POULTRY WASTE UTILIZATION

The word "poultry" comes from the Middle English "pultrie", from Old French pouletrie, from pouletier, poultry dealer, from poulet, pullet. The word "pullet" itself comes from Middle English pullet, from Old French poulet, both from Latin pullus, a young fowl, young animal or chicken.

"Poultry" is a term used for any kind of domesticated bird, captive-raised for its utility, and traditionally the word has been used to refer to wildfowl and waterfowl. "Poultry" can be defined as domestic fowls, including chickens, turkeys, geese and ducks, raised for the production of meat or eggs and the word is also used for the flesh of these birds used as food.

Waste

Waste and wastes are terms for unwanted materials at a specific time but can be converted to desirable products with different chemical or other treatments. Examples include municipal solid waste (household trash/refuse), waste water (such as sewage, which contains bodily wastes, or surface runoff).

Waste Product

Products that are made from the waste materials.

By-Product

A by-product is a secondary product derived from a manufacturing process or chemical reaction. It is not the primary product or service being produced. In the context of production, a by-product can be defined as the 'output from a joint production process that is minor in quantity and/or net realizable value (NVR) when compared to the main products.

Poultry Waste Utilization

Fertilizer

Whole Carcass Composting

Current methods for the disposal of poultry carcasses include hauling to a rendering plant, incineration, burial, or composting. Rendering plants are rapidly decreasing in number and of those that remain, many do not want to process poultry mortality. Unless proper equipment is used, incineration may cause air pollution. The fuel requirement for incineration is expensive also. Disposing of carcasses in the ground can result in water pollution. Composting therefore, appears to be the logical solution for many poultry operations.

Composting of dead poultry became popular in l988 when Dr. Dennis Murphy of the University of Maryland developed a successful method which utilized dead birds, straw, and

litter. Composting is a natural process where beneficial bacteria and fungi, convert organic material - in this case, poultry carcasses -into a useful end product called compost. Dr. Murphy and others have demonstrated that composting will work during all seasons of the year. No offensive odor is created if properly done and the end product is safe and can be used as a fertilizer.

The compost mixture is made by adding the correct volumes of birds, manure and straw, or similar products, to a primary box. The basic formula, as recommended by Dr. Murphy, consists of:

Material	**Parts by Weight**
Dead Chickens	1
Poultry Manure/litter (cake)	1 1/2
Straw (Wheat)	1/10
Water (If needed)	0 to 1/2

The formula should provide a carbon: nitrogen ratio of 15 to 23:1 and a moisture content of 55 to 65%. The correct combination of the carbon and nitrogen material and the moisture content is critical for rapid and complete composting. When using the composter for the first time, the materials should be weighed in buckets in order to observe the approximate amounts of each item to add. Unless the litter is extremely dry, water will probably not be needed.

Other products that may be used in place of straw include: a) hay, b) cornstover, c) dried grass. d) bean pods, e) shavings, f) sawdust, g) wood chips, h) any similar material that would normally be used as litter. i) or finished compost (up to 50% substitution can be made) The composter should be loaded in the following manner. On the bottom place a double layer of straw, then a layer of manure or "cake," then another layer of straw. This is followed by a single layer of dead birds. Next add a 6 inch layer of manure or cake." The remaining layers are followed with straw, dead birds, and manure. The final layer should be capped with a double layer of manure or "cake. After loading proper humidity and temperature conditions are provided and after 14 days the compost can be stored or applied to the fields in the same manner as fertilizer. The composted material has a nutrient content similar to manure. It is usually lower in nitrogen and slightly higher in phosphorus and potassium.

Litter

There has been increased interest in using poultry litter as fertilizer since fertilizer prices have skyrocketed. Poultry litter has long been used near the point of production, but high transportation costs for its low analysis has limited its use to within about 50 miles of poultry houses. The ultra-high fertilizer prices of 2007 and 2008 have increased the geographical range within which it can be profitably used.

Some may be unfamiliar with what poultry litter is. It is poultry manure mixed with the bedding (wood shavings, rice hulls, etc.) that is scooped up when the houses are cleaned. The nutrient content of the litter can vary tremendously depending on the house clean-out technique, storage methods of the litter and other factors.

An average ton of poultry litter contains 60 pounds of nitrogen, 60 pounds of phosphate (P_2O_5) and 40 pounds of potash (K_2O) per ton of litter. Poultry litter also contains some amounts of all the other essential elements for plant growth, but the amounts are usually small. It is also a source of organic matter for the soil. If the litter has not been composted (most is not), there may be some small-seeded weeds, like pigweed, in the litter.

Since most of the elements contained in poultry litter are in the organic form, they are not all available the first year. Also, some of the nitrogen will be lost as a gas if the litter is not incorporated. As a general rule, assume that about 75 percent of the P and K will be available the first year and the remainder will become available the next year. That means that about 45 pounds of phosphate and 30 pounds of potash will be available the first year the litter is applied.

If the litter is surface-applied and not incorporated into the soil, about 25 percent of the nitrogen in the litter will be lost. Of the remainder, about 75 percent will be available the first year. So, if litter is applied to the soil surface and not incorporated into the soil, you will probably get about 30-35 pounds of nitrogen per ton of litter the first year.

Litter as Cattle Feed

Traditionally used as fertilizer, it is now also used as a livestock feed as a cost-saving measure compared with other feedstock materials, particularly for beef animals. Prior to 1967, the use of poultry litter as cattle feed was unregulated but that year the FDA issued a policy statement that poultry litter offered in interstate commerce as animal feed was adulterated, effectively banning the practice. In 1980, FDA reversed this policy and passed regulation of litter as a cattle feed.

Power Generation

There are currently several electrical generating plants in the UK, and recently in the US they are utilizing poultry and turkey litter as their primary fuel. There are currently five plants working on litter fuel. These produce 38.5 MW, 12.7 MW, 13.5 MW, 9.8 MW, 55 MW and 3.76 MW plant in india. They are now working on poultry litter, burning meat and bone meal as well.

On a smaller scale, poultry litter is used as a biomass energy source. This system uses the poultry litter as a fuel to heat the broiler houses for the next batch of poultry being grown thus removing the need for LPG gas or other fossil fuels.

Biogas Production

Chicken can make another product that help our living society to get more renewable energy, the energy comes from chicken's dung. By recycling chicken dung in biogas plant you get gas, electricity, heat and high quality fertilizer. Produced energy will be sufficient to provide poultry-houses, drying and granulating equipment with energy sources.

In anaerobically treated biomass nitrogen preserved in plant accessible ammonia form. One tone of solid bio-fertilizer contains 15-30 kg and liquid fraction 3-7 kg of ammonia nitrogen. Untreated chicken dung contains pathogenic microflora. After biogas plant treatment only active microflora present in biomass that stimulates soil microbiological processes. In the process of broiler breeding different types of litter are used. Mixture of dung and litter is not highly gas productive but also can be used as biogas plant raw material.

Feathers

While feathers are often considered a by-product of poultry produciton (and often a waste by-product), some produces raise poultry speicifically for their feathers.

Feathers are used in a number of decorative products such as boas, feather fans, masks, costume accessories, bird ornamnets, and even earrings and flowers. Feathers are also routinely used in the production of fishing flies.

While chicken feathers don't weigh much, with the amount of chicken produced in the world annually, the volume of feathers produced is considerable. For the 8+ billion broilers produced each year, 2-3 billion pounds of feathers are produced. Research has shown that the keratin in the feathers (a protein also found in hair, hoofs, horns, and wool) can be used in the produciton of a wide variety of products.

- Pillow stuffying
- Diapers

- Insulation
- Upholstery padding
- Paper
- Plastics
- Feather meal

Feather protein has properties in common with cellulose, the starch that forms wood and paper. Feathers are keratin just like wool but the surface area is much large because the diamter of the fibers is smaller. So the fiber can absorb more than wool or cellulose fibers. The crystal structure of feather fibers also makes them naturally stable and durable.

More than 16 million dipaers, made from wood pulp, are discarded each year. A year's worth of feathers could replace approximately 25% of the wood pulp used annually for diapers.

Many people are now working to scale up production of absorbent feather-based products including diapers, filters, insulation, upholstery padding, paper and even clothing.

The orderly structure of keratin helps stabilize the structure of plastics, making them stronger.

Feather meal is produced by a high-pressure steam processing method similar to autoclaving, followed by drying. Heat and steam hydrolyze the feathers into a cysteine-rich, high protein product that is 60% digestible and used as animal feed.

Utilization Of Blood

Poultry blood has a high level of protein and heme iron, and is an important edible by-product. In Europe, animal blood has long been used to make blood sausages, blood pudding, biscuits and bread. In Asia, it is used in blood curd, blood cake and blood pudding. It is also used for non-food items such as fertilizer, feedstuffs and binders. According to the Meat Inspection Act of the United States, blood is approved for food use when it has been removed by bleeding an animal that has been inspected and passed for use in meat food products.

Blood is usually sterile in a healthy animal. It has high protein content (17.0), with a reasonably good balance of amino acids. Blood is a significant part of the animal’s body mass (2.4–8.0% of the animal’s live weight). The average percentage of blood that can be recovered from pigs, cattle and lambs are 3.0–4.0, 3.0–4.0 and 3.5–4.0%, respectively. However, the use of blood in meat processing may mean that the final product is dark in color, and not very palatable. Plasma is the portion of blood that is of greatest interest, because of its functional properties and lack of color.

Use of blood plasma in food

Blood is used in food as an emulsifier, a stabilizer, a clarifier, a color additive, and as a nutritional component. Most blood is used in livestock feed in the form of blood meal. It is used as a protein supplement, a milk substitute, a lysine supplement or a vitamin stabilizer, and is an excellent source of most of the trace minerals. Blood plasma has ability to form a gel, because it contains 60.0% albumin. Plasma is the best water and fat binder of the blood fraction. Plasma gels appear very similar to cooked egg whites. Plasma forms a gel at a protein concentration of 4.0–5.0%. The strength of the gel increases with increasing concentration. Cooked ham to which were added 1.5 and 3.0% frozen blood plasma, and hot dogs with 2.7% added plasma, were more satisfactory in color than those without it. Blood plasma also has an excellent foaming capacity, and can be used to replace egg whites in the baking industry.

Medicinal and pharmaceutical uses of blood

Blood can be separated into several fractions that have therapeutic properties. Liquid plasma is the largest fraction (63.0%). It consists of albumin (3.5%), globulin and fibrinogen (4.0%). In the laboratory, many blood products are used as a nutrient for tissue culture media, as a necessary ingredient in blood agar, and as peptones for microbial use Glycerophosphates, albumins, globulins, sphingomyelins, and catalase are also used for biological assay. Many blood components such as fibrinogen, fibrinolysin, serotonin, kalikreninsa, immunoglobulins and plasminogen are isolated for chemical or medical uses. It is used in testing for the Rh factor in human beings, and as a stabilizer for vaccines. It is also used in antibiotic sensitivity tests.

Glands And Organs As Food And Feed

Poultry organs and glands offer a wide variety of flavors and textures, and often have a high nutritional value. They are highly prized as food in many parts of the world, particularly Southeast Asia. Those used as human foods include the brain, heart, kidneys, liver, lungs and spleen.

Potential Uses And Preparation Of Edible Meat By-Products

The brain, nervous system and spinal cord are usually prepared direct for the table rather than processed for industrial use. They are blanched to firm the tissue before cooking, because of the soft texture. The membranes are peeled from the brain before cooking. Heart meat is generally regarded as relatively touch, reflecting the nature of the cardiac muscle. Heart is used as a table meat. Whole hearts can be roasted or braised. Sliced heart meat is grilled or braised. Heart meat is often also used as an ingredient in processed meats. Kidneys

are generally removed from the fatty capsule which holds the kidney in place. The ureter and blood vessels need to be trimmed before the kidneys are prepared for cooking. Kidneys may be cooked whole or in slices, and are generally broiled, grilled, or braised. Liver is the most widely used edible organ. It is used in many processed meats, such as liver sausage and liver paste.

Animal intestines are used as food after being boiled in some countries. Animal intestines are also used in pet food or for meat meal, tallow or fertilizer. However, the most important use of the intestines is as sausage casings.

Medicinal And Pharmaceutical Uses Of Glands And Organs

Animal glands and organs are traditionally used as medicine in many countries, including China, India and Japan. The endocrine glands secrete hormones (i.e. enzymes that regulate the body's metabolism). These include the liver, lungs, pituitary, thyroid, pancreas, stomach, parathyroid, adrenal, kidney, corpus luteum, ovary and follicle.

Brains, nervous systems and spinal cords are a source of cholesterol which is the raw material for the synthesis of vitamin D3. Cholesterol is also used as an emulsifier in cosmetics. Other materials can be isolated from the hypothalamus of the brain for the same purpose. The hormone melatonin, extracted from the pineal gland, is being evaluated for the treatment of schizophrenia, insomnia and other problems, including mental retardation.

Bile consists of acids, pigments, proteins, cholesterol etc., and can be obtained from the gall bladder. It is used for the treatment of indigestion, constipation and bile tract disorders. It is also used to increase the secretory activity of the liver. Bile from cattle or pigs can be purchased as a dry extract or in liquid form. Some ingredients of bile, such as prednisone and cortisone, can be extracted separately, and used as medicines. Gallstones are reported to have aphrodisiac properties, and can be sold at a high price. They are usually used as ornaments to make necklaces and pendants.

The liver is the largest gland in animals. Liver extract is produced by mixing raw ground liver with slightly acidified hot water. The stock is concentrated into a paste in a vacuum at a low temperature, and is used as a raw material by the pharmaceutical industry. Liver extract has been used for a long time as a source of vitamin B12, and as a nutritional supplement used to treat various types of anaemia. Heparin can be extracted from the liver, as well as the lungs and the lining of the small intestines. It is used as an anticoagulant to prolong the clotting time of blood. It is also used to thin the blood, to prevent blood clotting during surgery and in organ transplants.

The pancreas provides insulin, which regulates sugar metabolism and is used in the treatment of diabetes. Glucagon extracted from the cells of the pancreas is used to increase blood sugar, and to treat insulin overdoses or low blood sugar caused by alcoholism. Chymotrypsin and trypsin are used to im Bones used to flavor liquid concentrate

Bones

In Asian countries, chicken bones are often used to flavor a concentrate used in cooking. In this process, crushed bones are cooked with water for 8 - 12 hours. The product is cooled and the fat skimmed off. The liquid remaining contains approximately 5.0% solids. Currently, the time of processing has been reduced to one or two hours by using a high-pressure extraction system (4-6 kg/cm2 or 57-85 lb/in2). This techniques yields 66.0% liquid extract, which contains approximately 10% solids. It can be concentrated by vacuum to 60.0% solids. Nine percent salt is added to stabilize the product. These extracts are often used as a soup base, or in noodle products, sauces, stews and curries, as well as in processed hams and sausages.

Rendering

Rendering processes are processes used to convert the poultry waste of meat and poultry processing into marketable products, including edible and inedible fats and proteins for agricultural and industrial use. Materials rendered include viscera, meat scraps including fat, bone, blood, feathers, hatchery by-products (infertile eggs, dead embryos, etc.), and dead animals. Food grade tallow are examples of edible rendering products. Inedible rendering products include industrial and animal feed grade fats, meat and poultry by-product meals, feather meal, dried blood. Rendering plants that operate in conjunction with animal slaughterhouses or poultry processing plants are called integrated rendering plants. Plants that collect their raw materials from a variety of off-site sources are called independent rendering plants. Independent plants obtain animal by-product materials from a variety of sources, including butcher shops, supermarkets, restaurants, fast-food chains, poultry processors, slaughterhouses, farms, ranches, feedlots, and animal shelters. Edible rendering plants separate fatty animal tissue into edible fats and proteins. The edible rendering plants are normally operated in conjunction with meat packing plants. Inedible rendering plants are operated by independent renderers or are part of integrated rendering operations. These plants produce inedible tallow and grease, which are used in livestock and poultry feed, pet food, soap, chemical products such as fatty acids, and fuel blending agents.