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Composting of solid municipal waste

Compostaggio di rifiuti solidi urbani

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Abstract

L'argomento di questa tesi è la gestione della frazione organica dei rifiuti solidi urbani attraverso il processo di compostaggio quale valido strumento per stornare una notevole quantità di rifiuti che altrimenti sarebbero destinati alle discariche ed agli inceneritori, rappresentando, pertanto, un efficace complemento alle altre forme di riciclaggio. La trasformazione in compost di qualità consente infatti di recuperare sostanza organica per reintegrarla nei terreni, prevenendo, in tal modo, fenomeni di erosione, incrementando la fertilità biologica dei suoli e contribuendo in maniera determinante al ripristino dei siti contaminati. Ciò nonostante è possibile constatare come il compostaggio abbia annoverato, presso impianti distribuiti in tutto il mondo, un considerevole numero di fallimenti imputabili soprattutto alla scarsa qualità del prodotto ottenuto, alla inefficiente fase di preselezione del flusso di rifiuti ed alla scarsa conoscenza del processo. Pertanto, al fine di rendere il compostaggio un valido strumento di recupero dei rifiuti, complementare ad altre forme di gestione, devono essere adottate appropriate metodologie. Sono stati pertanto analizzati i principali temi inerenti il compostaggio visto nel contesto di un sistema integrato di gestione dei rifiuti, affrontando i diversi aspetti, chimico – fisici, biochimici, microbiologici e cinetici che caratterizzano le diverse fasi del processo. Nell'ambito della gestione del processo è risultata, altresì, inevitabile una attenta analisi delle operazioni da intraprendere presso l'impianto di compostaggio, dallo stoccaggio del rifiuto iniziale alla fase di confezionamento del prodotto finito, nonchè una valutazione delle misure e dei criteri da seguire per il controllo degli odori e per una corretta localizzaione dell'impianto (distanze di sicurezza, preparazione del sito, ecc.). Il documento è diviso in un totale di 8 capitoli. La parte introduttiva descrive le ragioni e gli obiettivi di base del compostaggio dei rifiuti. I capitoli 2 e 3 descrivono i processi biologici che avvengono nel processo di compostaggio. Il quarto capitolo descrive i fattori che possono influenzare la qualità del processo di compostaggio. Il capitolo 5 descrive i possibili metodi utilizzati nel mondo per il compostaggio dei rifiuti urbani. Il capitolo 6 descrive i vari impianti di compostaggio dei rifiuti urbani centrali con tutti i dettagli del loro funzionamento. Di seguito, al settimo capitolo viene fornito un metodo per il compostaggio dei rifiuti domestici e le caratteristiche biologiche di tali impianti. L'ultimo capitolo del documento è dedicato al quadro legislativo che affronta il problema del compostaggio, principalmente a livello dell'Unione europea. Infine vengono fornite le conclusioni chiave dell'analisi e alcune raccomandazioni per la ricerca futura.

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1. INTRODUCTION

Compost is a soil, an organic soil conditioner (which brings nutrients back to the soil). It is obtained, according to natural procedures, in the presence of air (aerobes), by the degradation, by bacteria, of the putrescible material (organic or wet) contained in urban waste, collected in a differentiated way, in controlled artificial environments (composting plants) . Compost is obtained by exploiting the action of the microbial flora, spontaneously present in the waste itself. In the composting plant, we let nature do it, with the sole concern of preparing the best conditions for the decomposition process to take place as quickly as possible (accelerated) and with the best results, so as to obtain a humus-rich soil in relatively short times. short (40/50 days).

Composting is a process of biological transformation in which the activity of microorganisms transforms organic matter into a humus-like material known as compost.

Composting is on the second level in the solid waste management hierarchy because it is a type of recycling that is particularly applicable to food waste. Specifically, composting can be used to recycle most organic wastes from food processing, including residues from fruits and vegetables.

Composting is "the biological decomposition and stabilization of an organic substrate, under conditions that allow the development of thermophilic microorganisms, as a result of the release of heat generated during biological processes, to produce a stable, pathogen-free and seed-free plant end product suitable for application on the land ".

Figure 1. Waste Reduction and Diversion

1.1. The goal of composting

The general goals of composting are:

(1) transformation of biodegradable organic material into biologically stable material and reduction of initial waste volume;

(2) the decomposition of pathogenic microorganisms, insect eggs and other unwanted organisms that may be present in the waste;

(3) keeping as much of the essential nutrients (nitrogen, phosphorus and potassium) as possible;

(4) obtaining a product that can be used for growing plants.

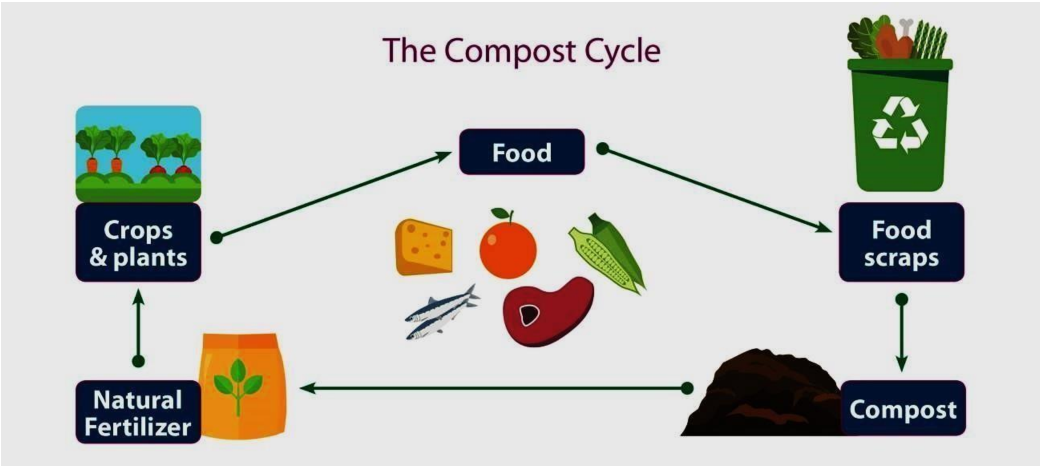


Figure 2 : The compost cycle

1.2. Composting waste in the world

Since the late 1980s, composting has become more widely used in Europe, in parallel with the development and implementation of a separate bio-waste collection scheme. In terms of separate collection and composting of bio-waste, European countries can be divided into 4 groups.

The first group includes Austria, Belgium, Germany, Switzerland, Luxembourg and the Netherlands. About 80% of bio-waste is used in these countries, and especially in Germany.

The second group includes Denmark, Sweden, Italy, Catalonia (Spain) and Norway. In these countries, there are few facilities operating and the market is still under development.

The third group includes Finland, France, the United Kingdom and Belgium (Wallonia); these are countries where entry-level composting programs are in use.

The fourth group includes countries where composting at source of separate bio-waste is only sometimes done; most of the regions in Spain, Greece, Ireland and Portugal are in this group. Composting of mixed municipal waste from urban areas is still practiced and plays a significant role in these countries.

1.3. Sources of compost

Compost is produced by mixing wet waste (kitchen / canteen waste) and "dry" waste (wood, pellets, mowing, etc.); also from waste from organic residues from agro-industrial activities.

- List of wet / organic materials of households:

leftover food, vegetable and fruit scraps; egg shells; advanced foods, coffee grounds, tea filters, flowers and leaves, branches of garden plants ... that is, the fraction selected from municipal solid waste also includes organic merchant waste, from restaurants and canteens.

- Other materials to start the industrial composting process:

branches and other maintenance waste from public and private green areas, pruning waste, vine shoots, mowing and leaves; bunches of grapes; sawdust, shavings and wood chips; bark of conifers or broad-leaved trees; straws of wheat, barley, etc .; food industry waste (coffee, peels, pulps); zootechnical waste; sewage sludge from the agro-food industry; urban sewage sludge.

- Non-compostable materials:

plastic bags; all products that contain synthetic substances (milk and fruit juice tetra Pak, yoghurt jars, plastic packaging; metals (cans, nails, cutlery, tinfoil); glass (there is separate collection); paper (c 'is the separate collection); lubricating oils (there is the separate collection); contents of the vacuum cleaner bag; special waste (medicines, dyes, pesticides, batteries, insecticides); cigarette butts and filters.

All residues must be of good quality with the exception of heavy metals or materials that are not wet. The compost is certified with analyses carried out during and after production and is subjected to strict controls by the local authorities.

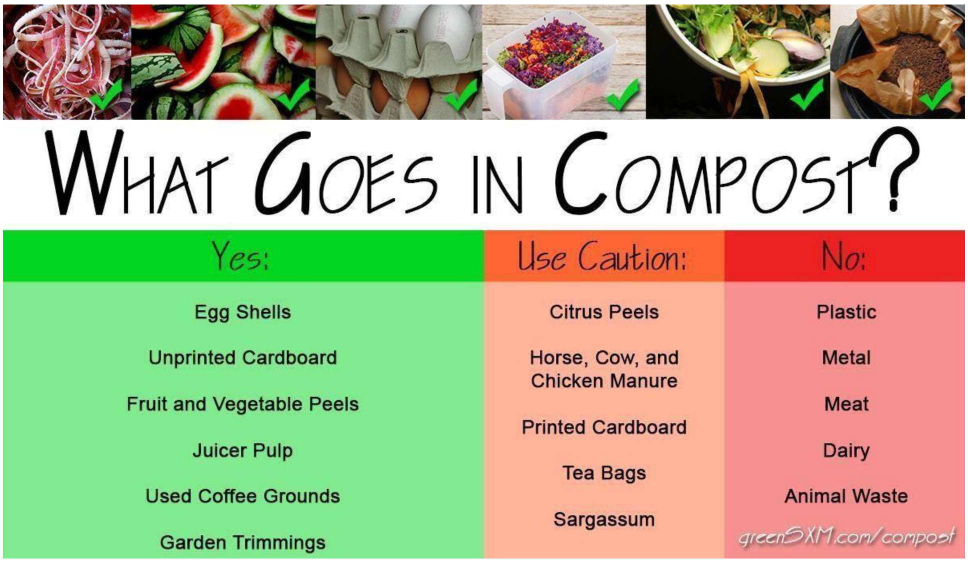
- What can be composted?

Good compost is obtained by mixing as many different ground material as possible;

- Kitchen waste (leftovers and bark of fruits and vegetables, eggshells, coffee and tea residue, leftovers of bread, pastries, lettuce, kale, chard, etc.)
- Garden or green waste (cutting grass and hedges, leaves, branches, withered flowers, fallen fruit, soil from flower pots, fruit and vegetable residues, weeds, bark)
- bio waste (wood bark, hair, straw, sawdust, particleboard, paper wipes, pine needles, small amounts of paper that have been wrapped in kitchen waste)

- What can't be composted?

- liquid food residues
- meat, fish, skin, bones
- dairy products, oils and fats
- Ash, packaging, rubber, hazardous waste
- Coloured and varnished wood waste
- paper and glass waste
- clothes, cigarettes



Slika 1: **Compostable and non-compostable materials**

2. STABILIZATION AND MATURATION

A finder obtained from the decomposition of a mixture of organic materials

2.1. Stabilization

- Mesophilic stage (with medium and little variable humidity).

At the beginning, the growth of the microbial mass, where aerobic bacteria predominate in the materials, releases carbon dioxide, water vapour and heat, with a consequent increase in temperature, which favours the development of mesophilic bacteria, actinomycetes and fungi, regulated by the presence of protozoa. The production of organic acids also determines a lowering of the pH around 4-5.

- Thermophilic stage

Reached the temperature of 40-50 ° C, most of the heat sensitive microorganisms, which had started the biological process, do not survive and are replaced by a more limited group of thermophilic bacteria, whose action leads to a further temperature increase up to 70 ° C.

The high temperature, the raising of the pH up to a value close to 8, due to the release of ammonia by the ammonizing bacteria,

The competition between microbial species are all unfavourable conditions for the development of pathogenic organisms, which die in a few hours, thus determining a sort of self-disinfection process.

2.2. Maturation

When the available substrate runs out, thermophilic bacteria slow down their activity, therefore, the production of heat is reduced and the compost gradually cools down. The pH in turn lowers due to the lower production of ammonia. In the latter stage, the presence of fungi and actinomycetes predominates, which feed on the residual food and begin the degradation of cellulosicmaterials, with the formation of substances that make up the humid acids, characteristic of humus. The compost thus tends to stabilize in all its mass, decreases the microbial activity with consequent further decreases both in temperature, up to values close to the environmental ones, and in pH, around neutral or slightly basic values (maturation stage) .

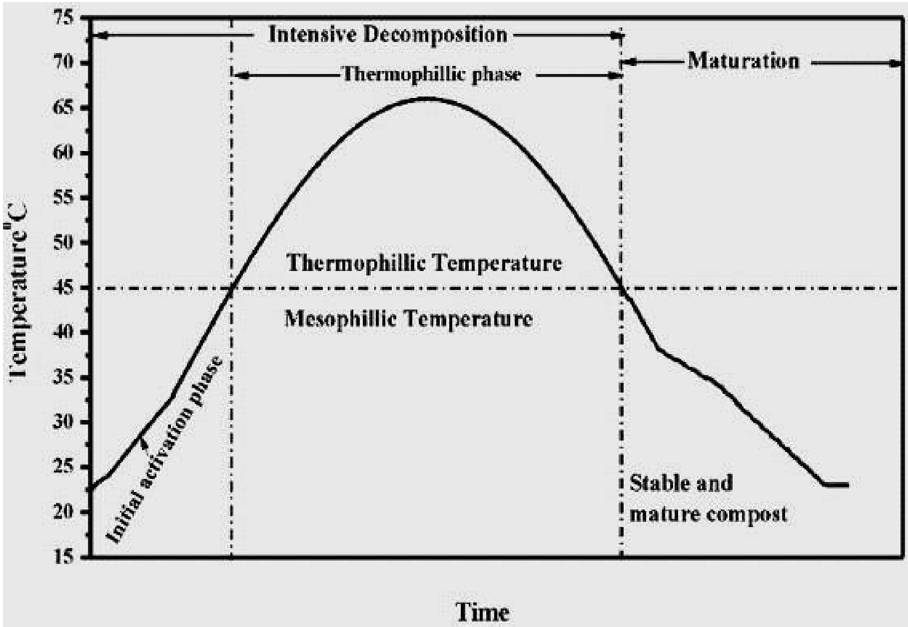


Figure 3 : Changes in Temperature and Ph During a Typical Static Composting Operation

3. MICROORGANISMS AND MACROORGANISMS PROTAGONISTS OF THE TRANSFORMATION

The transformation of the organic substance takes place through a process of biological aerobic decomposition: numerous biological and biochemical reactions caused by distinct bacterial and fungal species, actinomycetes, in the presence of protozoa.

These microorganisms, partly mesophilic and partly thermophilic, are the real architects of the composting process. There are also other macro-organisms involved.

For example, in the final stages of the process, when the temperature of the substrate tends to stabilize with respect to that of the surrounding environment, protozoa, helminths, mites and insects spread, living at the expense of the organic matrix and microbial cells.

3.1. The microorganisms involved

Composting is a purely microbial process, so knowledge of the different microbial groups involved and the role they play is extremely important. In general terms, the major groupings of microorganisms that participate in the composting process are:

bacteria and fungi, actinomycetes and eumicetes predominant. The latter include molds (filamentous fungi or simply fungi) and yeasts, which however usually play a secondary role in the stabilization of the organic substance.

The degradation of lignin is restricted to a limited microbial group: the upper fungi (basidiomycetes).

Generally, microorganisms are distributed differently within the heap: bacteria are found throughout the heap, whereas fungi and actinomycetes, on the other hand, are preferably detected in the layer between 5-15 cm from the surface.

3.2. Biodegradability and protagonists of the transformation

- Microorganisms and Bacteria

Bacteria are of different sizes and shapes (often filamentous) and are always present in the mass of organic waste since the beginning of the process. They remain active throughout the composting process and in particular at high temperatures. Their rapid multiplication even in different types of species allows the use of all organic residues.

- Mushrooms

Mushrooms act mainly on materials that resist bacteria. They therefore play a fundamental role. Mushrooms do not bear temperatures above 50 ° C; this explains why they are found in particular in the peripheral area of the compost and they are the only ones who can work in a drier compost, where the other organisms leave the lot.

- Actinomycetes or actinomycetes

They are a type of filamentous bacteria, they act later than other bacteria and fungi and multiply less quickly. Actinomycetes are active in the last stage of composting. They are specialized to attach themselves to the most resistant structures such as cellulose, hemicellulose and lignin (constituents of wood).

Alongside these three types of micro-organisms (bacteria, fungi, actinomycetes), algae, viruses and protozoa are also found in the compost.

- Macroorganisms

These are insects, worms, which appear in some phases and on some surfaces of the compost.

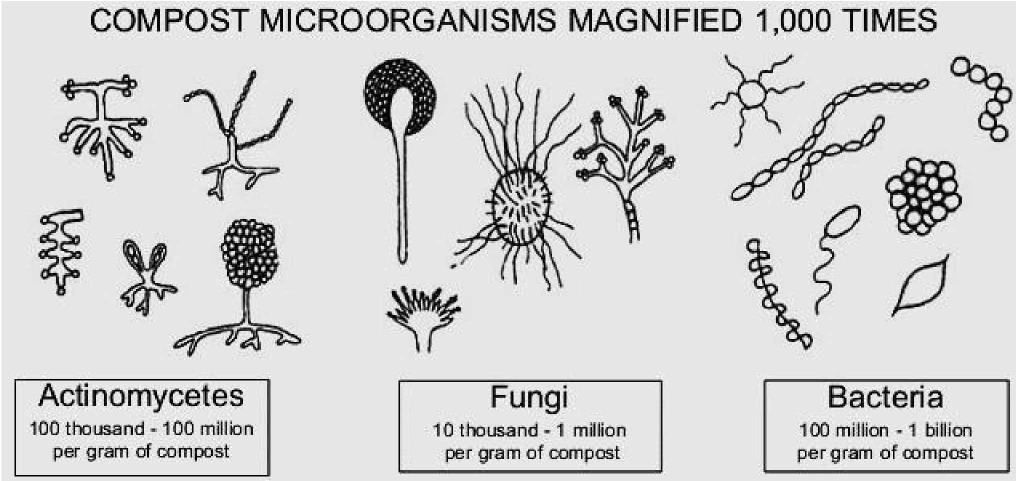


Figure 5: Compost Microorganisms

4. COMPOST HAS A PROCESS INFLUENCED BY SOME MAIN FACTORS

These are the main parameters that influence the biological process in the production of compost and are to be kept under control during its development:
-HUMIDITY,
-VENTILATION,
-NUTRIENTS,
-TEMPERATURE,
-PH,
-TIME.

4.1. Factors that influence the composting process

- Composition of the mass:

The mass to be transformed into compost is essentially made up of solids, water and gas, with continuous exchanges between the fractions, and the relationships between these components are extremely important both for the progress of the process and for the quality of the final product.

- List of wet / organic materials:

The physical and structural properties of the starting materials condition the composting process through the influence exerted on the aeration. These properties can be facilitated by shreddingthe starting materials and mixing them: satisfactory results are normally obtained when the average diameter of the particles of the composted matrix oscillates between 0.5 and 5 cm.

- Presence of oxygen and aeration:

the presence of oxygen, and therefore of air, is indispensable for the biological oxidation reactions that characterize composting to take place. In order to guarantee the quantity of air, it is almost always necessary to use a forced ventilation system (suction or insufflation), generally combined with a mechanical system for turning the heaps upside down.

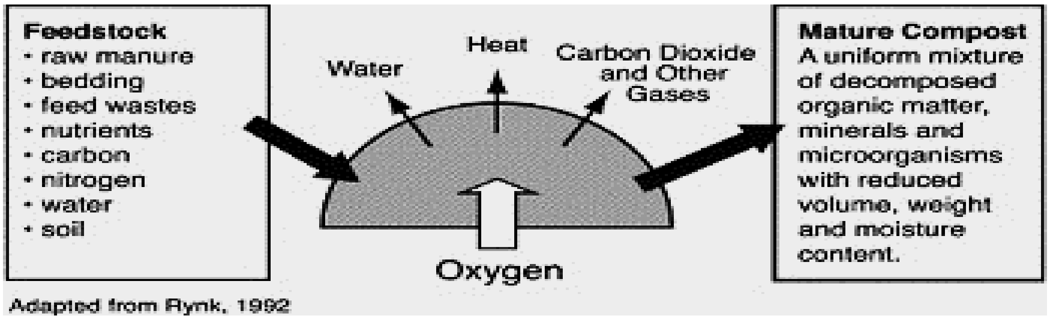


Figure: Schematic of composting process.

- Humidity:

Must be such as to guarantee optimal conditions of life of microorganisms. The optimal values are those between 40-65%. Therefore, you enter water spray.

- Temperature:

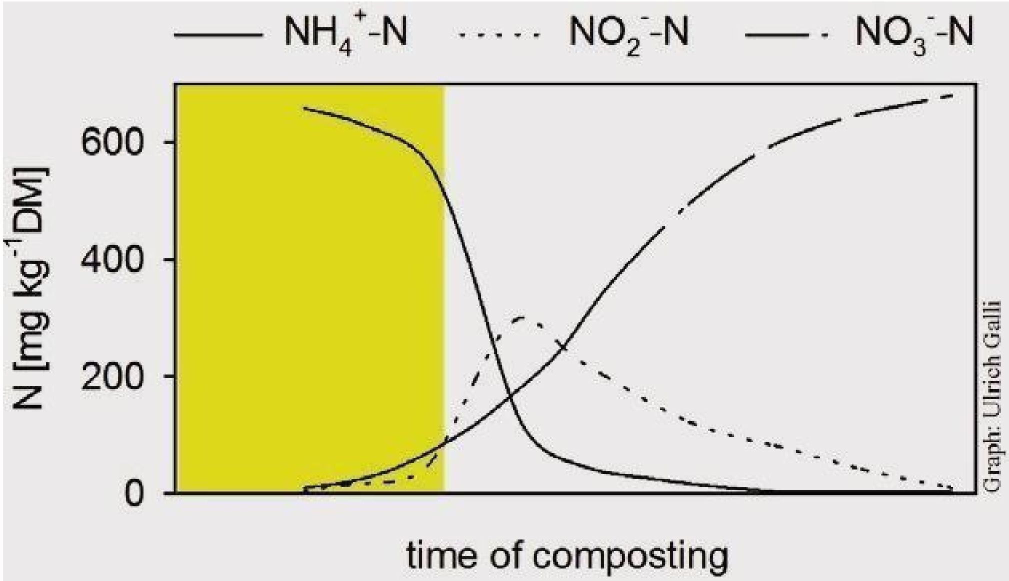
Microbial decomposition during composting releases a large amount of energy in the form of heat. In the initial phase and more active, the temperature values are placed around 50-60 ° C .

When the temperature in the mass exceeds 55-60 ° C , a strong selection is made among the microorganisms present. The widely set limit for the deactivation of human pathogens is 55 ° C. This temperature is also able to break down most of the phytopathogenic organisms, while weed seeds require temperatures not lower than 60 ° C.

Slika 2: **Temperature measurement is important to control the composting process.**

- Presence of nutrients and nutritional balance :

Most of the organic matrices intended for composting largely contain the main nutrients such as carbon, nitrogen, phosphorus, potassium, required by the microorganisms involved in the composting process. It is above all the amount of carbon and nitrogen in the substrate that can influence its stabilization through composting.



Slika 3: **Evolution of the mineralized forms of nitrogen in the compost piles during the composting process (Graph: Ulrich Galli).**

- pH :

Although the composting process is possible with residues having extremely variable H, the optimal values of this parameter for the starting material are around 5.5-8.0 . In fact, bacteria prefer a pH close to neutral, while mushrooms develop better in an acidic environment.

5. COMPOSTING METHODS

The two basic composting methods used today can be classified as:

(1) Static

(2) With agitation

In the static method, the compostable material does not move and the air is blown through the material.

In the agitation method, the composting material is rotated from time to time to provide oxygen, control the temperature and give a uniform product by stirring. If composting is done in the field with the agitation method, the waste is usually applied as a deposit (pile), and in the static method in the form of an embankment.

5.1. Composting by the deposition method

It is one of the oldest methods. In its simplest form, it is carried out by applying the organic material to be composted to form a bed width of 6 to 7 m, a height of 2 to 3.5 .

For low-grade systems with a backfill method, the material is rotated once a year, and in order to achieve complete decomposition, it takes from 3 to 5 years. Unpleasant odours also spread because some of the material is under anaerobic conditions.

For high-rise systems, these are heaps with smaller cross-sections, 1.8 to 2.1 m high and 4 to 5 m wide. With such systems, the material is turned twice a week. Composting is complete after 3 to 4 weeks. After a turning period, the compost is left for another 3 to 4 weeks to allow it to mature.

Slika 4: **Conversion Of Organic Waste into Soil Conditioner in 2 Months**

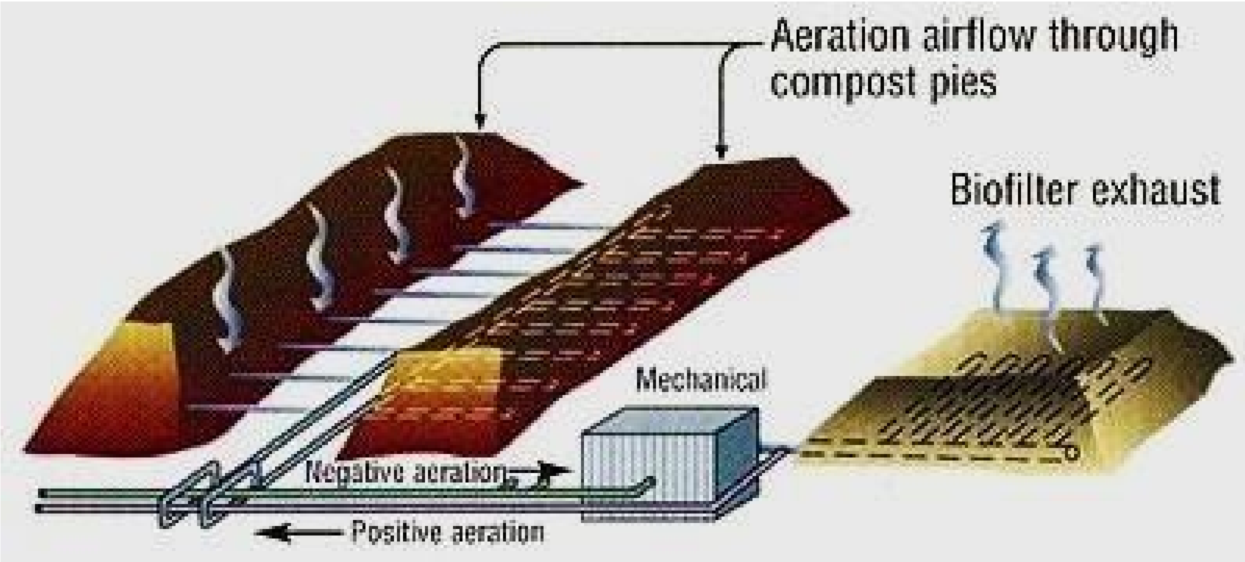
5.2. Aerated composting of static embankment

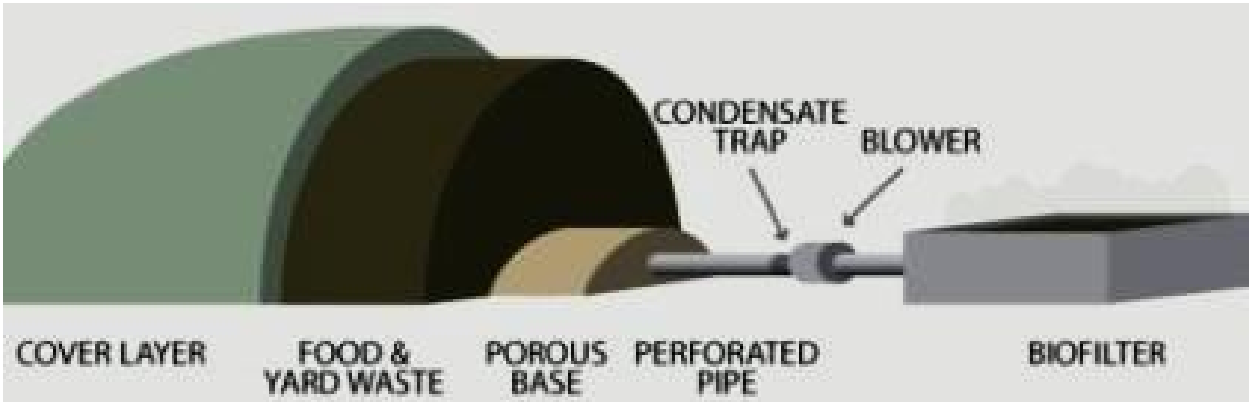
Aerated static embankments consist of a network of aeration tubes over which a pre-processed organic waste fraction is applied.

The height is usually from 2 to 2.5 m. A layer of averaged compost is usually applied from above through a formed embankment as insulation and to control the spread of odours .

Each embankment has its own fan for better aeration control. Usually, air is supplied through perforated plastic pipes. The air is blown in to provide the necessary oxygen for biological conversion and to control the temperature within the embankment.

Composting is done for three to four weeks. The maturation of the material takes place over the next four or more weeks.



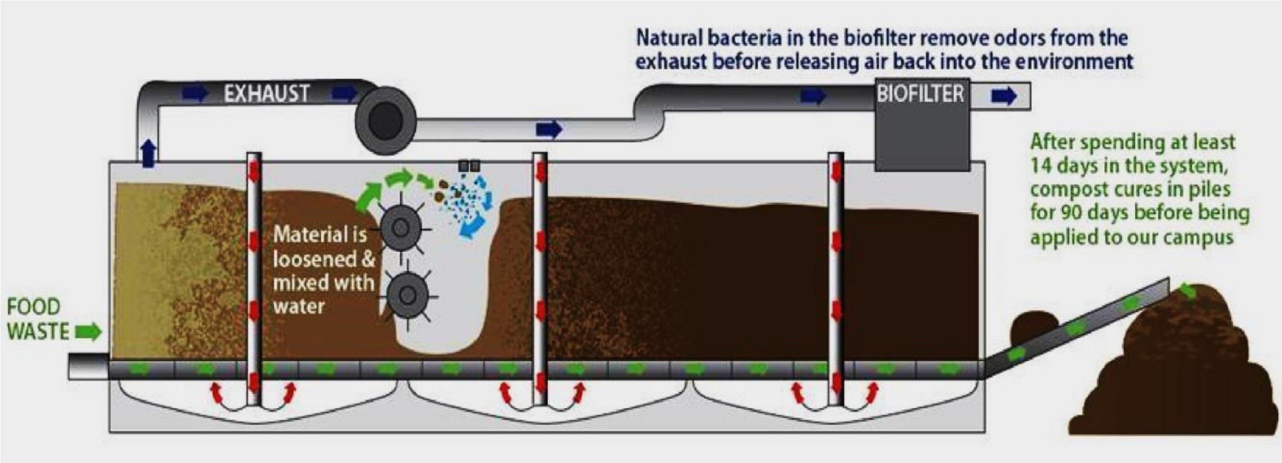


Slika 5: **Schematic Description of the main Systems of Centralised Composting**

5.3. Composting in a court

This type of composting is done inside a sealed container. Containers of all shapes can be used as reactors in these systems, including vertical drums, horizontal tanks and circulating rotary tanks. Mechanical systems are designed to minimize odour formation and processing time by controlling process conditions such as airflow, temperature, and oxygen concentration. These systems have become more populous in recent years due to simpler process and odour control, shorter running time, less handling costs and less space to occupy.

The retention time in the reactor is in the range of one to two weeks, while the maturation time is longer - from 4 to 12 weeks.



Slika 6: **Proposed Material Flow for Enhanced Composting Process**

5.4. Japanese method of composting

The Japanese architects came up with the idea of designing a round tea house, which would also be used for composting. The architects decided to use the evolving temperature during composting to heat the space, which was designed as a traditional Japanese garden hut for drinking tea. The outer walls contain a number of composting tanks. On the upper side, waste from the garden, grass, dry leaves and other materials of organic origin are inserted and compost is taken from the bottom. During the decomposition phase, the temperature at the centre of the compost can reach more than 60 °C, of which it will a small interior space is heated which, thanks to a transparent roof, is illuminated by natural light.

Slika 7: **Organic Waste Fertilizer Maker**

6. CENTRALIZED COMPOSTING PLANTS

The analysis of the types plant of composting not can that starting from the distinction between :

The systems open are those that are implemented outdoors or in local not completely closed ; the systems closed will refer to processes implemented in environments confined , in which it is possible to the control air in output from the heaps.

6.1. CUMULATING COMPOSTING

E ' derived from composting in cumulation outdoors , today in most part of the cases transferred in environment confined : the material organic is arranged in overlapping swath of size variables : in height from 1 meter to over 3 meters and in width from 2 meters up to 6-7 meters . Up to these widths there is the possibility of turning the mass in a single intervention ; when the width of the cumulation exceeds the 7 meters , the material is turned in the most past : in this case it speaks usually of cumulation in the table.

The size of the heaps depend essentially from the material to be treated and the system used for the reintegration in the cumulation of oxygen necessary to the process : the heaps ventilation forced (heaps static) are tend to be of smaller dimensions ; those in turning mechanical (heaps dynamic) can reach the size further .

In order to form, the heaps in section V (similar to those in sections triangular of greater dimensions) seem preferable for the better exploitation of space , given that the surface unused - not occupied by heaps - is lower . From this point of view , of course , the heaps at the table are even more interesting .

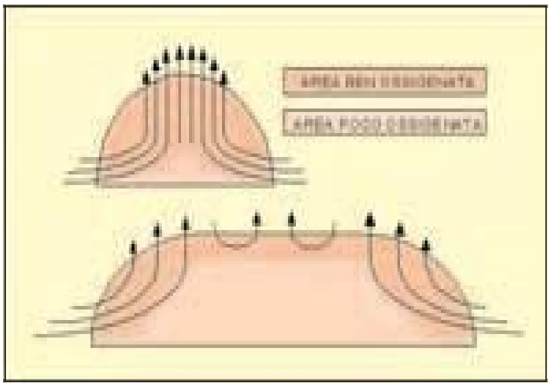


Figure 8 : Heaps of different width with the most oxygenated area in the case of natural ventilation.

6.2. STATIC CUMULES

The composting without turning and ventilation forced the mass can be feasible only in cases limit , with a material optimized in all the parameters of the process , given that the area affected by processes anaerobic in these conditions can be very extensive .

This is, in definitive , a solution devoid of interest practical , given that not allows to produce the material homogeneous : the heaps static are today used only for the storage of materials in waiting to be composted and, in any case , what should be done only for times limited . In fact , for some matrices with a high respiratory index such as grass coming from urban mowing , the start of anaerobic processes is generated in storage , with negative results in relation to emissions of annoying odours .

Figure 9 : The storage of lignocellulosic materials can be carried out in static accumulation without problems.

6.3. FORCED AIR REPLACEMENT CUMULES

The piles are made generally with section triangular or trapezoid of height equal to 1 5 - 2,0 m, width at the base of 2.5 - 3.0 meters and length theoretically unlimited (available in swath).

In the pavement they are formed the channels , covered by grids generally metallic , through the which is carried out the replacement air . Air can be sucked in ; also in this case by one or more centrifugal fans , the only ones able to overcome the resistance offered to the passage of air from the biomass in the pile .

At ventilation forced to suction it is attributed to a more homogeneous distribution of air and, consequently , a more regular oxygenation of the material . With the ventilation forced into compression , in fact , they are formed more easily in mass paths preferential for the air - however not be eliminated even in ventilation for depression - with the creation of unwanted areas anaerobic . The ventilation in depression , from the base of the mound , offers also the advantage of being able to convey the air directly to a plant for treatment of polluting gases . The air flow rates used are of the order of 50-100 m3 / h per m2 of surface , 3 , 5 -7.0 m3 / h per ton of material .

The oxygenation of the mass in composting only with a system air forced is not suitable toensure the optimization of the process , both for the already mentioned problem of the regularity of distribution of air in the mass , both for the problems the use of air cold , taken from the outside , in the period winter . This problem is of course the most heard in small heaps - just those that in general adopt this technology - and especially in the stage of initiation of the process , because it slows down the achievement of phase thermophilic .

The technique of replacement air with ventilation forced has constituted for long time the solution more adopted in composting : first in plants outdoors , then inside of buildings - however in systems open . It was a process managed approximately , given the difficulty of monitoring them with a system computerized , as is done today in the plants of new generation .

In installations in management computerized it intervenes with the ventilation when the content of oxygen lacunar is below the limit pre- set , that for the first phase - the most important of the process - is approximately the 5-15% by volume.

With this type of implant the first phase of the process lasts at least 3 weeks ; that of maturation a period at least similar .

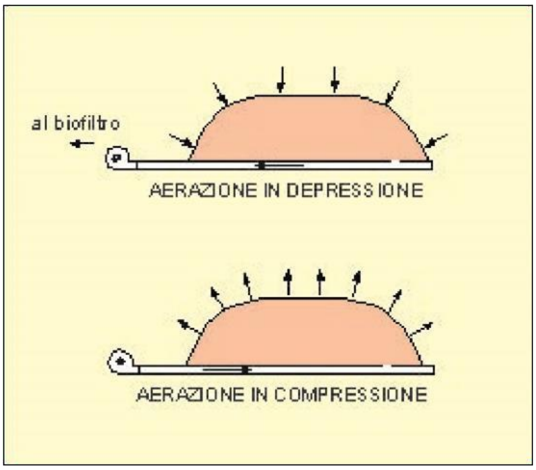


Figure 10 : Compression and depression heaps ventilation schemes

6.4. THE MECHANICAL REVOLVING CUMULES

In its configuration more simple the system is constituted by one or more heaps to section triangular or trapezoidal with a ratio between height and width approximately equal to 1: 2 and length theoretically unlimited .

For the turning , the shovel mechanics , which has constituted for decades the only solution adopted (and it is still in small installations especially treating biomass agro animal husbandry), it has been progressively replaced by the specific equipment of which it is spoken in the second part.

In terms of time , the first phase of the process has a duration indicative of 3-4 weeks , with turnings of norm carried out 2 - 3 times a week ; the second phase has a similar duration and involves two or three revolutions in the period .

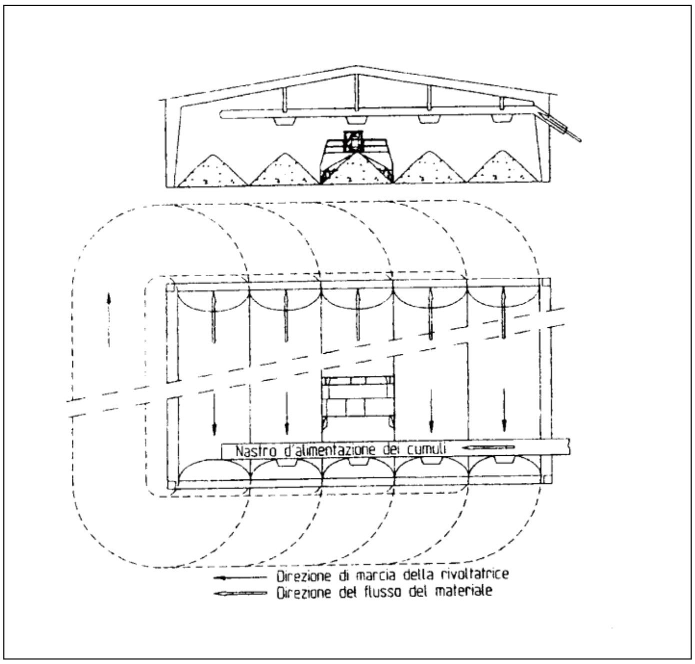


Figure 11 : Functional diagram of a dynamic heap system with mechanical turning, highlighting the empty return of the turning machine outside the building

7. THE PLANTS OF COMPOSTING HOUSEHOLD

Home composting is a natural process of decomposition of materials organic to obtain good soil from the garden's vegetable waste (grass, leaves, twigs, flowers) mixed and alternated with organic kitchen waste (fruit and fruit waste) vegetables, coffee grounds, etc.) Thanks to the high content of organic substance stable, compost provides a fundamental contribution for soil fertility and can be used as excellent soil conditioner on the garden beds, in the vegetable garden, at the base of trees or for houseplants.

There are different ways to realize a small plant of composting at home, in dependence of space at disposal , the amount of waste organic produced , time to dedicate .

The positioning is very important . It must be positioned in an accessible place all year round and possibly in the sun, perhaps under trees that lose their leaves (greater maintenance of optimal conditions). We present you a facility for composting well- managed non emanates bad smells .

7.1. Compost heap

Heaps - it is the piles of compost resting directly on the ground. The method is simple , easy to manage , it promotes oxygenation , interaction with earthworms and other useful animals . It is visible and dependent .

.

Figure 12: the use of the compost heap for composting

7.2. Compost heap pallet

Heaps fenced - are always in view, but are fenced with the pallets . Less easy to mix than simple heaps , but more orderly .

Figure 13: the use of the compost heap pallet for composting

7.3. Compost hole

Potholes - similar to piles, but buried . It would be well coated walls , and especially the bottom , with materials more coarse , such as gravel , pallets , branches, so as to favor the replacement of air and avoid accumulation of water . The material is less easy to turn over and pull out .

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Figure 14 : the use of the compost hole for composting

7.4. Composter

Composter - is a container of different sizes (from 200 to 1000 liters), comfortable in gardens and not very visible . It is less easy to manage and oxygenate , so it is better not to compress the material inside . It is always good to buy it with opening at the bottom to extract the ripe compost

Figure 15 : the use of the composter for composting

8. THE REGULATORY CONTEXT IN EU

Several countries have highlighted the problem of the lack of a provision on the matter, especially in the case of quality compost, which can be considered as a product and therefore included among the fertilizers admitted for marketing. In this case, a country that provides for less restrictive limits than another country can export to the latter a compost that does not respect the marketing limits if produced on site; this problem is evident in the European Commission.

Currently, at EU level it has been in place specific legal instruments on the eco-label (Ecolabel) for different products, on which the allocation system is identified by the Regulation 1980/2000 /

EC which replaced the Council Regulation 880/92 / EEC establishing the voluntary ecological quality certification system for products. The 1980/2000 / EC Regulation establishes that the quality mark can beassigned to products that contribute significantly to solving environmental problems of primary importance (article 3) and provides that the criteria for its assignment are identified by product groups (article 4). Pursuant to the procedures for the definition of the criteria relating to each group of products, provided for in article 6 of the aforementioned regulation, a series of measures have been developed and adopted for soil improvers and cultivation substrates, identified by the Decision of the Commission 2001/688 / EC. With this decision, the materials to be added to the soil in situ mainly to preserve or improve its physical characteristics and that can improve its characteristics or chemical and / or biological activities and materials other than soils are respectively defined as soil improvers and cultivation substrates. in situ, where vegetables are grown . The European ecological label certifies that the product to which it is applied guarantees a reduced environmental impact and allows the consumer to immediately check whether the product complies with the pre-established requirements or not.

8.1. The hierarchy of waste

The strategy Europe on waste establishes a preference for different options of management of waste that , in order , are : " reducing the production of waste , reuse , recycling , recovery of energy and waste ." This hierarchy is based on the effects that each option has on the environment and has as reference the general objective of sustainability .

To improve the management integrated of waste and contribute to a more sustainable it is necessary that the practices of management of waste will adapt more and more to the hierarchy of mentioned , moving away from the situation today in which a proportion preponderant of waste in some countries in Europe is still putting in landfill .

8.2. The Directive on landfills

The Directive on landfills 1999/31 / EC is intended to ensure a high level of protection of the environment in the disposal of waste in the Union European and encourage the means of prevention of mass in the landfill through the composting and biogasification as well as the recycling . The directive includes provisions for the reduction of the amount of waste biodegradable that can be placed in the landfill to avoid the damage environmental arising from the leachate and the emission in the atmosphere of the gas landfill (compound in good part by methane).

Article 5, paragraph 2, of the Directive includes objectives amounts to decrease the amount of waste biodegradable put into landfill , wondering of incentives to collect waste , the recycling and the recovery of energy . Many Member States have already introduced limits on the quantity of biodegradable waste destined for landfills .

For those States members that do not have yet established such limitations , the achievement of the objectives laid down by the Directive will present a challenge to the authorities local and industry of the management of waste . Alternative Vie management must be developed for the waste biodegradable , routes that achieve benefits environmental in a manner convenient from the point of view of economic . The most readily feasible is the composting , both centralized that home

Standards on the use and quality of compost exist in most Member States, but differ substantially, partly due to differences in soil policies. While there is no comprehensive Community legislation, certain rules regulate specific aspects of bio-waste treatment, biogas production and compost use.

The *Organic Farming Regulation* lays down conditions for the use of compost in organic farming.

The *eco-labels* for soil improvers and for growing media* specify limits for contaminants and require that the compost be of waste origin only.

The *Thematic Strategy for Soil Protection* calls for the use of compost as one of the best sources of stable organic matter from which new humus can be formed in degraded soils. An estimated 45% of European soils have low organic matter content, principally in southern Europe but also in areas of France, the UK and Germany.

9. CONCLUSION

Based on extensive literature review, composting research of different types of organic wastes shown different performance on the effectiveness of the composting process. Composting, as a treatment of organic waste, had been proven to significantly reduce the volume of wastes in the country. In addition, composting can also provide nutrients that are suitable for agriculture and can be used as fertilizer to replace chemical fertilizer. Furthermore, compost can also be used as soil amendments as well as being eco-friendly, hygienic economical and toxic free. In conclusion, during the composting of agricultural wastes the addition of animal manure can enhance the degradation process, whilst in the composting of municipal solid waste and kitchen waste it is important to measure the heavy metal content because of its toxicity and different method of composting influenced the nutrient status of compost. Nevertheless, the compost provided must comply with the standard limit to ensure the quality of the compost.

Table of advantages/disadvantages for centralised and household composting

	Advantages	**Disadvantages**

* Decision 2007/64/EC.

Centralised composting	▪ Require the least amount of land ▪ Most rapid production of composting parameters ▪ Odours can be controlled reasonably well inside a building in most cases ▪ Control release of leachate	▪ Most capitale intensive ▪ Requires extensive training of personnel ▪ Higher maintenance and operational costs
Household composting	▪ Good for the environment ▪ Improves soil structure and water rentention ▪ Natural , organic fertilizer ▪ Less cost involved ▪ Anyone can compost	▪ It's stinky ▪ It's ugly ▪ It's sucks up a lot of time and energy ▪ It's not a perfect fertilizer ▪ It many take longer than you expect

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