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BOKASHI MANUAL

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*The **ZEBRAS Project -Zero Waste through Bokashi Composting to Produce Compost for Healthy Soil***
Project no: KA210-VET-3F4E2C51, funded by the Erasmus+ Programme of the European Union

UNIWERSYTET ROLNICZY im. Hugona Kołłątaja w Krakowie

ISPARTA UNIVERSITY OF APPLIED SCIENCES

PiriTeknoloji

Co-funded by the European Union

Publisher: Infrastructure and Ecology of Rural Areas Association

Publication Editor: *Roman Rolbiecki*
Scientific Editor: *Kamil Ekinci*
Language Editing: *Emine Ekinci, Yasemin Kavdir*

Cover and Title Page Design: *Kamil Ekinci*

Reviewer 1: *Joanna Kocięcka*
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ISBN 978-83-966062-5-9

First Edition

Isparta, Kraków 2026

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Publisher: Infrastructure and Ecology of Rural Areas Association
Ul. Św. Jana 28
31-018 Kraków, Poland
Tel. 12 662 46 59

This manual is available in three language versions (English, Polish, and Turkish) exclusively online at: https://www.zerowastebokashi.org/

Co-Funded by the European Union.
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PREFACE

This handbook was developed within the framework of the Erasmus+ KA210 project dedicated to environmental education, sustainable household practices, and the promotion of ecological awareness in everyday life.
The main objective of this manual is to provide accessible and practical knowledge about Bokashi composting as an innovative method of organic waste management suitable for households, schools, community groups, and beginner gardeners.

Modern societies face increasing environmental challenges related to food waste, soil degradation, and excessive consumption of natural resources. In this context, small-scale household solutions such as Bokashi composting can play an important role in building more sustainable lifestyles and supporting local environmental responsibility.

This handbook presents the basic principles of Bokashi fermentation, the role of microorganisms, practical methods of using fermented material, and comparisons with traditional composting systems. Special attention is given to simple, low-cost solutions that can be implemented both in urban apartments and rural households.

The Authors hope that this publication will encourage readers to:

- ✓ reduce household organic waste,
- ✓ improve environmental awareness,
- ✓ support soil health and biodiversity,
- ✓ and actively participate in sustainable living practices.

We hope this handbook will serve as a useful source of inspiration, practical knowledge, and motivation for environmentally responsible action in everyday life.



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1. What Bokashi is and how does it work?

1.1. What is the Bokashi Process?

The rapid increase in organic waste generation represents a major global environmental challenge, contributing to greenhouse gas emissions, nutrient loss, and inefficient resource use. Conventional waste management practices, especially landfilling, lead to methane emissions and disrupt natural nutrient cycles. In response, sustainable waste management approaches have been developed to recover organic matter and reintroduce it into biological systems. One such approach is the Bokashi process, a fermentation-based technique that transforms organic waste into a nutrient-rich soil amendment.

The word *bokashi* comes from Japanese and means “fermented organic matter”. Bokashi is a composting method that involves the anaerobic fermentation process of organic matter using specific groups of microorganisms, resulting in a final product that is easily decomposed by the soil biota. It uses anaerobic fermentation, meaning the process happens without oxygen. In an airtight bucket, microorganisms ferment the food waste instead of fully decomposing it. Unlike traditional composting, bokashi does not rely on oxygen and high temperatures. This environment allows Effective Microorganisms (EM) to ferment organic waste rather than decompose it through oxidation. This method allows food waste to be processed quickly and efficiently while preserving nutrients that are often lost during aerobic composting.

The Bokashi method aligns with circular economy principles by converting waste into a resource and closing nutrient loops between food consumption and soil production systems. Bokashi composting starts with the collection of organic waste such as fruit and vegetable scraps, cooked food leftovers, coffee grounds, eggshells, meat and dairy products (kitchen waste). In a bokashi system, food scraps such as vegetable peels, fruit waste, cooked food, and even small amounts of meat or dairy can be added to a bucket (Figure 1). Unlike many composting systems, Bokashi can process a wide range of food waste, including materials that are difficult to compost in traditional systems. The second step is to ferment these wastes in Bokashi Bucket. Each layer of food waste is covered with bokashi bran, which contains special microorganisms. These microorganisms start the fermentation process. The bucket is then closed tightly to create an anaerobic environment. During fermentation, microorganisms break down sugars and organic compounds, organic acids are produced, harmful bacteria are suppressed, and nutrients are preserved in the material. This fermentation stage typically lasts 10–14 days.

The last step is the soil integration of fermented organic matter or pre-compost. After fermentation, the material is not yet fully composted. Instead, it becomes pre-compost. This fermented organic material is then buried in soil, added to garden beds and mixed into compost piles. Soil microorganisms continue the decomposition process, transforming the fermented waste into plant-available nutrients (Figure 1).

Bokashi composting eliminates the need to mix green and brown organic waste in precise proportions, produces no heat or greenhouse gases, and prevents nutrient loss because the waste is kept in a closed system. The bokashi composting is not affected by issues like rodents, insects, or foul odors from food waste because the system is closed Bokashi composting is a good method for the residential area with

the limited space in the living environment. For example, if there is enough space for a 19-liter bucket in the apartment, the kitchen waste can be bokashi composted thus preventing it from going to the city landfill and adding plenty of mature organic matter to the garden.



Figure 1. How bokashi works

1.2. Differences between Bokashi and Traditional Composting

Traditional composting is a natural biological process in which microorganisms, fungi, insects, and oxygen decompose organic matter into humus-like material called compost.

The process usually takes place:

- in outdoor compost bins,
- compost piles,
- garden composters,
- or open heaps.

The final product is a dark, crumbly, earthy-smelling fertilizer rich in nutrients and organic matter.

Traditional composting is based on aerobic decomposition, meaning that oxygen is essential. Microorganisms require air to break down organic matter effectively. As microorganisms work, heat is

generated. Temperatures inside a compost pile may reach 40–60°C during active decomposition, sometimes even higher in large system.

This heat helps destroy many pathogens, weed seeds, and harmful microorganisms. This heat helps destroy many pathogens, weed seeds, and harmful microorganisms.
Depending on temperature, humidity, waste composition, oxygen supply, and pile management, traditional composting may take from several months to more than one year.

In most home compost systems, users are advised not to add:

- meat,
- dairy products,
- cooked food,
- fats and oils,
- fish,
- large amounts of citrus,
- or animal waste.

These materials may attract pests, create odors, and disturb the composting balance.

Bokashi is a fermentation-based method of processing organic waste developed in Japan. The word “Bokashi” roughly translates as “fermented organic matter.” Unlike traditional composting, Bokashi does not rely mainly on oxygen and decomposition. Instead, it uses beneficial microorganisms that ferment food waste in an airtight environment.

Bokashi is an anaerobic process, meaning it occurs without oxygen. Food scraps are placed in a sealed container and layered with Bokashi bran. Over approximately 10–14 days, the waste ferments instead of rotting.

The material produced by Bokashi is not fully finished compost. It is a pre-fermented organic mass that requires:

- burial in soil,
- addition to a traditional compost pile,
- or further maturation.

After soil incorporation, decomposition continues rapidly and enriches the soil with nutrients. Table 1. lists the key differences between traditional and Bokashi composting.

Table 1. Bokashi vs Traditional Composting

Feature	*Traditional Composting*	*Bokashi Composting*
Type of process	Aerobic decomposition	Anaerobic fermentation
Oxygen requirement	Requires oxygen and airflow	Requires airtight conditions
Main microorganisms	Decomposer bacteria and fungi	Effective Microorganisms (EM)
Processing speed	Slow (3–12 months)	Fast (10–14 days + soil maturation)
Suitable location	Mainly outdoors	Indoors and outdoors
Space requirements	Requires garden or yard space	Suitable for apartments and small kitchens
Accepted waste types	Mostly plant-based waste	Nearly all food waste, including meat and dairy
Odor level	Earthy smell; may smell if poorly managed	Slightly sour fermented smell
Need for turning/mixing	Regular turning required	No turning required
Final product	Finished compost	Pre-fermented organic material
Additional processing needed	Usually not	Yes, burial in soil or secondary composting
Nutrient preservation	Moderate nutrient loss possible	Better nutrient preservation
Liquid fertilizer production	Usually absent	Produces Bokashi liquid (“tea”)
Cost level	Low	Moderate (requires Bokashi bran and bucket)
Best suited for	Gardens and large outdoor spaces	Urban households and indoor use

Bokashi and traditional composting are both valuable systems for reducing organic waste and supporting sustainable living. However, they operate through different biological mechanisms and are suitable for different environments and user needs. Traditional composting relies on aerobic decomposition and produces mature compost over a longer period (Figure 2). Bokashi uses anaerobic fermentation to process food waste rapidly in compact indoor systems. Understanding these differences helps households choose the most appropriate waste-management strategy and encourages environmentally responsible behavior. Both methods contribute to:

- reducing landfill waste,
- improving soil health,
- recycling nutrients,
- and promoting ecological awareness in everyday life.

As sustainable living becomes increasingly important worldwide, both Bokashi and traditional composting are likely to play a growing role in household environmental education and practical ecological management.



Figure 2. Differences between Bokashi and traditional composting

1.3. Advantages of Using Bokashi at Home

Modern households generate significant amounts of organic waste every day, including vegetable peels, fruit scraps, leftovers, coffee grounds, and cooked food. Traditional waste disposal methods often send these materials to landfills, where they contribute to environmental pollution and greenhouse gas emissions. Bokashi composting offers an alternative solution that is practical, hygienic, and suitable even for small living spaces.

One of the greatest advantages of Bokashi is that it can be used indoors. Unlike traditional composting systems, Bokashi does not require a large garden, outdoor compost piles, or extensive open space. The airtight Bokashi bucket can easily fit in kitchens, on balconies, in apartments, under sinks or in utility rooms.

This makes Bokashi especially valuable for people living in urban environments where outdoor composting may not be possible.

Bokashi can process a much wider variety of organic waste. Accepted materials include:

- fruit and vegetable scraps,
- cooked food,
- bread,
- rice and pasta,
- meat,
- fish,
- dairy products,
- eggshells,
- coffee grounds,
- and small bones.

This significantly reduces the amount of household waste sent to landfills. For busy households, this broad acceptance of food waste is one of Bokashi's most practical benefits.

Because the process occurs in an airtight environment, unpleasant rotting odors are minimized and this makes Bokashi comfortable and hygienic for indoor daily use.
Bokashi systems are simple to operate, even for beginners. No complicated turning, mixing, or aeration is required. This simplicity makes Bokashi highly accessible for families and individuals with limited gardening experience. Likewise, Bokashi fermentation occurs effectively indoors regardless of season, allowing year-round organic waste processing.

Additionally, children and family members can participate in the process, making Bokashi a valuable educational tool for promoting ecological habits in everyday life.

2. Basics of the bokashi process

2.1. The Role of Effective Microorganisms (EM)

Effective Microorganisms (EM) are a group of beneficial microorganisms that support the fermentation of organic materials and improve soil health. The concept of EM technology was developed in the 1980s by Professor Teruo Higa at the University of the Ryukyus in Japan. EM technology combines different naturally occurring microorganisms that work together to enhance microbial activity in soil and organic waste systems. In Bokashi composting, EM microorganisms are used to ferment organic waste such as food scraps, plant residues, and agricultural by-products. Unlike traditional composting, which relies on oxygen (aerobic decomposition), Bokashi composting is based on an anaerobic fermentation process carried out in sealed containers. This fermentation process transforms organic waste into a nutrient-rich material that can later be incorporated into soil to support plant growth and improve soil fertility.

Effective Microorganisms are not a single type of microbe. Instead, they are a mixture of beneficial microorganisms that work together in a balanced microbial community. The most common main types of microorganisms in EM are lactic acid bacteria (LAB), yeast, and photosynthetic bacteria. These microorganisms support each other through symbiotic interactions, producing beneficial compounds such as organic acids, enzymes, vitamins, and amino acids during fermentation. These substances help break down organic materials, suppress harmful microorganisms, and enhance soil microbial diversity.

During fermentation, beneficial microorganisms produce useful substances such as alcohol, amino acids, organic acids, and antioxidants through their metabolism. Part of the fermentation process involves the production of organic acids such as acetic acid, butyric acid, propionic acid, lactic acid, and others. These organic acids lower the pH, halting decay and initiating the fermentation process. A low pH environment has the ability to suppress and eliminate pathogens. The by-products formed as a result of fermentation contribute to the nutritional value of the final product (compost). During the fermentation process, microorganisms produce by-products that can suppress microorganisms that cause decay and disease.

2.1.2. Lactic Acid Bacteria

Lactic acid bacteria (LABs) is a taxonomically generalized term used to describe bacteria that convert sugars into lactic acid through lactic acid fermentation (Figure 3). LABs also lower pH by producing lactic acid. This acid helps prevent the growth of pathogenic microorganisms and reduces the development of unpleasant odors during fermentation thereby inhibiting the growth of various. In Bokashi systems, lactic acid bacteria create an acidic environment that supports the preservation and transformation of organic waste. They are widely recognized for their use in the production of naturally preserved fermented foods such as cheese and yogurt. LABs have multiple functions within the microbial consortium. They acidify the fermented content by lowering its pH from a moderate level to levels as low as 3. This creates an environment where both pathogenic and methane-producing bacteria cannot survive, thus preserving the nutrients in food waste and preventing their loss into the atmosphere.

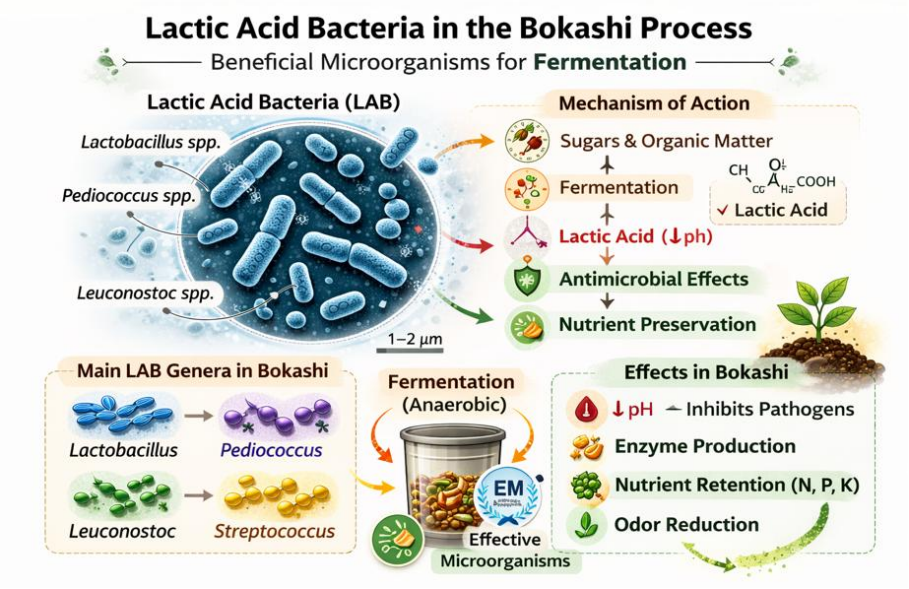

Figure 3. Lactic acid bacteria in the bokashi process

2.1.3. Yeasts

Yeasts are single-celled fungi that can be found in the air, soil, plants, humans—in short, everywhere (Figure 4). Through the secretion of enzymes they produce, yeasts break down organic matter by separating sugars, such as monosaccharides, into forms that can be absorbed back into their bodies through their cell walls. During this decomposition process, they produce beneficial byproducts such as vitamins, hormones, and amino acids. Yeasts play an important role in producing enzymes and vitamins that stimulate microbial activity. They help break down organic matter and produce substances that promote the growth of other beneficial microorganisms. Yeasts also contribute to the production of bioactive compounds that improve soil fertility. Yeasts utilize organic matter, roots, and amino acids and sugars secreted by phototrophic bacteria to synthesize antimicrobial and other beneficial substances necessary for plant growth. Bioactive substances produced by yeasts, such as hormones and enzymes, actively promote cell and root division (essential for plant growth).

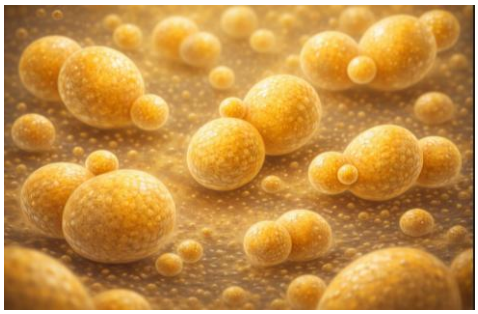

Figure 4. Yeast in the bokashi process

2.1.4. Photosynthetic Bacteria

Photosynthetic bacteria (Figure 5) are unique microorganisms that use sunlight and organic substances to produce useful compounds such as amino acids and bioactive molecules. These compounds support plant growth and contribute to nutrient cycling in the soil ecosystem. Purple non-sulfur bacteria are a group of bacteria that can survive under different conditions and adapt their energy production to the available conditions. They obtain their energy, for example, by using photosynthesis if light is available, and by using organic compounds if it is not.

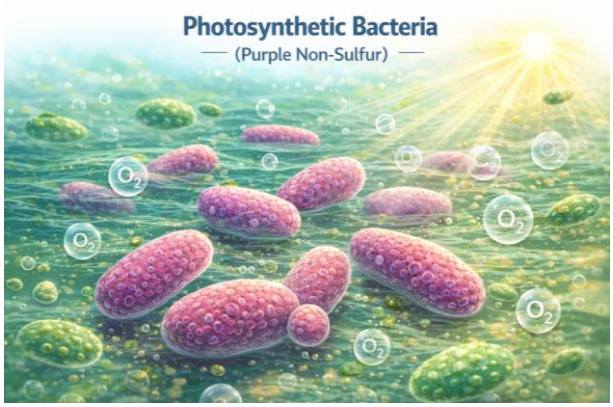

Figure 5. Photosynthetic bacteria in the bokashi process

2.1.5. How EM Works in Bokashi Composting

The Bokashi composting process begins when organic waste is mixed with Bokashi bran, which contains EM. The Bokashi system works effectively because these microorganisms interact synergistically. Instead of competing, they support one another, creating stable fermentation conditions that accelerate the preservation and transformation of organic waste. This microbial cooperation results in rapid fermentation, minimal odor production, nutrient preservation, and production of biologically active organic material beneficial for soil health.

The balanced interaction among microorganisms is one of the key reasons why Bokashi is considered an efficient and environmentally friendly method of organic waste management.

The fermentation process follows several stages (Figure 6):

1. Organic waste is placed in an airtight container.
2. Bokashi bran containing EM microorganisms is added.
3. The microorganisms begin fermenting the organic material.
4. Organic acids and enzymes are produced.
5. The fermented material becomes a pre-compost product.

During this process, nutrients in the organic waste are preserved rather than lost through oxidation or heat. The fermented material can then be buried in soil, where soil microorganisms continue the decomposition process and convert it into plant-available nutrients.



Figure 6. Bokashi process flow diagram

2.2. Bokashi bran

2.2.1. What is it and how does it work?

Food waste is essentially fermented when it is composted using bokashi. Particular group of microorganisms (consortium) are introduced into the food waste in order to regulate the fermentation process and produce the intended outcomes. Bokashi bran is typically used to make bokashi compost. Bokashi bran is a carbon-rich nutrient inoculated by a specific group of beneficial microorganisms. Bokashi bran has two main components: microbial component (biological part) includes Effective Microorganisms (EM) such as: Lactic acid bacteria (produce organic acids), yeasts (produce enzymes and vitamins), photosynthetic bacteria (support nutrient transformation). These microbes are responsible for fermentation, odor control, and pathogen suppression carrier material (the microbes need a surface to live on) is provided by wheat bran (most common), rice bran, sawdust, and dry organic matter. This material absorbs moisture, distributes microorganisms evenly, helps maintain anaerobic conditions. Additionally, Bokashi bran also contains molasses (sugar source), water to activate microbes. Molasses provides energy for microorganisms to grow and multiply.

A microbial inoculant is needed to make bokashi bran. The most widely used inoculant is commercially produced EM (EM-1 concentrate) mother culture. Several manufacturers sell these stock solutions under their own brand names. As long as it is produced by reliable manufacturers, any EM1 type mother culture will yield comparable outcomes in applications. The following explains how EM bokashi bran is made in accordance with "industrial standards." This calls for a few basic ingredients, many of which are readily available locally, like molasses and wheat bran, as well as EM mother culture, which is readily available online.

2.2.2. How to prepare Bokashi Bran

Ingredients needed are: 5.5 kg wheat bran, 84 ml EM mother culture (EM1) (approximately tea glass), 84 ml melas (approximately tea glass), 3.8-liter water (depending on consistency), and 2 x 19-liter buckets or bowl.

The procedure is as follow:

1. Add 2.8 liters of water to one of the 19-liter buckets/bowl.
2. Boil 1 liter of water.
3. Add 84 ml (approximately tea glass) of molasses to the boiling water and stir. Then pour this mixture into the 19-liter bucket/bowl containing 2.8 liters of water.
4. Add 84 ml (approximately tea glass) of EM mother culture to the molasses water and stir.
5. Put 5.5 kg of wheat bran into the other 19-liter bucket /bowl (Figure 7).
6. Slowly pour the EM mother culture, molasses, and water mixture into the bucket or bowl containing the wheat bran.
7. Mix the contents thoroughly by hand, making sure that all of the wheat bran is sufficiently moistened.



Figure 7. Mixing all the ingredients for EM Bokashi bran

8. The moisture content of the bran mixture should be approximately 50%. When you form the bran into a ball with your hand and gently toss it up and down, it should not fall apart. If you cannot form the mixture into a ball, try to form a ball by slowly adding small amounts of water, for example, a glass of water.
9. After all the ingredients are thoroughly mixed and the moisture content is brought to the appropriate level, the mixture is placed in a double-layered plastic bag (two plastic bags of the same size placed inside each other) (Figure 7). Garbage bags can also be used for this purpose for ease of preparation and good functionality. When the mixture is added, the inner bag is compressed until all the air is completely removed, and the bag is tightly sealed. The same process is applied to the outer bag to ensure no air remains.
10. Place the bags in a warm place, i.e., between 18-32 °C, and leave them to ferment for at least two weeks. Exposure to indirect light is acceptable; the bags do not need to be kept in the dark. During the two-week fermentation process, the bags should not be opened or their contents stirred again. After successfully fermenting the bran and transforming it into a usable end product, there are two options: bokashi bran can be dried (Figure 8) or use it while it's still moist. In the first option, after two weeks, it is spread in a thin layer and left to dry in the shade for a maximum of one day. In the second option, you can use the bran while it's still moist. If you do, it must be stored under controlled conditions. It's recommended to use the bran quickly because if damp bran isn't kept tightly sealed (without air) to maintain its anaerobic environment, it's prone to mold growth (of harmful types).



Figure 8. The mixture placed in a double-layered plastic bag



Figure 9. Drying of EM bokashi bran

Bran should smell sweet and sour/cheesy/vinegar-like. It may also have a slight alcohol odor. If you notice a musty smell (think of a damp basement) or a foul, putrid odor, the fermentation has failed. Since you can easily tell the difference between good and bad bokashi bran by its smell, you can quickly determine what kind of product you have.

Bran should have a sweet, sour, cheesy, or vinegar-like smell. Additionally, it might smell slightly of alcohol. The fermentation has failed a foul, putrid odor or a musty smell is detected. The scent of bokashi bran can be quickly distinguished. If there is white, mold-like mycelium on the bran, that's acceptable. If there is green or black mold detected, it means something went wrong during the fermentation process.

Since wheat bran is a byproduct of the flour industry, it can be found all over the world. You can buy it in the quantities you want. While larger quantities can be bought from animal feed stores in standard 50-kilogram bags, small amounts of wheat bran can be found in the food sections of many grocery stores. Wheat bran can be substituted with other carbon sources as substrates. Another appropriate substrate is rice bran, for instance. If the moisture content of coffee grounds is changed, they can also be utilized as a substrate. Wheat or rice bran can be added to high-moisture coffee grounds.

Easily digested nutrients like molasses, particularly sugarcane molasses, can be added to bokashi bran to hasten the growth of microorganisms. Sugarcane molasses is a concentrated by-product of the refining process in sugar factories. It is high in carbohydrates and has many vitamins, minerals, and trace elements that are absent from white refined sugar.

Molasses containing sulfur or other preservatives should be avoided. Anything added to molasses will inhibit the fermentation of the bran and the growth of microorganisms. Pure molasses, whether its source is organic or not should be preferred. Another important detail is to ensure that no pH buffering agent is mixed into the molasses as a preservative. This is because this detail can interfere with the fermentation process when fermenting bokashi bran or activating EM, thus hindering its effectiveness.

Chlorine-free tap water, spring water, or filtered water can be used.

2.2.3. Culturing homemade lactic acid bacteria (LAB) solution

A homemade lactic acid bacteria (LAB) solution can also be used for bokashi composting. However, commercially produced EM concentrates (like EM1) are highly complex collections of microorganisms, and it takes intricate procedures to get them all to cooperate in a consortium. This is difficult to accomplish, even in the best of circumstances at home. In reality, only lactic acid bacteria (LAB) are present in a homemade EM solution, whereas photosynthetic bacteria, yeast, and lactic acid bacteria are present in EM1. Additionally, none of the other supporting members of the consortium are present in homemade lactic acid bacteria. It provides a solution for a single microorganism. This is referred to as homemade EM.

Although lactic acid bacteria can ferment food waste, they might not have the same ability to reduce odor as other microorganisms on the EM1 list. In some cases, the amount of homemade EM to make bokashi composting could be more than that of commercially produced EM1. Additional assistance may be required to determine the strength of a homemade starter culture (LAB) in comparison to a known EM1.

Homemade lactic acid bacteria (LAB) solution can be made as follow (Figure 10):

1. One cup of rice (from a freshly opened package with a recent expiration date) is rinsed with two cups of water (chlorine-free) and left to soak for 15 minutes. The rice water is strained and the strained liquid is left to sit in a dark place for a week. After a week, it is gently strained. The strained bottom portion is transferred to a larger, clean jar.



Figure 10. Production of homemade LAB

2. Eight or ten cups of milk (farm or pasteurized milk) are added. The jar is left uncovered for about a week. After a week, proteins clump together at the top of the jar, forming a cheesy layer that can be fed to pets. A yellowish, sour-smelling liquid remains at the bottom. This liquid is lactoserum, or bokashi mother culture (Figure 11).



Figure 11. Bokashi mother/pure culture

3. After straining, add 2 tablespoons of molasses to the liquid portion. This forms homemade lactic acid bacteria (LAB) solution. You can tell it's done correctly by doing a smell test; it should smell like vinegar. [It can be stored in the refrigerator at +4°C for 6 months]. Fermentation continues, albeit very slowly, at +4°C. The jar lid should be loosened occasionally to release the gas (Figure 12).



Figure 12. Pure culture can be mixed with molasses and stored at room temperature, outside of the refrigerator

3. Bokashi equipment at home

Bokashi composting is a regulated anaerobic fermentation process that needs specialized tools to guarantee maximum microbial activity and effective waste conversion. The microorganisms and the bokashi bucket, or fermentation vessel, are crucial components in the production of bokashi compost. Because Bokashi depends on airtight conditions and liquid management, unlike traditional composting systems, the design of the composting container is crucial. The container must be kept sealed and airtight for the duration of the waste's successful anaerobic fermentation. As long as the buckets are airtight, they can be used in a variety of sizes, whether they are made at home or purchased commercially. In terms of usability, functionality, and durability, commercially manufactured bokashi buckets are virtually identical, with only slight variations in design.

The double (nested) bucket design and the spigot bucket are the most popular systems. These designs facilitate the collection of Bokashi leachate, encourage microbial fermentation, and stop oxygen intrusion. Depending on the frequency of use, these designs enable the separation of solid and liquid fractions during fermentation and the use of bokashi leachate.

Since oxygen inhibits fermentation and encourages aerobic decomposition, an efficient Bokashi system must be airtight to keep oxygen out. Organic waste releases liquid (leachate) during fermentation. To avoid putrefaction, prevent excess moisture, and maintain ideal fermentation conditions, the system must enable effective drainage. Effective Microorganisms (EM) require a stable environment in the container, which includes controlled moisture, restricted airflow, and a constant temperature.

3.1. The double nested bucket

For Bokashi leachate collection, this design is the simplest. Two 19-liter (five-gallon) buckets and an airtight lid are necessary for this design (Figure 13). A two-bucket design nestled inside one another is appropriate if bokashi leachate is to be kept at the bottom of the bucket for extended periods of time. The inner bucket (perforated at the bottom) and outer bucket (liquid collection chamber) of the nested bucket system are positioned inside one another.



Figure 13. The double-nested bucket design

The inner bucket contains small holes drilled at the bottom that allow liquid to pass through (Figure 14). The size or number of holes is not critical; it is recommended that they be large enough to allow the liquid to drain (e.g., a 6.35 mm diameter hole). This hole size will not cause clogging and will allow sufficient drainage of the waste. Inner bucket has perforated base, holds organic waste, and allows liquid drainage. Outer bucket has no holes and collects Bokashi leachate.



Figure 14. Drilling hole at the bottom of bucket

The two buckets will fit perfectly inside each other, leaving an air gap at the bottom between the two buckets where the bokashi leachate can be collected. To harvest bokashi leachate from the bucket, top bucket should be removed and pour the leachate from the bottom bucket. This design supports gravity-driven liquid separation, reduce microbial inhibition, and improve fermentation efficiency. Excess liquid accumulation can lead to anaerobic imbalance and odor formation, making separation essential. Threaded bucket lid with airtight rubber seal could be used to maintain airtightness of the outer bucket (Figure 15).



Figure 15.Threaded bucket lid with airtight rubber seal

3.2. Spigot bucket

Using a homemade bokashi bucket, which is a 19-liter (5-gallon) bucket with a tap attached, is another way to harvest bokashi leachate (Figure 16). The bottom of the bucket is where the tap (Figure 17) should be placed. It is impossible to place the bucket on a level surface if the tap is installed too close to the bottom of the bucket because the tap tip will be lower than the bottom and touch the ground. A rubber seal should be fitted inside the bucket to prevent leakage. Then the tap nut should be tightened. By placing a raised platform inside (sieve at the base of the bucket) (Figure 18), a plenum can be created on the ground for the collection of bokashi leachate. Bokashi leachate should be allowed to flow by providing a raised, permeable substrate that keeps organic waste at the top.



Figure 16. Spigot bucket (homemade bokashi bucket)



Figure 17. Bucket tap



Figure 18. Bucket sieve

Regardless of size, the organic waste in a bokashi bucket needs to be compressed as much as possible. The easiest way to compress waste is with a plastic bag. Furthermore, commercially produced press cover (Figure 19) can also be used. Immediately after adding the waste to the bucket, place the plastic bag flat on top of the waste. The bag will create an oxygen barrier between the fermented food waste and the air pocket above it, and it also provides a clean surface for compressing the waste. Simply lay the bag flat and press down with your body weight.

The tap enables regular removal of leachate, maintenance of optimal moisture levels, and prevention of anaerobic failure. Leachate should be drained every 1–3 days to maintain system stability.

It should be noted that the lid must remain closed to maintain anaerobic conditions and prevent contamination.



Figure 19. Press cover

Commercially produced bokashi buckets are all essentially the same; they only have minor design differences in terms of ease of use, functionality, and durability. They all feature an airtight lid, a riser to keep food waste at the top, a compartment for the bokashi tea to drain to the bottom, and a tap for emptying the bokashi leachate. The buckets are designed for ease of use and convenience. if a high-quality bokashi bucket or system, commercially designed and produced buckets can be purchased (Figure 20).





Figure 20. Commercially produced bokashi bucket

If there is sufficient waste, a +190-liter (+50-gallon) plastic bin or wheeled trash can be used in place of a 19-liter (5-gallon) bin. But it's also important to consider the weight when it's full; a +190-liter bin will be heavy and challenging to move when it's full of moist organic waste (Figure 21). From a bucket-based standpoint, it may be more practical to use multiple smaller buckets rather than a single large one. However, some restaurants and industrial settings also use 190-liter plastic bins or wheeled trash cans because of the excessive amount of daily kitchen waste. When deciding on the system's size, the quantity of waste generated must be taken into account. It is advised that the fermentation bin be big enough to fill with waste in no more than two weeks—shorter is preferable since opening the bin every time to add fresh food waste lead to oxygen enter the system (bokashi fermentation must be anaerobic).

The likelihood of spoiling and decay increases with the number of times the bin is opened and closed, delaying fermentation and decreasing the likelihood of anaerobic microorganisms becoming dominant. Fermentation typically fails if the lid is continuously opened and closed for more than two weeks. If fermentation bin is too big, it should be replaced with a smaller one.

For the average family, a 19-liter bucket is perfect; most families fill it up in less than a week. With four different buckets, you have a continuous system that enables you to continuously make soil conditioner and collect newly generated kitchen waste during rotation.



Figure 21. Commercially available 220 litter Bokashi container

3.2. Bokashi composting kitchen waste

In bokashi composting, a symbiotic community of microorganisms turns organic matter—like waste—into a beneficial soil conditioner (compost) while preventing it from fermenting into hazardous by-products. Because these microorganisms do this outside of a lab, in their "real wild" environment, the outcomes will always differ to some extent as conditions change. Although it is anticipated that everything will go according to plan, this isn't always the case because factors like temperature, the kind and combination of kitchen waste, moisture content, and bran quality can all have an impact. It is extremely difficult for the process to fail entirely because it is generally quite tolerant. The organic matter will continue to nourish the soil even if fermentation is unsuccessful.

The process of bokashi composting involves fermentation. This indicates that the waste has a similar appearance both inside and outside the bin. However, the soil biota further breaks it down after it is incorporated into the soil, turning it into a dark black humus. Food waste can only be fermented to speed up the initial process.

The size of waste materials should be decreased for bokashi composting. The total surface area exposed to the microorganisms rises as the size decreases. Cutting and shredding the materials also gives the microorganisms places to attach. Natural substances found in fruit and vegetable peels stop them from fermenting. As a result, cutting and shredding the peels facilitates the breakdown, feeding, and passage of microorganisms through the protective barrier. They will quickly eat fruits that have been crushed and their peels shredded. Therefore, when adding waste to your bokashi bin, it is much better to shred it into small pieces rather than leave it whole and large.

The fermentation process will be sped up by using a knife to shred food waste into smaller pieces before adding it to the bokashi bucket. This approach meets the needs of small-scale composting companies looking to expedite their operations. Many small-scale farmers want to quickly turn food waste into usable compost. The cycle can be sped up by pre-processing the waste.

Food waste must be exposed to a microbial source in order for it to ferment. Usually, microorganisms are added to bokashi bran, a solid organic matter carrier. Because bokashi composting doesn't use oxygen, it must be done in a closed space. The following steps describes how to ferment kitchen waste using bokashi bran and a homemade or commercial bokashi bucket.

1. Sprinkle a layer of bokashi bran at the bottom of the sieve. It's enough for the soil to cover the bottom in a powdery layer (Figure 22).



Figure 22. Sprinkle a layer of bokashi bran at the bottom of the sieve

2. Add a layer of kitchen waste on top. It is preferable that the waste be cut into small pieces (Figure 23). Organic waste from our households is broken down into small pieces approximately 3-5 cm long. This makes it easier for beneficial microorganisms to access and transform the waste. The layer should be approximately 2.54 cm (one inch) thick.



Figure 23. Kitchen waste cut into smaller pieces with a knife

3. Sprinkle a handful of bokashi bran on top of the kitchen waste layer (approximately 2.5-3 mm thick); a thin layer of powder is sufficient (Figure 24); it doesn't need to be thick. If there are meat products among the waste, sprinkle extra bran in that area. Adding more bran is better than adding less. If there is a foul odor after adding waste to the bin, extra bran needs to be added.

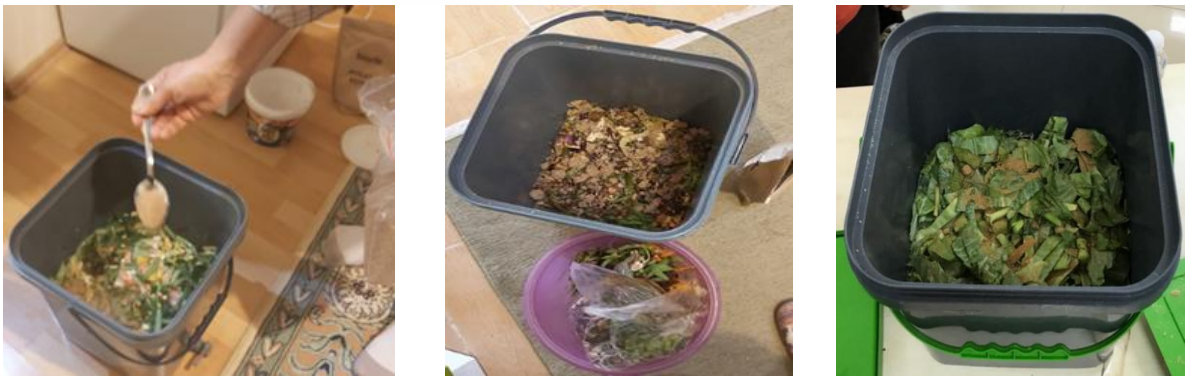

Figure 24. Sprinkle a handful of bokashi bran on top of the kitchen waste layer

4. Gently mix and compress the contents (Figure 25). Compressing the contents increases contact between the microorganisms in the bokashi bran and the food waste. It also helps reduce air gaps between the ingredients and forces excess liquid to drain downwards in the system.



Figure 25. Compressing kitchen waste with press cover

5. Cover the layer of kitchen waste sprinkled with bokashi bran with a plastic bag (Figure 26) and press down. This step isn't mandatory however; it helps keep the waste in a more airtight environment until the bin is completely full. Another optional step is to place a brick, a bag of stones, or another heavy object on top of the bag to help compact the layers.



Figure 26. Use of plastic bag

6. The lid of the bin is closed (Figure 27). When adding the next batch of waste, the lid is opened, the waste is added to the bin, beneficial microorganisms are sprinkled in, it is compacted, and the lid is closed again. This process is continued until the bin is full.



Figure 27. Closed bokashi bucket in the kitchen

7. Once the bucket is full of waste, it is placed in an environment with a temperature of 16-32 °C, away from direct sunlight, and left for 15 days to allow the waste to ferment. Depending on the air temperature, the bokashi leachate should be emptied from the tap at the bottom of the bucket once or twice a week. The leachate (Figure 28) can be diluted 100 times and poured into the soil or undiluted down the sink as a drain cleaner without delay.



Figure 28. Bokashi leachate

Two weeks later, when the bucket is opened, a sour, apple cider vinegar-like smell will be detected. If the bucket smells like vinegar instead of foul-smelling, the fermentation has been successful. The difference between a foul-smelling product and a successfully fermented, sour, apple cider vinegar-like product is easy to discern.

After a successful fermentation, there will be will usually see white, cotton-like mycelium covering the surface of the food waste (Figure 29). White mycelium is a sign that things are going well, which is good. As long as the bucket smells good, the fermentation is successful. Seeing white mycelium is good, but it's not a mandatory sign of successful fermentation.



Figure 29. Successful fermentation

4. Bokashi Feedstocks

4.1. Organic materials from waste

Feedstocks are the organic raw materials used in the Bokashi process. Feedstocks serve as substrate, nutrient sources, microbial hosts, and structural components of bokashi formulations.

A. Kitchen & Organic Food Waste

These are the most fed materials in a typical Bokashi bin. If the food waste pieces are large, they should be chopped into smaller pieces, ideally less than 5 cm in size, to ensure better processing and decomposition.

- Fruit and vegetable scraps: Peels, cores and trimmings from vegetables and fruits such as banana peels, pomegranate peel, orange and apple peels.



- Bread, grains, and mixed meal leftovers such as white or whole wheat bread, rolls, pasta, rice, bulgur, couscous, noodles, breakfast cereals, leftover sandwiches, pizza crusts, cooked grain dishes, and mixed meals like casseroles, pilaf, or stir-fry dishes containing grains.
- Meat, fish, dairy products such as raw or cooked beef, chicken, lamb, and turkey, fish and seafood, processed meats like sausages or deli slices, dairy products including milk, cheese, yogurt, butter, and cream, as well as leftovers from meals containing these ingredients.
- Coffee grounds and tea bags,



- Eggshells and small bones



B. Bran & Carrier Materials (for Bokashi Bran / Starter)

Bokashi bran is a carrier base inoculated with microbes like lactic acid bacteria and yeast, essential for fermentation. Research shows wheat and rice bran are the most common carriers for bokashi starter, often combined with a higher-N bran (castor bean, cottonseed, or legume). It's often made from:

- Wheat bran,



- Rice bran or husk,
- Castor bean bran,
- Cottonseed / legume brans,
- Other brans or husks like oats, barley, or millet,
- Brewer's spent grain,
- Coffee grounds,
- Sawdust.

These provide structure and carbon, and act as hosts for the microbial starter during fermentation. Molasses or sugar solutions can be used as easily fermentable carbon source.

C. Carbon-Rich Materials

Some Bokashi systems include dry carbon materials to improve texture and aeration:

- Coconut coir (shredded),
- Wood shavings or sawdust (from untreated wood),
- Dried leaves or straw,
- Cardboard/ paper in small amounts (for moisture control).

These materials play an important role in the process by helping to balance the overall moisture content and providing a valuable source of carbon. Goat manure, horse bedding waste, rice husk biochar, and cow manure can be used as feedstocks in different proportions. For example, a good-quality Bokashi fertilizer can be produced by combining 60% horse bedding waste, 20% cow manure, and 20% rice husk biochar and can be produced at the end of 30 days of maturation. This combination was not phytotoxic as indicated by the seed germination bioassay test. Biochar produced from fruit stones (cherry, olive, apricot, and peach pits) can also be effectively used as a component in Bokashi feedstock mixtures.

D. Nitrogen-rich materials (fertility boost)

The reason of using high nitrogen feedstocks is to keep C/N ratio (around 25–30:1 in the mix, 10–20:1 in the finished bokashi). These includes dairy, poultry, swine, cow, goat, horse, sheep and goat manures and fishmeal and fishery wastes.

E. Specialized Additives & Local Resources

In more complex or purpose-specific Bokashi formulations (like biofertilizers), additional ingredients may be used:

- Molasses or brown sugar (microbial food source),
- Charcoal / biochar (surface area for microbes, nutrient retention),
- Manure or soil clays (microbial diversity & nutrients),
- Rock flour / wood ash (mineral sources),
- Local crop residues (rice husk, maize stover, etc.).

Adding molasses for extra carbon sources can reduce N-NH_3 loss during the composting of dairy wastes and wheat straw.

4.2. Materials Less Suitable or to Avoid

Extra moisture in the bokashi bucket can be problematic. Liquids such as beer, milk, juice and oil can cause extra moisture. Avoid using:

- Molasses that contains Sulphur,
- Moldy or rotten food,
- Large and hard moldy or rotten food bran,
- Materials such as big bone pieces,
- Non-organic waste (plastic, metal),
- Excess dry carbon without sufficient moisture, for example, adding large amounts of dry bread, dry rice, or tea leaves without mixing them with moist food scraps can create excess dry carbon without sufficient moisture.



Figure 30. What to avoid in Bokashi

5. What to do with the Fermented Material

After the Bokashi fermentation process is completed, the resulting material is not yet fully mature compost. Instead, it is a nutrient-rich pre-fermented organic mass that requires further integration into soil or additional decomposition. Proper management of the fermented material is essential to obtain the greatest environmental and agricultural benefits.
This section explains practical methods for using Bokashi-fermented material in households, gardens, and container cultivation.

5.1. Burying in the Soil

The most common method of using Bokashi-fermented waste is direct burial in soil.
The fermented material should be:

1. Buried in a trench or hole approximately 15–30 cm deep,
2. Covered completely with soil,
3. Left for several weeks before planting.

During this stage:

- microorganisms continue decomposition,
- organic matter integrates into the soil,
- nutrients become available to plants.

Fresh Bokashi material is acidic due to fermentation. Direct contact with roots immediately after burial may temporarily stress young plants. Allowing the material to stabilize in soil for 2–4 weeks, usually provides sufficient time for safe nutrient transformation.
Burying Bokashi material improves soil fertility, microbial diversity, moisture retention and long-term soil structure.

This method is particularly suitable for:

- vegetable gardens,
- flower beds,
- orchards,
- and raised beds.

5.2. Use of bokashi pre-compost for plants

Bokashi material can also be used in home gardens and container cultivation. In gardens, fermented material may be:

- buried between plant rows,
- added to planting holes,
- incorporated into empty beds,
- or mixed into garden soil before the growing season.

Many gardeners use Bokashi to improve vegetable production, flowering plants, shrubs and fruit trees. For potted plants, smaller quantities should be used carefully.
Recommended practices include:

- burying small portions deeply below the root zone,
- mixing fermented material with soil before planting,
- avoiding direct contact with delicate roots.

Container plants may benefit from improved nutrient availability, better water retention and enhanced microbial activity. However, excessive quantities may temporarily increase acidity or create anaerobic conditions in small pots.
Bokashi is an organic amendment similar to compost, providing organic matter and nutrients such as nitrogen, but it can be produced more quickly due to the use of microbial inoculants. However, depending on the materials and method, the final product may sometimes be only partially stabilized.

Bokashi can improve plant growth, yield, and leaf nitrogen content, improper management especially high ammonium levels may lead to environmental risks or phytotoxicity. Therefore, assessing Bokashi maturity and safety (e.g., nitrogen forms and seed germination tests) is important before use.

Studies on Bokashi application generally show positive effects on plant growth and yield. For example, research with spinach demonstrated that Bokashi not only improved plant growth and productivity but also provided a more balanced nitrogen supply than vermicompost and more readily available than thermophilic compost. In addition, Bokashi enhanced the nutritional quality of plants by increasing essential nutrients such as potassium, iron, manganese, and zinc.

Bokashi leachate, Bokashi tea or juice, is derived from the Bokashi composting process, which involves the anaerobic fermentation of organic material combined with a Bokashi mixture. The tea is a mixture of all materials placed in the bucket, including water, organic waste, bokashi bran, microorganisms, and their by-products. This liquid is typically yellow orange in color and has a vinegar-like odor. It should ideally be used within a few hours after collection. Even if Bokashi tea cannot be applied to plants immediately, it can still be poured into sinks or toilet drains.

Since Bokashi tea is acidic, ***it should be diluted at least 1:100*** with water before being applied to soil. Direct application to plant leaves may cause burning. A more diluted solution (1:500) can also be used for seed soaking.

Bokashi application consistently improves crop yield and growth across multiple species, including coffee, lettuce, peanut, tomato, and shallot. Notably, shallot yield increased by up to 145%. In lettuce, Bokashi enhanced total and marketable yield as well as head size. Bokashi compost has shown positive effects on several plants. It increased seedling survival (87–100%) and height in *Pinus pseudostrobus* by reducing transplant shock. In coffee (*Coffea arabica* cv. 'Bourbon'), Bokashi applications at 60–66% improved yield. For passion fruit (*Passiflora edulis*), a 16% Bokashi application resulted in the best early growth and development.

Parsley: Applying bokashi to the soil at 15% and 30% concentrations increased the chlorophyll index and dry matter weight of parsley leaves. A 30% application rate also increased the leaf phosphorus (P)

levels of parsley plants and the soil P content. To enhance parsley plant growth, it is recommended to apply at least 15% by weight (**150 g compost per 1 kg of soil**) of bokashi compost to the soil.

Lettuce: Bokashi compost was thoroughly mixed with the soil and pre-incubated for 60 days. At the end of the incubation period, the soil was homogenized by hand to ensure uniformity. Subsequently, one lettuce seedling was transplanted into each pot, and the plants were allowed to grow for two months. Results showed that dairy manure bokashi was the most effective treatment for lettuce, improving growth and nutrient uptake, especially at an application rate of **7.5 t/ha.** Composting the manure into bokashi provided better results than using raw manure.

Okra: 10 g/plant EM bokashi application promoted both vegetative and reproductive performance of okra producing thicker stems and more fruits. The best approach is to combine reduced NPK with EM bokashi to achieve balanced growth and more sustainable production.

Cocoa: The most effective treatment was **2 kg bokashi per tree** per year which significantly improved soil chemical fertility and increased cocoa yield. Additionally, Bokashi provides essential nutrients and enhances soil quality while reducing harmful elements such as aluminum, which can be toxic at high levels.

In summary, the recommended bokashi application rates are approximately 5 t/ha for spinach, 7.5 t/ha for lettuce, 3 t/ha for arugula, and 3 t/ha for onion, while for potted plants, at least 10 g per plant can be recommended.

5.3. Use as a Soil Improver

One of the most important advantages of Bokashi material is its role as a soil improver. Unlike synthetic fertilizers, Bokashi contributes not only nutrients but also organic matter and beneficial microorganisms.
The addition of fermented organic material helps:

- loosen compact soils,
- improve aeration,
- increase water-holding capacity,
- and support healthy root development.

Bokashi supports beneficial soil organisms such as: bacteria, fungi, earthworms and other decomposers. Healthy microbial activity contributes to nutrient cycling, disease suppression, and long-term soil productivity. Fermented Bokashi material contains nutrients including: nitrogen, phosphorus, potassium, calcium, and micronutrients. These nutrients become gradually available as decomposition continues in the soil.

Bokashi compost from the bucket should be buried in soil for a pre-composting stage before being applied to plants. The recommended steps are outlined below.

How to Apply Bokashi Pre-Compost in Soil

- Dig a trench about 30 cm deep and shovel-width. The length should be roughly twice the height of your container,
- Drain excess bokashi liquid from the bucket (if present) and save it for later use,
- Empty the bokashi pre-compost into the trench and spread it evenly,
- Add a thin soil layer (about 2.5 cm) on top and mix thoroughly with the pre-compost,
- Fill the trench with soil, leaving about 15 cm of soil cover to prevent animals from accessing it,
- Wait for decomposition: Planting is possible after about 2 weeks. Most material becomes unrecognizable within 4 weeks.

Pre-compost is buried in the soil because the acidic environment breaks down the cell walls of the waste, allowing them to be further decomposed and assimilated in the soil. It also raises and balances the pH of the soil. By combining with beneficial microorganisms in the soil, they establish dominance over harmful microorganisms that cause disease. In the pre-composting process, the waste comes out of the bin looking exactly the same as when it enters, but as fermented food waste. Just like with pickled cucumbers, the fermentation process doesn't change the external appearance of the waste, but it changes its chemical internal structure (Figure 31). They can be planted between rows of plants, 30 cm away from the roots. It can be buried by digging a 30 cm hole (Figure 32). It can be planted in a pot (after 15 days, the lid can be opened and plants can be planted on top) (Figure 33 and 34).



Figure 31. Pre-compost or bokashi compost



Figure 32. Plantation between rows of plants, 30 cm away from the roots and buried by digging a 30 cm hole

Besides burial in soil, Bokashi material may also be:

- added to traditional compost piles,
- incorporated into raised beds,
- used in greenhouse cultivation,
- or applied in permaculture systems.

Adding Bokashi material to traditional compost often accelerates decomposition and increases microbial activity.

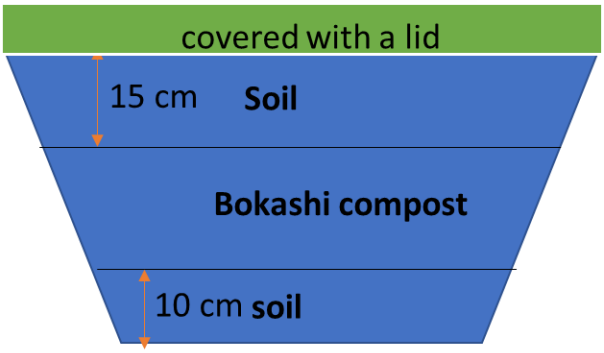

Figure 33. Diagrammatic application of bokashi in a pot



Figure 34. Plantation in a pot

Planting can be done on the area where the pre-compost has been buried after 2 weeks. The pre-compost will be completely transformed in approximately 2-4 weeks. This time frame varies depending on the type of waste, soil conditions, and air temperature (Figure 35 I 36).



Figure 35. Mature compost in the soil



Figure 36. Use of Bokashi precompost

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6. Large-scale bokashi compost production in the field

Bokashi-composting of rose oil processing waste of 500 kg can be done in the field. A waste pile was created with 6-7 layers, 1 meter in diameter and length, in the following order: Bokashi Bran + LAB + 15 cm of waste. The pile was then filled with a mixture of 4 liters of chlorine-free water + 400 ml of molasses + 400 ml of LAB using a 5-liter backpack sprayer, ensuring a 60% moisture content for each layer. It should be noted that you can also create the pile with Bokashi bran. you can create a pile 1-1.5 meters high by placing a few shovels of Bokashi bran at the bottom, then 15-20 cm of organic waste on top, and then another few shovels of Bokashi bran in layers.

For a homogeneous mixture, it can be stirred with a shovel, covered with thick, opaque nylon, and supported with weights. The application can be done on sloping concrete or soil surfaces. The seeping water will not pollute groundwater.









7. Practical Recommendations for Households

7.1. Important rules for beginners

For beginners interested in ecological waste management, the following recommendations are useful.
If Choosing Bokashi:

- Keep the container tightly sealed,
- Drain liquid regularly,
- Add Bokashi bran after each layer,
- Avoid excessive liquid accumulation,
- Bury fermented waste in soil promptly.

Consistency and proper management are more important than the method itself. New users often encounter small problems during the learning process. The most common mistakes include:

- leaving the lid open too often,
- adding excessive liquid,
- insufficient Bokashi bran,
- storing waste too long before fermentation,
- or exposing fermented material directly on the soil surface.

Most problems can be solved easily through better moisture control and proper sealing.

7.2. Safety and Good Practices

To obtain the best results, several practical recommendations should be followed:

- Do not leave fermented material exposed on the soil surface.
- Always cover the material with soil.
- Avoid direct contact with young roots immediately after application.
- Use moderate amounts in small containers.
- Store fermented material only for short periods after fermentation.

Proper management ensures efficient nutrient recycling and minimizes odor or pest problems. Bokashi-fermented material is a highly valuable organic resource that can significantly improve soil quality and plant growth when used correctly.
The most effective uses include:

- burial in garden soil,
- application in raised beds,
- careful incorporation into pots and containers,
- and use as a biological soil improver.

8. The significance of Bokashi

Macronutrient Enhancement

Research shows that bokashi application increases key nutrients, including nitrogen (N), phosphorus (P), and potassium (K). Bokashi introduces a diverse blend of Effective Microorganisms (EM), including lactic acid bacteria and yeast, which stimulate the decomposition of organic matter and improve nutrient mineralization. It also enhances soil enzyme activity (such as phosphatase and urease), which is crucial for nutrient cycling

EM bokashi made from food waste is an effective organic soil amendment that provides a longer-lasting supply of plant-available nitrogen compared to thermophilic compost and vermicompost. It improves plant growth and biomass due to sustained nutrient release (N, P, K). Additionally, the anaerobic fermentation process creates a reduced environment that increases the availability of redox-active micronutrients such as iron (Fe) and manganese (Mn). Bokashi provided a more prolonged supply of inorganic nitrogen to plant. Overall, EM bokashi can be considered a suitable supplemental or alternative fertilizer for organic vegetable production systems.

Multi-year studies have demonstrated that bokashi can significantly improve essential soil mineral content. While bokashi can be applied alone, its effects become more pronounced when combined with other soil amendments such as biochar due to synergistic interactions. For example, the co-application of bokashi and biochar significantly increases total soil nitrogen. Available phosphorus can increase by up to 80% in bokashi + 2% biochar treatments compared to the control, and by about 58% compared to bokashi alone. Similarly, extractable potassium levels can be up to four times higher than in untreated soils. Overall, these findings indicate that combining bokashi with biochar enhances nutrient availability and improves soil fertility more effectively than using bokashi alone.

Water retention

Bokashi compost and bokashi–biochar mixtures are also highly effective in improving soil water retention and enhancing plant water use efficiency under limited water conditions. This combination helps reduce water stress and supports better plant performance. In addition, the combined application contributes to increases in soil pH and organic carbon, further improving soil quality.

Bokashi compost application to soil significantly improved soil water retention, particularly during the winter season. In podzol soils, bokashi enhanced water retention up to 77%.

Soil aggregate stability and CEC

Bokashi increases the soil's Cation Exchange Capacity (CEC), making it easier for plants to access nutrients. It also improves soil structure and water-holding capacity. Application of 50 t ha^{-1} bokashi compost significantly improved soil aggregate stability (mean weight diameter), increasing it by about 0.73 mm (40.5%) in winter at the podzol site. Across seasons, bokashi showed an even stronger improvement, with an increase of up to 1.21 mm from summer to winter, indicating a substantial positive effect on soil structure compared to the untreated control. Bokashi improves soil structure and

aggregate stability, which physically protects organic carbon from decomposition and further enhances SOC retention.

Enhancing Carbon Sequestration

Bokashi is increasingly recognized as a superior method for carbon management compared to traditional aerobic composting. Because bokashi is an anaerobic process, it retains more of the original organic matter. It can increase soil organic carbon by up to 17% more than traditional composting methods. Bokashi contains sugars, organic acids and microbial biomass that contribute to labile carbon pools. Over time, part of this carbon is transformed into more stable forms such as humic substances, contributing to long-term carbon sequestration.

Reduced Emissions

Traditional composting often releases higher levels of greenhouse gases, particularly methane. In contrast, bokashi fermentation produces minimal methane, effectively "locking" carbon into a stable form within the soil.

9. Overview

Bokashi composting is an innovative and environmentally friendly method of organic waste management that allows households to recycle food waste efficiently, hygienically, and sustainably. Unlike traditional composting, Bokashi uses anaerobic fermentation supported by beneficial microorganisms to transform kitchen waste into nutrient-rich organic material (Figure 37).

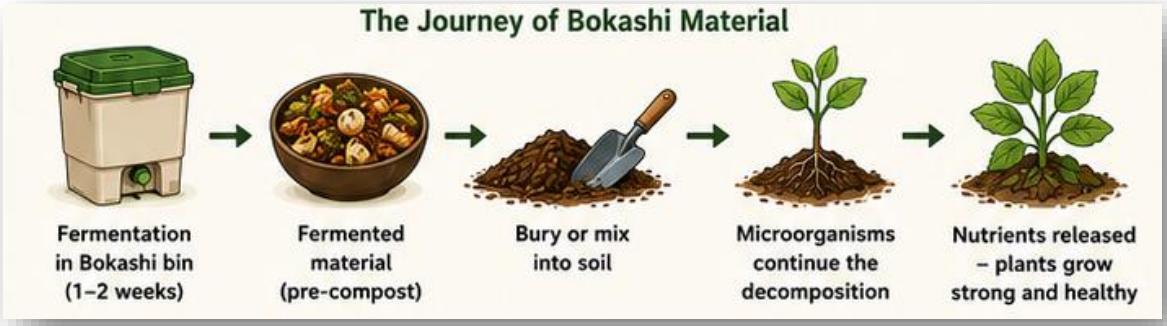

Figure 37. Bokashi process

Bokashi is especially valuable for:

- urban households,
- apartment residents,
- beginner composters,
- environmentally conscious families,
- and individuals seeking simple waste-reduction methods.

The method demonstrates that even small daily household activities can contribute to sustainable living and environmental protection.
Successful Bokashi composting depends on several fundamental principles:

1. Anaerobic Fermentation
2. Use of Effective Microorganisms (EM)
3. Proper Waste Management
4. Secondary Soil Integration

Beginning Bokashi composting is relatively simple and requires only a few basic materials. To start a home Bokashi system, users typically need:

- a Bokashi bucket with an airtight lid,
- Bokashi bran or microbial inoculant,
- a small kitchen container for collecting scraps,
- and access to soil, garden beds, or compost for final processing.

Commercial Bokashi kits are widely available and designed for beginners.

Step-by-Step Beginner Process include:
Step 1 — Collect Food Waste
Step 2 — Add Bokashi Bran
Step 3 — Compress and Seal
Step 4 — Drain Liquid Regularly
Step 5 — Complete Fermentation
Step 6 — Transfer to Soil

In many regions, food waste represents a major environmental challenge. Household Bokashi systems allow individuals to participate directly in local environmental protection efforts. Small-scale composting practices can collectively create significant ecological benefits.

Bokashi composting is not only a technical process but also an educational activity. Families, schools, community gardens, and educational organizations increasingly use Bokashi as a practical teaching tool for environmental education.

Bokashi composting demonstrates that sustainable environmental practices can be simple, practical, and accessible to nearly everyone.
By transforming kitchen waste into valuable organic material, households can:

- reduce environmental impact,
- improve soil health,
- support plant growth,
- and participate actively in ecological stewardship.

The Bokashi method combines traditional biological knowledge with modern sustainability practices, offering an effective solution for contemporary waste-management challenges.

Even small household actions can contribute to healthier ecosystems and a more sustainable future.

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