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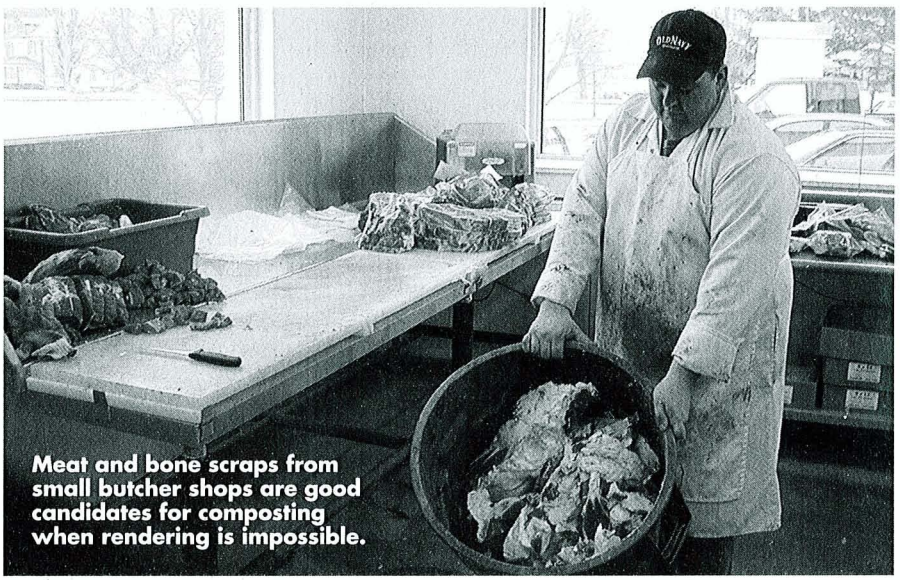
ALTERNATIVES TO RENDERING

MEAT BY-PRODUCTS AS COMPOSTING FEEDSTOCKS

THE MEAT processing industry is finding it increasingly difficult and expensive to manage by-products, as Part I of this series (January, 2001, p. 62) explained. While meat by-products still are rendered into raw materials for manufactured products like soaps, fertilizers and animal feed, trends in the rendering industry have changed the situation and the economics. Concerns about diseases like BSE ("Mad Cow disease") have restricted feeding of animal proteins to livestock. Thus, for many meat processors, rendering is now an expense rather than an income source.

With this increasing expense, composting has become a viable option for recycling meat by-products. Well-established procedures for composting animal mortalities on farms provide both precedent and guidelines for composting raw meat by-products. Nevertheless, meat by-products present certain management challenges due to their highly degradable nature and attraction to pests. The purpose of this article is to profile the various types of meat by-products, their characteristics and potential uses.



Meat and bone scraps from small butcher shops are good candidates for composting when rendering is impossible.

Characteristics of meat processing residuals indicate a strong potential for composting with other feedstocks. Part II

Federica Vidussi and Robert Rynk

BY-PRODUCT TYPES AND TYPICAL USES

In the U.S., slaughterhouses, packing plants, supermarkets, butcher shops and restaurants collectively generate over 40,000 tons of animal by-products each week, on average. Much of this total has been recovered by rendering. The larger meat processing plants, including most poultry processing facilities, typically have their own rendering operations. Therefore, the meat by-products available for composting are more likely to be generated by comparatively small processing facilities that slaughter or process beef, pork, deer and other species. Like the large processors, some of the smaller facilities slaughter or process one species only, but many process several (hogs, calves, etc.). Thus small plants often have to address by-products of different species in varying amounts throughout the year.

The relationships between the weight of meat processed (i.e. live weight) and the meat products recovered and by-products generated for three species are as follows: Steer by-products represent 44 percent of the initial weight of the animal, with edible by-products comprising 27 percent and inedible by-products accounting for 17 percent. Lamb by-products represent 54 percent of the initial weight, 32 percent as edible by-products and 22 percent as inedible by-products. By-products generated from pigs are 32 percent of the initial weight, with edible and inedible by-products making up 24 percent and eight percent, respectively.

Edible by-products are typically recovered for human food uses, including variety meats, sausages and sausage casing, soups and bouillon, gelatin and fats used in chewing gum and candies. Inedible by-products are normally processed into intermediate products that become ingredients for other manufactured products. For example, glands are a source for a variety of pharmaceutical chemicals, including estrogens, insulin, hormones, vitamins, nutrient supplements and numerous medicines. In addition to these industrial uses, several by-products are land applied directly or processed into fertilizers via drying, composting or other processes. Examples include paunch manure, blood, meat and bone meal, and offal.

FEEDSTOCKS FOR COMPOSTING

Generally, meat by-products are considered for composting where rendering is unavailable or impractical. This might apply to specific by-products that renderers will not accept, such as paunch manure or offal. Or it can apply to all by-products generated because of a lack of local rendering facilities. In either case, successful composting of animal mortalities has demonstrated that nearly all meat processing by-products can be composted. Although some components such as bones, feathers and wool are slower to decompose (especially bones), animal tissue generally disappears within six months to a

year — a normal time frame for composting.

Meat and bone scraps, offal, blood, and paunch manure and other stomach contents are among the more probable candidates for composting. At larger facilities, solids generated from wastewater treatment are also good feedstocks. While these materials are discussed individually below, composters would likely handle a mixture of several meat processing by-products.

Meat and bone scraps: After the usable meat is trimmed, the meat and bone scraps that remain can be composted. The characteristics depend on the proportion of meat remaining with the bone. The meat itself has a moderate moisture content (50 to 70 percent) and is a rich source of nitrogen (two to five percent). The bones provide minerals, particularly calcium and phosphorus, but only if they become incorporated in the compost. In a typical composting time frame, the meat decomposes and disappears during the composting process. The bones remain intact, although they become more brittle and break apart relatively easily. The bones are commonly screened out before the compost is used. Unless it is an aesthetic problem, bones can be spread on land with the compost. Small bones disappear relatively quickly. However, large bones may persist for a long time and may puncture tractor tires.

Offal: Offal is a general term for the collection of organs, soft tissue and other components not used for meat products or recovered as specific usable by-products (e.g. intestines for sausage casing). Generally, offal has a high moisture and nitrogen content. It is also highly decomposable.

Blood: Blood is a concentrated source of nitrogen (ten to 15 percent). It can be dried and manufactured into a fertilizer or processed for pharmaceutical products. However, these uses may be impractical where only a small volume of blood is generated. Because it is a liquid, landfills may not accept it unless it is solidified first. Consequently, it also has been composted. Blood decomposes very quickly. Soon after being exposed to air, it takes on a gel-like consistency, although with a moisture content of approximately 80 percent, it essentially remains a liquid unless it is deliberately dried. Composting blood requires dry absorbent amendments like sawdust, finished compost or chopped straw.

Paunch manure and stomach contents: Paunch manure is the partially digested feed present in the cattle's stomach (i.e. paunch) at the time of slaughter. Stomach contents of pigs and other animal species are similar in nature. The characteristics of paunch and stomach contents reflect the feed material consumed by the animal, except that it is partially digested and wet (70 to 90 percent moisture). Generally, paunch manure has a well-balanced C:N ratio. It tends to decompose well, having gotten a good start in the animal's digestive system. Paunch manure is a good candidate for composting because it is not a product for rendering. Frequently, it is directly land applied to crop land.

Wastewater treatment residuals: Many meat processing facilities, especially larger ones, employ wastewater treatment operations that generate sludge, screenings and other solids. Such treatment operations include lagoons, waste activated sludge, dissolved air flotation, screening and settling. Like municipal biosolids, solid residuals from these operations are suitable for composting. The defining characteristic of most

A PRIMER ON BSE

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BOVINE Spongiform Encephalopathy (BSE), also known as "Mad Cow Disease," belongs to a group of poorly understood emerging diseases known as Transmissible Spongiform Encephalopathies (TSEs). TSEs are progressively degenerative (and fatal) diseases of the central nervous system of humans and a number of animal species, primarily ruminants. TSE in humans is called Sporadic Creutzfeldt-Jakob Disease (CJD), and exists throughout the world with an annual incidence of approximately one case per million population.

Although the cause of TSEs is unknown, one theory proposes that an infectious protein, or "prion," causes the disease. The mode of transmission is also not understood. The only common factor in the cattle with BSE is that feed containing meat and bone meal was fed to the affected animals. Further epidemiological studies suggest that feed contaminated by a TSE agent was the cause of the disease. As a matter of fact, the spread of BSE in the United Kingdom appeared to be facilitated by feeding calves rendered by-products from BSE-infected cattle. Moreover, processing cannot assure a complete removal of the BSE agent from feed materials since it can survive several physical processes, including heat and pressure.

Even though BSE has not been diagnosed in cattle in the United States, information and theories on TSE diseases raise concern that BSE could occur. TSEs have been diagnosed in several other animal species, and sheep scrapie (an animal TSE) does exist in the United States.

To prevent the establishment and amplification of BSE through feed in the United States, the FDA implemented a final rule that prohibits the feeding of mammalian protein to ruminant animals, with some exemptions. The FDA BSE regulation became effective on August 4, 1997 and applies only to mammalian proteins because studies have not detected a TSE of plants or nonmammalian animals (poultry and fish). The exemptions for pure swine or pure equine proteins are allowed because these species never have been found to have a naturally occurring TSE. Blood and blood products, milk and milk products, and gelatin are exempt because none of these tissues have been shown scientifically to play a role in transmitting BSE. The following products also are exempt because they are not protein or tissue: grease, fat, tallow, oil, amino acids and dicalcium phosphate. Pet foods are exempted from the regulation because once manufactured and packaged for sale as pet foods, they are unlikely to be fed to ruminants.

Renderers, protein blenders, feed manufacturers, distributors including haulers, and individuals responsible for feeding ruminants are directly affected in this regulation. They have to label all products that contain or may contain prohibited material with the following cautionary statement: "Do not feed to cattle or other ruminants."

Although the risk of BSE in the U.S. is small, the consequences and cost would be very high, should it be detected. U.S. cattle would be at risk for disease, and the human population could be at risk for CJD. The provisions and requirements of the regulation are based on current science. Because BSE is an emerging disease, the scientific base is limited, and should be expanded through research.

The fate of the BSE agent during composting is not known, nor is it certain that research trials have ever been conducted. With composting increasingly becoming an option for meat processing by-products, initiating research on the fate of the BSE agent would be timely.

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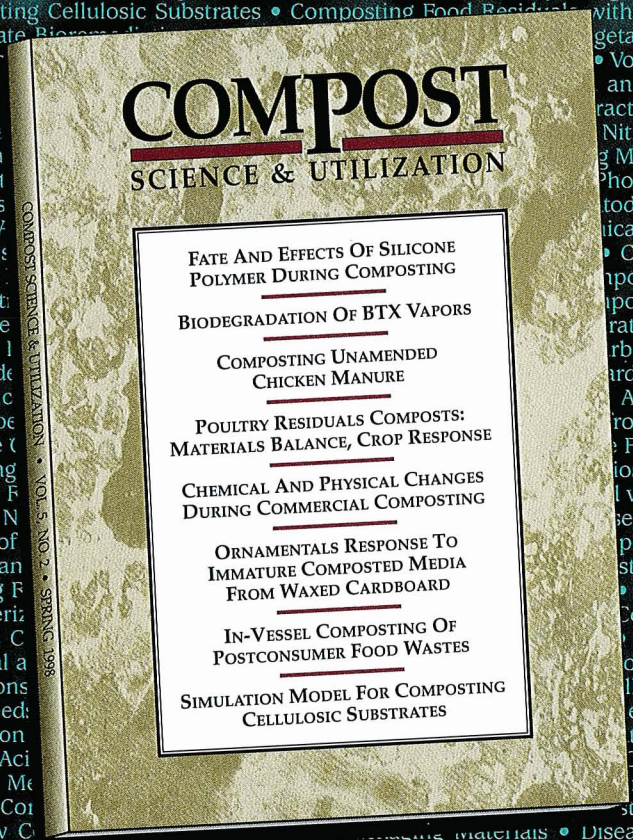

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Meat by-products cannot constitute a large portion of a feedstock mixture, the volume of other feedstocks must be sufficient to cover the meat by-products in open windrows and piles.

treatment residuals is high moisture content. Unless they are dewatered, moisture contents over 95 percent are typical.

Other by-products: Several other materials generated by meat processing facilities also can be composted. Examples include: discarded cardboard and paper that cannot be recycled; manure collected from corrals and pens; and sawdust used for cleaning and bedding.

COMPOSTING PRACTICES

Meat by-products are challenging feedstocks for composting. As a group, they are too wet and have an excess of nitrogen. All of the by-products, including paunch manure and wastewater treatment residuals, are easily odorous. Materials like offal and meat and bone scraps are very attractive to pests, including flies, birds, rodents and dogs. Therefore, composting these materials in open windrows and piles requires specific management practices. Contained or in-vessel techniques provide more certain control and containment.

In regard to handling and composting procedures, paunch manure and most wastewater treatment residuals are comparable to manure and municipal biosolids. They demand a sensitivity to odors and sufficient and appropriate dry amendment. Offal, blood, meat and bone scraps and other "raw" meat by-products require even more attention because of their tendency to release moisture, attract pests and generate odors, and also because these materials can be unsightly. In addition to odor management, these by-products must be isolated within the interior of windrows or piles, or inside composting vessels, at least until they decompose beyond recognition.

Given their character, meat by-products cannot constitute a large portion of a feedstock mixture. Generally, abundant dry and nitrogen-poor amendments are necessary just to balance moisture and C:N ratio. In addition, the volume of other feedstocks must be sufficient to cover the meat by-products in open windrows and piles. In most cases, meat by-products are included as a minor ingredient in composting systems that handle other feedstocks like manure, yard trimmings or MSW. As such, the meat by-products can supply needed moisture or nitrogen to the existing system.

Experience with composting animal mortalities provides some guidance for handling meat by-products in windrow and open pile composting systems. When building piles (or windrows), the meat by-products should be incorporated with amendments as best as possible, although layering is often recommended for simplicity. The primary requirement is that the meat by-products are contained well below the surface and edges of the pile (preferably greater than 12 inches below). To accomplish this, the pile is capped with a layer of compost, amendment, dry manure or other innocuous feedstock. It may be necessary to start piles with a base layer of amendment to absorb water released during decomposition of by-products like offal or whole carcasses. The layer should be 12 to 24 inches thick, depending on how much offal is included. After piles or windrows are established, they should remain static for a period. Turning should be delayed until the meat by-product is substantially decomposed — enough that it no longer attracts flies and other pests. This can be as short as one week or as long as several months, depending on the by-product and its particle size. Alternatively, turning can be accomplished before the meat by-product is sufficiently decomposed, but the pile or windrow must be capped again to cover the exposed meat.

Another key requirement is reaching pathogen-killing temperatures — 131°F according to the U.S. EPA's PFRP standards. The combination of feedstocks should have the appropriate volume, moisture content, nitrogen content and degradability to reach 131°F and maintain it for three consecutive days in a static pile. Even if PFRP conditions are achieved, the precautions regarding pathogens should extend to the use of the compost. For example, it may be prudent to avoid using compost made from meat and mortalities as topdressing on pastures where animals graze. ■

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