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Composting Seafood By-Products

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by Philip H. Averill

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As costs of waste disposal rise, due to the closing of old landfill operations and other improvements in environmental management, alternative methods of handling seafood processing by-products must be found. Since disposal is becoming one of the most expensive end uses of by-products, it is now economically feasible to use these materials and possibly produce an income as well. This may change these materials, presently thought of as mere waste, into a valuable commodity.

There are several methods available to convert seafood by-products into usable forms. Conversion to livestock feed or pet food by **dehydration, grinding, anaerobic digestion, or hydrolysis** are all currently practiced to some extent. Most of these methods require either large volumes or large capital investments, or both, and some also carry the risk of odor or other environmental problems. **Composting** offers another alternative to the conversion of by-products, specifically to a fertilizer or soil amendment product. Which of the above methods a seafood processor chooses to handle his by-products is a business decision based on volume, location, available market, and manpower.

This booklet is designed to assist the seafood processor who has performed the above analysis and determined that composting may be the best way to handle his by-products. This is only a brief introduction to the various composting methods, and before beginning a compost operation, a seafood processor should enlist the aid of an experienced compost specialist.

What Is Composting?

Composting uses natural processes to break down plant and animal material into its basic components. The only engineering needed is to set up a system that helps this process occur quickly and evenly through-

out the pile of organic material. The material itself is broken down odorlessly by living organisms (**microbes**) which require oxygen to live, grow, and "do their thing." The various compost methods described below involve different ways to get that oxygen into the pile evenly. Heat is produced by the action of the microbes, and pile temperature is monitored daily as a means of determining the health of the decomposition organisms within the compost pile.

How Does It Work?

Just like any other living thing, the microbes in the compost piles need carbon and nitrogen, as well as oxygen, to live. Seafood by-products are high in nitrogen (anaerobic conversion of nitrogen to ammonia is one of the causes of the odor of rotting seafood). Anything made from plants such as wood chips, peat moss, or shredded paper is high in carbon. A compost operation shreds the nitrogen (seafood) and carbon (plant material) to a small size so they can be well mixed, and then places them in a pile so the microbes can "eat" the nitrogen and carbon to live and make more microbes to "eat" more nitrogen and carbon, and so on. This process continues until either the nitrogen or the carbon runs out. At that point, the pile of seafood and plant material will have been converted into an enriched loam material suitable for growing plants.

It is essential that oxygen (air) be supplied to the pile, either by providing air inlet pipes (**static pile method**) or by turning the pile over on a regular schedule (**turned pile method**). These are the two primary ways to compost seafood waste. The choice of which one to use determines not only the cost of the operation but also the potential markets for the final product.

Methods of Composting

Static Pile

The static pile method of composting incorporates air inlet and outlet pipes in a pile as it is built. Typically, inexpensive 4-inch sewer and drain pipe is used, and sometimes a blower is added to assist air flow. Once the pile is built, no further handling of the material is needed until the composting process is complete. This represents a great savings in the cost of the operation. However, since the material is not mixed and turned repeatedly, the final pile is not homogenous. The center of the pile is composted most thoroughly, while the outside surface is composted to a lesser extent. This makes the final product difficult to sell. In a large-scale operation, the installation and removal of the many pipes used in this method can also be a problem. Nevertheless, for small operations where the final product is given away or used in

the backyard garden, this low cost method is "the way to go." It is also a good way to start a small operation which will later grow into a larger business.

Turned Pile

The most common method of composting employs a turner. In this method, a windrow is made of mixed plant and sea-food materials. Windrows are usually 6-10 feet wide and 100-200 feet long. They are arranged so that heavy equipment, including a purpose-built turner, can work down one pile and up the next to turn and mix the pile on a daily basis. This turning incorporates the air into the pile and maintains a loose texture. It also makes the piles compost evenly, producing a salable, homogenous product. While the costs of the turning equipment are higher than the static pile mentioned above, this method opens up the whole area of compost marketing and running the operation at a profit.

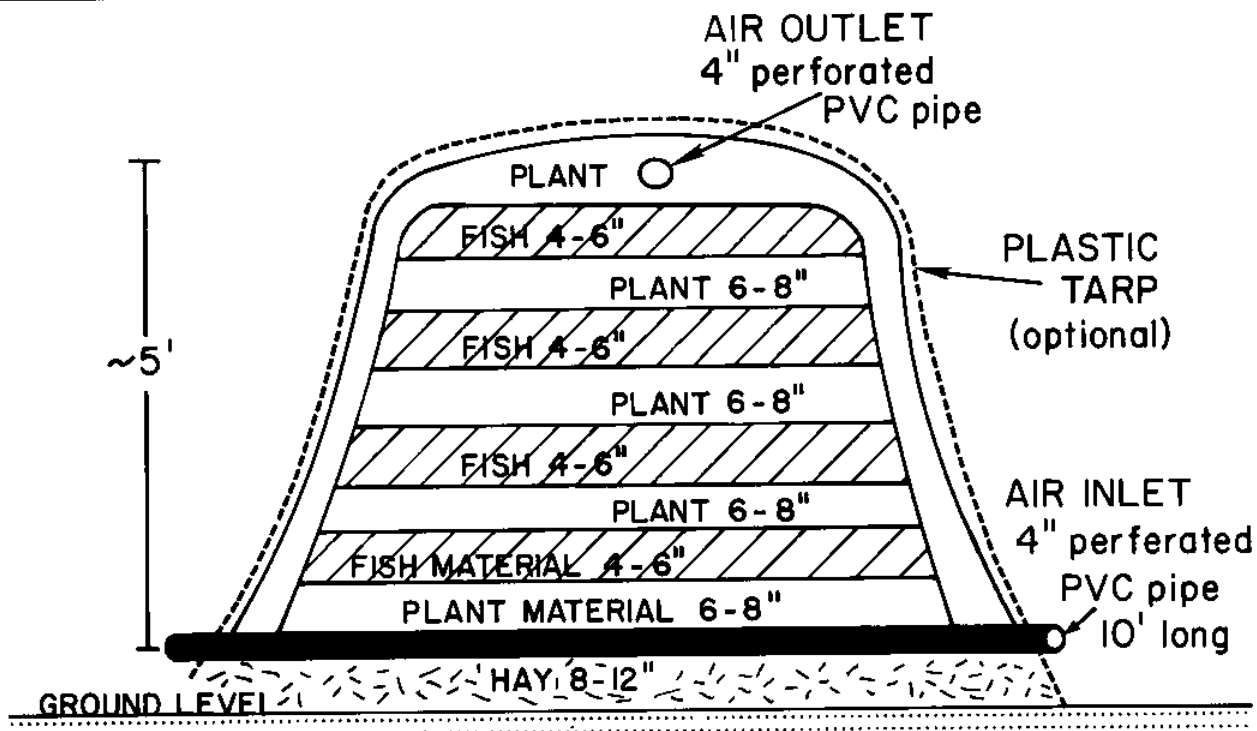


Figure 1. Cross-section of a typical static pile. The more the layers are mixed together, the better.

Operational Considerations

No matter which method is used, if the operation is receiving product daily, a full-time person must be on site to oversee the process. Seafood by-products must be received and composted immediately to avoid odor problems. A continuous supply of plant material must be received and stockpiled for use. Compost piles must be monitored to determine the level of composting taking place. (refer to **Figure 2.**) Once fully composted (6-12 weeks), the compost must be stockpiled for sale. The site must be kept clean and neat and the area monitored for any odor production. When properly managed, compost operations are unlikely to produce offensive odors. However, it is always possible to make mistakes resulting in off odors, although such situations are usually easy to correct. Except for small operations, composting is not the type of thing that can be done the last hour of the day before going home!

It is also important that the pieces of seafood and plant material are the proper size. If they are too large, they will not mix well and there will be too little surface area to support the number of microbes needed to convert the nitrogen to odorless compounds quickly. On the other hand, if the pieces are too small, the pile may become so compact that the air will not pass through it easily, thus causing the microbes to smother. Particles $\frac{1}{4}$ - $\frac{3}{4}$ inch across are a good size. If smaller particles are used, something larger, such as wood chips, should be added to keep the pile from becoming too compact.

The various materials in the pile must be well mixed, since any clumps of fish racks or shredded paper will just sit there without composting. This could lead to an odor problem. Obviously this is more of a concern with the static pile method than the turned pile. Putting all material through a chipper as the pile is built is a good way to mix the products and be certain they are the proper size.

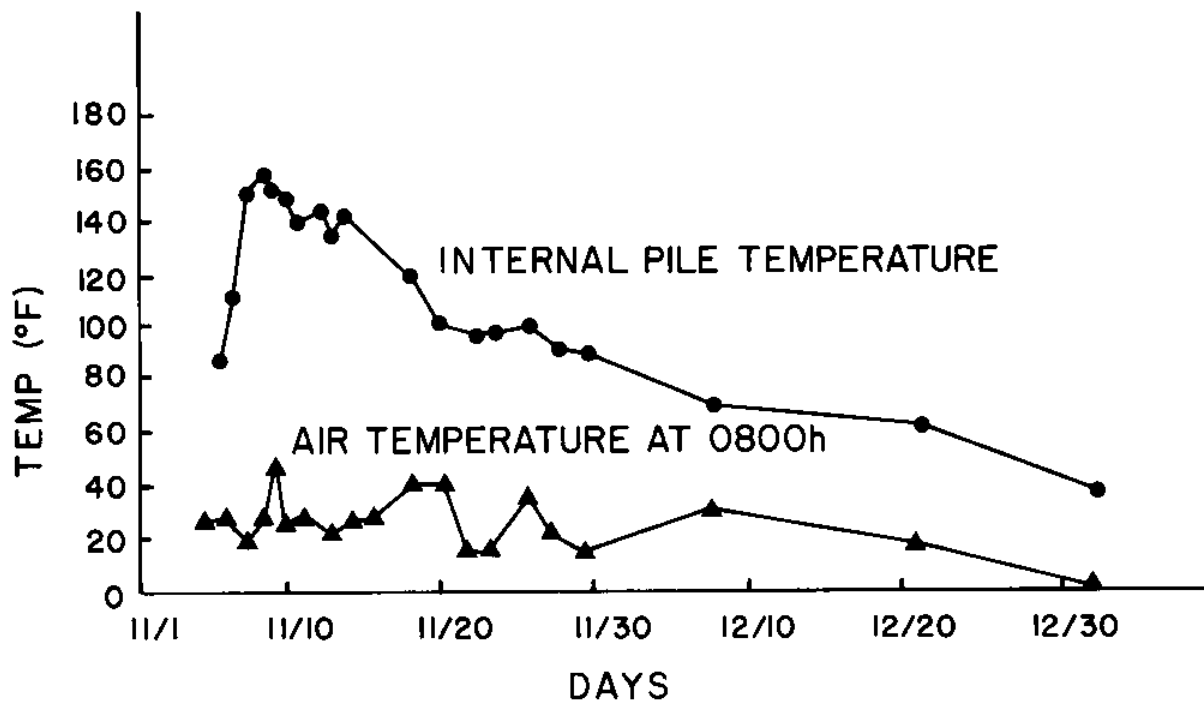


Figure 2. Typical temperature plot of a static compost pile taken from an actual compost operation in Bristol, Maine. Monitoring temperature is important to determine the success or "health" of a compost pile.

Before any commercial operation is established, the services of an experienced testing lab should be employed to determine the proper compost "recipe." Samples of the nitrogen (seafood) component and carbon (plant) component need to be analyzed for their chemical content, so that a recipe can be formulated to save unnecessary trial and error as well as avoid the possibility of loud complaints from the neighbors who may smell the "errors." It is also important to check with the Department of Environmental Protection (DEP) and local officials to obtain any permits or approvals needed for this type of operation.

Experience in Maine to Date

A number of compost trials were carried out in Maine between 1985 and 1987. Static piles built with peat and herring and dogfish gurry, plus others built with hay and shrimp shells, have been successfully carried out. The latter example was a commercial-scale operation handling almost all the shrimp by-products from one processor for a season.

A large, turned pile demonstration was carried out in 1987 using piles built with oak sawdust and herring, dogfish, flat fish, crab, and lobster by-products. This project also inventoried available seafood and plant material supplies, as well as carrying out marketing and product performance studies.

Additional, less controlled trials have been carried out by a number of individuals using mostly shrimp, crab, and herring as the seafood component. As can be seen, a variety of source materials have been utilized in all seasons of the year. What few odor problems encountered thus far have been easily identified and corrected. To avoid the possibility of odor-causing mistakes, consult the list of groups at the end of this pamphlet, who have learned from their experiences during earlier trials.

Marketing

A variety of markets can be developed for composted material. The market chosen depends on the material used, the method used, the carbon/nitrogen ratio used, and the length of time composted. It is sometimes best to determine which market to supply first and then adjust the component recipe to fit the end product which that market desires.

Potential markets include farmers, landscapers, state and local highway departments, and home gardeners. Since nitrogen-enriched loam is a highly desirable product, markets are usually not hard to find.

Conclusion

This short pamphlet just scratches the surface of compost technology and is intended to inform people about the process and whether it fits into their own by-product handling situation. Anyone interested in starting an individual operation should contact any of the agencies listed below to receive more detailed information on compost methods and concerns.

Agencies in Maine with Compost Expertise:

Maine Department of Marine Resources	
Hallowell	(207) 289-2291
Maine Department of Agriculture	
Augusta	(207) 289-3511
University of Maine Cooperative Extension	
Service	
Orono	(207) 594-2104
Time and Tide RC & D	
Waldoboro	(207) 832-5348
U.S. Soil and Water Conservation Service	
Waldoboro	(207) 832-4292

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