Tech Topics

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Raw Material

The thesis is the title. The words raw material are used by a number of industrial manufacturers for a variety of products. Raw material is a literal definition, though considered secondary by livestock and poultry producers and processors, is primary and essential to the rendering industry. While edible meat, poultry, and fish are the primary products of the livestock, poultry, and fishery industries and represent the majority of the animal value, the by-products are an important key in maintaining a symbiotic relationship with the production and processing functions of providing meat, milk, and eggs. Edibility is determined by a number of factors including consumer acceptance, regulatory requirements, economics, hygiene, tradition, and religion.

The market for U.S. meat and meat-based products requires the production and annual slaughter of approximately 139 million head of livestock as well as 36 billion pounds of poultry, and a growing aquaculture industry. The current average annual slaughter and processing of 100 million hogs, 35 million cattle, and approximately eight billion chickens in the United States makes it #2 in pork, #1 in beef, and #1 in poultry meat production in the world. There can be no challenge to the importance of meat production to the American preferences for lifestyle and their demand for animal sourced protein. In order for this historical precedent to continue to be a reality, an entire series of integrated resources must function to assure the United States' current stature in world production. Certainly the production influences such as genetics, nutrition, disease prevention and treatment, husbandry practices, and numerous others all command continuing research and attention. Processing, technology, food safety, packaging, and promotion likewise command the total meat industry's undivided, unified, and supportive attention. Effective and safe utilization of the by-products as an important adjunct to the production and processing is paramount. Only rendering can fulfill that function.

Edible meat and poultry production/processing results in an inedible faction as with any other food brought to our table. From animal production, these raw material by-products are hides, skins, hair, feathers, hoofs, horns, feet, heads, bones, toe nails, blood, organs, glands, intestines, muscle and fat tissues, shells, and whole carcasses. As has been documented via centuries of utilization of these by-product materials as resources for other significant uses, as well as volumes of scientific references validating their nutritional qualities, the products produced from the inedible raw material make important economic contributions to the overall productivity to their allied industries. Using basic approximates, these tissues comprise 50 percent of the live weight of the cattle, 42 percent of the live weight of pigs, 37 percent of the live weight of broilers, and 57 percent of the live weight of codfish.[1] As further processing, pre-packaged, and table-ready meat products are brought to the marketplace, the inedible portions have increased in relation to the original live weight of the animal. This trend is enhancing, leaving increasing amounts of the inedible portions of the processing locations. This has been recently documented in an independent study completed by the Sparks Companies (see June 2002 *Render*) and published by the National Renderers Association.

The current annual amount of raw material generated exceeds 50 billion pounds and if all could be accounted for, may approach 54 billion pounds. The thesis thus far is well understood by the rendering industry, but beyond this relatively small group of some 50 companies with approximately 200 facilities, the function, service, and the sustainable relationship to the livestock and meat industries have not been appreciated. If one were to put

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Table 1. Microbiological Isolations of Index Foodborne Pathogens in Raw Material*

Organism	Winter	Summer	Total	%
Clostridium perfringens	30/42	30/42	60/84	71.4
Listeria spp	33/42	31/42	64/84	76.2
1) Listeria monocytogenes	4/42	3/42	7/84	8.3
Campylobacter spp	19/42	6/42	25/84	29.8
1) Campylobacter jejuni	15/42	2/42	17/84	20.0
Salmonella spp	37/42	34/42	71/84	84.5
*Coliform spp***	42/42	42/42	84/84	100.0

* Samples taken at 17 midwestern rendering establishments during two periods: winter and summer (number of isolates/number of samples including replicates). Some establishments operated more than one rendering line. Sampling occurred twice at each visit for each line, hence the denominator is based on 21 lines sampled twice each visit = 42.
** Characterization of the bacterial organisms and aerobic plate counts were not possible due to the nature of the raw material.

into perspective 50 to 54 billion pounds of animal raw material, perhaps one could envision Interstate 80 that spreads for some 2,946 miles across the heart of our nation from Newark, NJ, to/from San Francisco, CA, filled to capacity with trucks that contain animal raw material. This illustration represents the volume of animal raw material generated annually. Should all of those trucks deposit their cargo in the U.S. landfills, approximately one-third of all current sites would be occupied each year. Equally relevant is the fact that until time and temperature treated (rendered), animal raw material is and becomes extremely laden with microorganisms of multiple genera and species.

Unprocessed, non-cooled animal tissue decomposes quite rapidly providing an excellent media for microbial organisms and chemical alterations of the proteinaceous components. A recent study completed by Dr. Fred Troutt, University of Illinois Veterinary College, has demonstrated that raw material contained high concentrations of all of the five classes of pathogenic foodborne (*Clostridium sp., Listeria sp., Campylobacter sp., Salmonella sp., and Coliform sp.*).[2] Samples of raw material were collected from 17 facilities during both winter and summer. The facilities were randomly selected to include an industry representation of raw material content, species origin, and processing origin. The raw material derived from food animal production and processing was found to be highly contaminated with the five index potential foodborne pathogens that were targeted for identification as table 1 illustrates.

The heavy contamination rate for all bacterial genera/species was expected based on the numerous published surveys illustrating the ubiquitous association with animal production. Clinically normal animals, including humans, harbor microbial organisms within their digestive, respiratory, and other vital systems. The presence of digestive tissue and contents, other contaminated tissue from processing, and fallen animals all contribute to raw material with high microbiological content. The raw material processed by the rendering industry thus is known to contain significant numbers of potential foodborne pathogens including a large number of *Salmonella* serovars. The microbiological isolations in Dr. Troutt's study verified that fact. *Coliform* cultures and the specific bacterial isolations were not even possible due to the heavy overgrowth and presence of a bacterial load in the unprocessed animal raw material.

The tremendous microbial populations demonstrated to be present in the material generated by the production and processing of animals for meat serves to illustrate the tremendous environmental and biosecurity challenges presented via the antiquated alternatives of burial, landfilling, burning, composting, leaving dead animals to the elements of nature, and even on farm or central incineration should rendering not occur.

Although the bacterial load in the unprocessed animal raw material prevented total plate counts, the subsequent rendering processes that followed verified the highly effective process of rendering in inactivating these potential foodborne pathogens. Research work performed at Iowa State University used the pseudorabies virus (PRV) to determine if this viral class resists the rendering process and persist in meat and bone meal.[3] The study concluded that the rendering process of 240-270 degrees Fahrenheit (F) completely inactivated the virus.

Rendering is a time-temperature controlled process that removes moisture and facilitates in separation of fat, but more importantly, microbial organisms are rapidly and effectively inactivated. It is important that those outside the familiarity of rendering understand its function to sustainable animal agriculture. Let us review for those unfamiliar or unwilling to accept science the very basic benefits. The impressive volume of raw material resulting from the direct production and processing of our meat products has been described. The alternative animal tissue disposal methods when compared to rendering are not economical, environmentally, or ecologically satisfactory, and certainly do not meet the requirements for human/animal health assurance. There is no current infrastructure to biosecurely dispose of the material. So what if there was no rendering as the gate keeper for food safety and our environment?

Should rendering cease and its facilities close, this nation will be subjected to a disposal crisis with a public health significance that is unprecedented, affecting both the human and animal populations. As one briefly reviews the alternatives to rendering, all have severe limitations.

Burial can no longer be considered as a responsible option due to its potential for environmental and groundwater contamination as well as the persistence of microbial organisms for spread of disease. The regulation of transport of raw material to a burial site and the regulation of the burial are not in place. Spore forming diseases such as *Clostridium sp.*, anthrax, and blackleg persist in the soil for years. The agent associated with sheep scrapie has been demonstrated to persist in entombed carcasses for up to three years.

Composting has become a demonstrated method for waste recovery of solid waste and plant fibrous material. It has not been scientifically proven as a means of processing animal tissue safely. Composting becomes a common burial site proposed to be managed to allow decomposition by bacteria and fungi. Heat is generated by the decomposition process but generally does not exceed 140 degrees F, which is not sufficient to inactivate many disease-causing pathogens. The process is slow, generally requiring up to 180 days. Composting attracts many vectors (birds, wildlife, rodents, and insects) capable of spreading disease to humans, livestock, and poultry. The process has severe limitations and many potential public health ramifications as a means of addressing the 50-plus billion pounds of annual raw material.

Landfilling is currently being used and permitted in some sections of the United States as an acceptable means of animal and raw material disposal. Considerable scientific and

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ecological based knowledge makes the general practice of landfilling raw material a poor choice precedent. The nature of the material affords great potential for surface water, ground water, and air pollution. The accumulation, transport, and landfilling processes provide innumerable avenues for transmission of both human and animal diseases. As previously referenced, the use of landfills as an exclusive means of disposing of animal raw material would reduce the country's available landfill space to a three- to four-year window.

Open burning of any material results in a negative environmental impact. Certainly the health implications are immediately evident. The burning of animal tissue is associated with greater health hazards and cannot be condoned as an acceptable method for its routine disposal.

Historically, fallen animals have been cared for by nature. In today's society, with the concentration of both the animal population and the knowledge possessed of human and animal disease transmission, the practice of decomposition by nature cannot exist.

Currently, the rendering industry processes approximately 50 percent of all livestock mortalities. National biosecurity plans should encourage the development of disposal methods that assure that unregulated, unacceptable methods are not exploited, which includes all of the above alternatives.

Incineration is considered to be the most biosecure process for destroying pathogenic organisms in hazardous waste. An infrastructure for incinerating the animal tissue raw material currently is not available. The process results in an ash residue of some seven-and-a-half to 10 percent, which must subsequently be disposed or utilized. The expense and impracticality of developing such makes the alternative unobtainable.

In Conclusion

The alternatives to rendering have been briefly characterized. This basic review does not provide a complete reference of the historical, scientific, and global experiences with alternatives to the proven rendering industry and process that has synergistically supported the livestock and poultry industries so successfully in the United States. It is and must continue to be the raw material gate keeper in support of sustainable animal agriculture. ❖

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