Pollution in the Meat Industry

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1. INTRODUCTION

The production, transformation and preparation of foods uses great amount of natural resources producing residues of several types. The production of grains for feeding human or animal, fruits, green vegetables and vegetables, it uses great soil extensions and high volume of water. The creation of animals produces solid residues of high polluting capacity, mainly for the deposition, ìin naturaî, in the soil or in rivers and lakes. The industrialization phase consumes energy, (electric and thermal), producing residues (solids, liquids and gaseous). Even after the production cycle to be complete, and the Ýnal product to arrive to the consumerś hands, the environmental impact of this product continues to exist, mainly due to the discard of preparation surpluses and used packings.

The objective of this work is to present some comments about the pollution generated in the main types of processes of industrialization of meat and the available forms for treatment and handling of residues.

2. MEAT PRODUCTION

2.1 - Swine and Bovine

The creation of swine is made, in most of the cases, in conÝnement, generating high amount of liquid and solid residues, and unpleasant odor. The system adopted for treatment of the residues is the separation of the solid phase, usually in laystalls, and deposition in the soil. The liquid phase is treated at ponds, usually anaerobic or facultative, for release in rivers and lakes. Sometimes this liquid phase is used for irrigation directly from the laystalll, other times it is thrown, directly in rivers and lakes. This model has been causing degradation of great soil areas and pollution of the superÝcial and underground waters. This model is also used in the conÝnement of bovine.

The control of the pollution, in these cases, begins for an appropriate handling of the creation using more efÝcient feeders and appropriate cleaning of the stalls, with the dry removal of the solid residues. The separation of the solid and liquid phases should be made the fastest possible. In larger facilities it is recommended the use of presses sifters, sieves or Ýlters. In small facilities decantation tanks should be used. The separate solid material should be treated in a process of stabilization, with the use of controlled fermentation, for bio-fertilizer production. The application of this material in the soil should be made in a controlled way, being considered the application taxes obtained after study of the soil type and cultivated species. This application tax will vary depending on several factors, like proximity of rivers and lakes, depth of wells and underground waters, permeability of the soil and geological characteristics.

The liquid phase should be sent for biological treatment with the use of tanks or ponds. The Ýnal destiny of the liquid phase will determine the characteristics of the biological treatment. If the Ýnal destiny of the liquid is the irrigation of agricultural areas, there will be larger tolerance of removal of organic material and of phosphate and nitrogen.

For release in rivers and lakes, the parameters are more rigorous, mainly as for the concentration of phosphate and nitrogen, ans it is necessary the installation of additional treatment for removal of nitrogen and phosphate, with aeration.

The use of controlled processes of microbiology has been a viable alternative for the adaptation of the treatment facilities, with the use of the existent constructions (piping, laystalls, tanks, ponds) and, also, for the Ýnal disposition of dead animals.

2.2 – Chickens and Turkeys

To obtain maximum broiler production potential, management of the poultry house environment is essential. An important measure of a suitable environment is proper maintenance of poultry litter. Litter is deÝned as excreted manure mixed with bedding material.

Both heating and ventilation systems must be continually monitored to ensure that the moisture content of the litter is controlled and the litter remains friable. If the moisture content becomes elevated and the litter is allowed to become ìsealed,î then the birds are being grown on a continually damp, slippery and sticky surface. This sealed litter is often referred to as being ìcaked.î In this condition, the litter is simply saturated with water and the water is unable to escape. A severe litter moisture problem can result if large areas of the house Ðoor surface are caked. It is more common, however, to Ýnd localized areas of caking near leaky watering cups, nipples, troughs or roofs. The litter in these house locations must be continually stirred, raked or replaced to prevent the problem from becoming worse.

If litter is not kept at an acceptable level, very high bacterial loads and unsanitary growing conditions may result producing odors (including ammonia), insect problems (particularly Ðies), soiled feathers, footpad lesions and breast bruises or blisters. Expect carcass downgrading at the processing plant when birds are reared under such poor conditions. In a well-managed broiler house, litter moisture normally averages between 25 to 35 percent. Litter that is managed correctly with the moisture content kept within the acceptable range can be reused if no disease or other production problems occur. On the other hand, caked litter must be removed between Ðocks and replaced with new litter.

There are several causes of wet litter. A number of control measures can help prevent wet litter problems.

2.2.1 Watery Droppings

Diarrhea can be caused by nutrition and/or infectious agents. High intake of the minerals potassium, sodium, magnesium, sulfate or chloride can lead to excessive water consumption and wet droppings. If a wet litter problem occurs, feed levels of sodium and chloride (salt) should be determined. It is possible that a feed mixing error has occurred, resulting in an excess of salt in the diet. The water should be checked periodically for mineral concentrations, especially for sulfate and magnesium. Poor quality dietary fat or rancid fat can lead to wet fecal droppings. Likewise, using feed ingredients such as wheat, barley, rye or cassava (tapioca or yucca) will often result in excessively wet droppings. To control wet droppings associated with some feed ingredients, it is usually necessary to use a commercially available enzyme preparation in the diet if wheat, barley or rye are used for diet formulation.

2.2.2. Moldy Feed

If broilers are provided moldy feed ingredients, consumption of mycotoxins may cause the droppings to be excessively wet. Mycotoxins are known to irritate the digestive tract and to cause marked pathological changes in the kidneys. Ochratoxin, Oosporin and Citrinin are mycotoxins known to cause these changes. Such changes can lead to increased water consumption and wet droppings. To prevent mycotoxins from becoming a problem, good quality feed ingredients must be used in broiler diets. Feed handling equipment must be cleaned and disinfected periodically. Caked and moldy feed lodged in handling equipment can contaminate feed as it passes through the equipment; thus any caked feed must be routinely removed.

2.2.3. Disease

Numerous diseases cause poultry to excrete wet droppings. This effect may be primary where an infectious agent directly damages the alimentary canal resulting in diarrhea. Secondary effects may occur where birds go off feed but maintain water consumption, resulting in a higher moisture content of the droppings. Coccidia infections result in direct damage to the gut and will result in wet droppings. Control of coccidiosis through the use of an anticoccidial supplement in the feed is essential because if not controlled, coccidial infection may lead to necrotic enteritis and wet litter.

Bacterial infections caused by **Escherichia coli**, **Camphylobacter jejuni** and **spirochaetes** will also result in wet litter. In addition, several viruses, such as reovirus and adenovirus, have been implicated as causative agents of diarrhea. Viruses associated with malabsorption of nutrients have an adverse effect on the consistency of the birdís droppings.

2.2.4 Climate Control and Equipment Failure

Those involved in the poultry industry have little control over the ambient temperature and humidity outside the poultry house. Nevertheless, temperature and humidity largely inÐuence water consumption and impact litter quality. For example, high temperatures within a broiler house lead to increased water consumption and wet litter.

When high humidity accompanies high temperatures the problem can become so severe that it becomes very difficult to properly maintain the litter in a dry and friable condition.

Leaking watering systems, when not maintained in good working order, can cause wet litter problems. The in-line water pressure must be within the manufacturer's specifications. Roofs should be leak-free and ventilation systems should move an adequate amount of air to keep litter moisture levels in the proper range.

2.2.5 Bedding Type

There are a limited number of bedding materials that can be used in broiler houses. Any material that is in contact with the birds must be nontoxic, and able to absorb water and subsequently release the moisture to the atmosphere. The material must be readily available in sufficient quantities. Most importantly, it must be economical.

Quality soft wood shavings are the most widely used bedding material and are the product of choice if available and competitively priced. Straw, rice hulls, composed municipal garbage, and shredded cardboard have not proved to be useful bedding materials. These materials have met with limited success because of their low moisture absorption and release qualities which has led to litter caking. The proper choice of material is essential and will reduce problems associated with litter management.

2.2.6 Wet Litter Disposal

The use of bio-transformation of the wet litter in fertilizer, through controlled fermentation, is a good alternative. The compost resulting from this operation can be used as fertilizer.

3. SLAUGHTER AND INDUSTRIALIZATION

The slaughter and industrialization of animals is important source of environmental pollution, due to the generation of liquids, solids and gaseous residues. We will discuss below, the description of these residues and comments about the treatment processes.

3.1 - Gaseous residues

The main sources of these residues are the boilers, used for the steam generation, and the facilities for preparation of flours of feathers.

The boilers are source of residues of the burns of fossil fuels (petroleum), vegetables (firewood) and minerals (coal). The control of this pollution is made with the adoption of the preventive measures recommended by the legislation (installation of filters, tuning of burns, analyses of gases, treatment of the purgative water).

The factory of flours produces volatile organic residues and unpleasant odors. The installation of washers of gases and filters, usually biological, solves the problem in most of the cases. A new technology is the direct oxidation of the organic gases using catalysts.

3.2 - Solid residues

These residues are composed by process discards, residues of the process of wastewater treatment and organic and inorganic garbage. The process of bio-transformation of these residues in fertilizer is an alternative that should be studied with attention, mainly due to the possibility of biogas generation in one of the parts of the fermentation process.

3.2.2 - Discards of the process

These discards are composed by guts and feathers (birds). Nowadays they are destined to the preparation of pet food. Composting is an alternative.

3.2.3 - Solid residues of the wastewater treatment

The largest volume of these residues is composed of residues of the sieves, flotation sludge and waste of the biological processes. The residues of the sieves and the flotation sludge are, partly, destined to the production of flours (pet food). It is important to consider that the use of these residues cause serious problems of quality of the flour, demanding special cares in the process and hindering the operation. The sludge of the chemical flotation that uses metallic coagulants, should not be used for the flour production.

Nowadays we have available in the market coagulants and polymers derived of cellulose, starch and sugar destined to the removal of oils and greases by flotation generating a material that can be processed in the digesters without great problems, mainly due to the absence of metallic ions (iron and aluminum). The challenge, in the use of these new products, is to find the ideal balance between the cost and the benefit.

The sludge originating from the ponds of stabilization are another problem because it presents great amount of chemicals, organic and inorganic, resultants of the lingering decomposition of the wastewater residues. So, the cleaning and emptying of the ponds should be preceded of a detailed study of the wastewater contained at these ponds with forecast of a phase of controlled microbiology stabilization of the sludge, before its deposition in agricultural areas.

3.3 - Liquid residues

The liquid residues of slaughterhouses should be divided in three parts:

3.3.1 Reception, Bloodletting and Scald

These residues are usually destined to the biological system after screening and decantation for the removal of solids. Many slaughterhouses donít use the decantation before sending these waste for the biological system, resulting in the increase of dissolved solids, hindering the puriÝcation, increasing the maintenance of equipments and the consumption of energy of the treatment (larger density of the liquid to be moved results in larger consumption of energy).

3.3.2 Other Points of Slaughter Process

These wastes are destined to the biological system after screening and Ðotation. The screening for the retreat of solids and the Ðotation (physics or physiochemical), for the retreat of oils, greases and fats.

The adjustment of the Ðotation stage is quite difÝcult in some cases, mainly due to the integration lack between the production personnel and the operators of the Ðotation equipments. One of the most frequent problems is the discard of the tanks of hot water in short intervals of time, causing an abrupt elevation of the volume, temperature and pollutants sending to the Ðotation and causing problems for the biological process, hindering the puriÝcation and elevating the presence of pollutants in the exit.

In systems based on the use of ponds of stabilization, a solid layer is formed in the surface of the ponds, increasing the sludge formation in the bottom, reducing the time of detention (reduction of useful volume), hindering, in signiÝcant way, the operation of the system.

So, we should try to integrate the discard Ðow of the process to the nominal capacity of the treatment equipments installed.

4. CONCLUSION

The meat industry produces high pollution levels however efÝcient technologies exist for the reduction of the environmental impact of itś activity. The integration among controlled production processes, with low level of losses, with the treatment system and handling of residues (solids, liquids and gaseous) it is fundamental for an effective environmental administration with acceptable cost. To accept the handling of residues and waste as part of the production process and to apply the techniques to control the productivity, quality and efÝciency, usually applied to the evaluation of the production, it is the shortest way for the sustainability.

5. BIBLIOGRAPHY

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