also to carry out an assessment on the management of bio-waste with a view to submitting a proposal if appropriate.

3.3 __ Directive 94/62/EC on Packaging and Packaging Waste

The European Directive on Packaging and Packaging Waste (94/62/EC) established the essential requirements regarding the composition and the reusable and recoverable nature of packaging and packaging waste. Six European standards have been issued in connection with the 94/62/EC, under EC mandate to cover both prevention of packaging and the different forms of recovery. Among them the European standard EN

13432 – “Packaging – Requirements for packaging recoverable through composting and biodegradation – Test scheme and evaluation criteria for the final acceptance of packaging”. It defines the characteristics a material must have in order to be recognised as “compostable”. This Standard is a harmonised norm, written in the Official Gazette of the European Communities. It provides presumption of conformity to the Directive.

3.4 __ COM(2008) 811 final – Green Paper on the Management of Bio-waste in the European Union

From the introduction: “Today, very different national policies apply to bio-waste management, ranging from little action in some Member States to ambitious policies in others. This can lead to increased environmental impacts and can hamper or delay full utilisation of advanced bio-waste management techniques. It should be investigated whether action on national level would be sufficient to ensure proper bio-waste management

in the EU, or whether Community action is needed. This Green Paper aims to discuss these questions and prepare grounds for the upcoming impact assessment which will also address the subsidiarity issue.”

¹² <http://europa.eu/rapid/pressReleasesAction.do?reference=IP/05/1673&type=HTML&aged=0&language=EN&guiLanguage=en>

¹³ Schils, et al., 2008 Review of existing information on the interrelations between soil and climate change. (CLIMSOIL). Final report. Brussels, European Commission, 208pp.

3.5 __ Council Conclusions on the Green Paper on the Management of Bio-waste in the European Union (25 June 2009)

“The Council of the European Union encourages the Commission to continue the impact assessment with a view to preparing, if appropriate, an EU legislative proposal on biodegradable waste by 2010. In particular, the Council invites the Commission to consider the need to stipulate, if appropriate and while respecting the subsidiarity principle and taking into account local conditions:

- (i) Measures for the prevention of such waste;
- (ii) Measures for introducing separate collection of biodegradable waste where necessary to guarantee a high quality for subsequent recycling;

- (iii) A quality assurance system, based on the principle of integrated chain management and traceability throughout the process up to the final receptor, without entailing disproportionate costs or administrative burdens;
- (iv) The establishment of requirements on the labelling and on quality criteria for compost and digestate as well as on quality criteria for recycled biodegradable waste that is intended for use on land to facilitate the management of this material and assist in stimulating the market by increasing consumer confidence.”

3.6 __ Thematic Strategy for Soil Protection¹⁴

Soil protection has been introduced as one of the thematic strategies to be developed within the Community's 6th Environment Action Programme (6th EAP).

The Technical Working Groups established under the Thematic Strategy for Soil Protection give as recommendation to the EC: “Whereas soil organic matter losses are not only due to practices, but also to other reasons such as climate, one of the basic principles of the EU Soil Thematic Strategy should

recognise that it is necessary to avoid Organic Matter and Biodiversity losses by promoting appropriate (agricultural) practices” and “preventing potentially harmful (agricultural) practices. Among these adequate (agricultural) practices, maintenance and management of grasslands (herbaceous land), crop residues management, cover-crops, manure land-spreading management, crop rotation management, use of compost, sewage sludge and soil improvers and cultivation management are often recognised as key issues”.¹⁵

3.7 __ First European Climate Change Programme (ECCP I) Launched June 2000¹⁶

The first European Climate Change Programme (ECCP I)¹⁷ has identified new methods to achieve this goal and the role soil plays in capturing carbon has been investigated.

An ECCP report¹⁸ estimated that up to 60-70 million tonnes of CO₂-eq per year could be captured in agricultural soils. Carbon can be trapped in soil, by the activity of bacteria, fungi and earthworms. They convert organic matter into a substance known as humus, which remains as part of the soil and prevents carbon release as CO₂. One way to get more carbon into soils is by spreading biodegradable organic residues, such as compost, onto agricultural land. Combining soil and waste management in this way

directs carbon to the soil where it can be captured and has the added benefit of reducing the amount of waste that goes to landfill. Estimates of the contribution this method could make to carbon capture range from 2-20 million tonnes of CO₂-eq per year, due to regional differences in soil, management practices and climatic conditions.

¹⁴ COM(2002) 179 final: Communication from the Commission to the Council, the European Parliament, the Economic and Social Committee and the Committee of the Regions – Towards a Thematic Strategy for Soil Protection.

¹⁵ Van-Camp, L., Bujarrabal, B., Gentile, A.-R., Jones, R.J.A., Montanarella, L., Olazabal, C. and Selvaradjou, S.-K. (2004). Reports of the Technical Working Groups Established under the Thematic Strategy for Soil Protection. EUR 21319 EN/1, 872 pp. Office for Official Publications of the European Communities, Luxembourg.

¹⁶ Marmo, L. (2008). EU strategies and policies on soil and waste management to offset greenhouse gas emissions. Waste Management. 28: 685-689.

¹⁷ <http://ec.europa.eu/environment/climat/eccp.htm> Launched June 2000

¹⁸ ECCP I 2003 report *Sinks Related to Agricultural Soils* http://ec.europa.eu/environment/climat/pdf/execsummary_agricsoils.pdf

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