

NEW REGULATIONS AND SUSTAINABLE SOLUTIONS REMOVAL OF BY-PRODUCTS OF SLAUGHTERED LIVESTOCK

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Abstract: The environment is now threatened by the creation and accumulation of waste materials in all branches of industrial production and in the meat industry. The importance of harmless removal of animal waste increases with the intensification of animal breeding and with the development of meat processing plants..

Problem solution of harmless removal of animal origin waste products has the big importance. It is irreplaceable, namely preventive veterinary and sanitary measure used in control of livestock diseases and zoonosis. Nowadays, it has a big role in environment protection.

In the world, the best way of harmless removal of animal waste from meat industry as well as died animals is exactly their collecting and utilization (for feed production, chemical industry and fuel), depending on raw material structure and its characterization, their processing in special plants with modern equipment and technology.

It was emphasized that objects for animal waste processing should be treated from the two aspects: as processing plants serving for the environment protection and as possible environment polluters.

Key word: animal by-products, harmless removal, utilization of by-products, environment

Importance of Safe Disposal of Animal by-Products

Necessity of solution for safe removal of animal by-products by their utilization with processing into animal feed and bioenergets, grows with the intensification of animal growing and the increase of capacities of industrial slaughterhouses, uprise of new small slaughterhouses, building of plants for meat processing and increase of the volume of international trade of commercial animal products [1].

Correct solution for safe disposal of animal by-products can be perceived through three key aspects that should fulfill the technological solutions for solving of disposal of such materials by their processing, namely:

- the epidemiologic-epizootiologic aspect,
- aspects of environment protection, and
- economic aspect.

a) Epidemiologic-epizootiologic aspect

Having in mind that animal products (inedible by-products of animal slaughtering, died animals and other waste from cattle-growing farms) must be treated as potential sources of infective diseases of human beings and animals, their sanitary disposal ought to attach an exceptional significance [2].

Ristić et al. [3], in their research articles state that, in breeding stocks of animals, exist the individuals, which, in spite the fact that they do not show any clinical signs of diseases, carry in themselves definite

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pathogens, which they during their life excrete into environment (feces, urine) and after their natural death or slaughtering such carriers can be found in their carcasses or slaughterhouse waste. Many carriers which occur in such waste materials can relatively long keep their viabilities, and after that they can in different ways reach into the environment. For aerobic bacteria survival in tissues of died animals, conditions are better if animal was not buried, especially if the degradation process runs in the environment with optimal moisture content [4].

Exceptionally high dangers represent the animals that died from the infectious diseases, whose carriers are spores, and those are the cases with anthrax and the gas edema. Sporogenous forms are very resistant to the environmental factors, so that their survival life is long-lasting. According to Ristić et al. [5], the number of recognized zoonoses in the World is high (about 180), and we are witnesses of the appearance of some new ones, which until today were not registered as zoonoses (lime-boreliose, Ebola hemorrhagic fever, ehrlichiosis and from the year 2005 officially the bird flu as well).

According to the World Health Organization data, momentous epizootiologic – epidemiologic situation in the World points to the fact that the high number of communicable diseases shows trends of expansion, so that, with justification, it can be said that mankind's future belongs to the communicable diseases that, day by day, take their tribute on distinct parts of the World. Cited data confirms that animal by-products, from epizootiologic and epidemiologic point of view, represent high dangers with respect to animal and human health, and this necessitates needs for rapid and efficient, and at the same time, safe disposal of the mentioned materials [6].

b) Aspects of the environment protection

Today, even more and more attention is paid to the protection and upgrading of human environment, because it is threatened by the creation and accumulation of waste materials. The country strives to produce highest possible quantities of material properties that should satisfy human's needs for the best possible standard of living and to create optimal conditions for maintaining of sanitary conditions. Nevertheless, together with welfare properties that are necessary for human being, modern technical civilization creates high quantities of waste, which exert negative effects on the environment, degrading it to such degree that it becomes harmful to the health of people and animals [2].

Polluters are numerous inorganic and organic substances that reach in an organism by contaminated air, water and primarily, food. Their quantities are small, but in the course of time, they accumulate in an individual tissues and organs, causing diseases, degeneration or even death of organisms.

It seems that, together with aspirations for something better, it can have opposite consequences. This is fully applicable on agricultural and cattle growing production, which survived many changes. Such one tendency has been enabled by industrial preparing of feed and with even higher automation and mechanization of cattle growing. Dead animals, and inedible slaughterhouse by-products, as waste materials created in the production process, must be safely disposed, or, otherwise, they can become a serious brake for further development of production, in this case of food, and as such, they are serious polluters of the environment [7].

With the strengthening of production process in cattle growing and production of even higher quantities of meat, the problem of died animals as well as of heaping up of slaughterhouse waste emerges. Dead animals, and inedible slaughterhouse by-products, as waste materials created in the production process, must be safely disposed, or, otherwise, they can become a serious brake for further development of production, in this case of food, and as such, they are serious polluters of the environment. On the other hand, they can so severely contaminate the environment, that it begins to hinder intellectual and operative capabilities of human beings and disables the possibilities for their recreation [8].

Animal waste during putrefaction contaminates not only the atmosphere, but also the terrain, food and water. The greatest part of blood terminates in the sewage, i.e. in waste water, and only small share of blood is collected and processed [9]. Water courses are physically polluted, and at the same time, in such environments, blood appears as nutrient for microorganisms, many of which are strains, pathogenic for human beings and for the animal kingdom. Biological oxygen demand of blood, according to Baras et al. [10], is about 100,000 mgO₂/L. In the year 1982, contamination of water courses with waste blood in SFR of Yugoslavia was about 57·10⁹, which corresponds to the pollution caused by about 1 million of inhabitants.

Pollution of the environment by animal waste shows other adverse effects as well. Such places are also locations with ideal conditions for development of other insects and rodents. They enable the spreading of infections and substantially contribute to the degradation of visual acceptance of environment in which they live. Aesthetic unacceptability of so threatened environment is one of the problems that deserve even more space and time. Disrespecting of the rules on safe disposal of polluters reflects on soil-, atmosphere-, surface- and underground water qualities in the neighborhood, i.e. on climate and, further, on plant- and animal kingdoms and on health of human beings or, definitely on the eco-system as the whole [9].

c) Economic aspect of disposal of dead animals and inedible by-products obtained from slaughtered animals

Economic side of this problem implies collection and safe disposal of huge quantities of biological materials that necessitate costs, which have to be incorporated in prices of the obtained products. If waste of animal origin was not processed (recycled), it represents lost raw material that is possible to incorporate in production of proteinaceous - energetic feed, technical fat for chemical industry, or of fuels with high calorific value [9].

According to the European Union directives included in the Regulation (EC) N° 1609/09, by the processing of sanitary safe inedible by-products obtained during slaughtering of animals (materials Category 3), it is possible to obtain:

- proteinaceous, protein-mineral and energetic products aimed for animal feeding,
- technical fats,
- feathers for textile industry,
- skins, horns, hoofs, hairs,
- and from died animals (materials Category 2):
- meat-and bone meal as an energent,
- technical fat as an energent or raw material for further processing in chemical industry for production of bio-diesel, and
- biogas, compost.

Safe disposal of the described animal waste (material Category 1) by combustion at high temperatures (over 850°C) enables obtaining of warm water or steam as an energent for processing plant that uses warm water or steam, and ash as construction material for roads.

We shall mention only that, with the respecting procedures of blood collection and its technological processing, various articles for human use can be obtained, primarily products, which are used as functional additives in manufacture of meat products. Special processing procedures enable their use as raw materials in pharmaceutical industry or for production of functional foods [11].

On the other hand, industrial waste blood can be collected and processed using corresponding technological procedure in a plant for processing of other animal by-products, using special processing unit. Such

one procedure enables obtaining of feed with high protein content, which, mostly, contains high quantities of essential amino acids, vitamins and mineral substances, and particularly iron [12].

Articles (meat- and bone meal and fat) obtained by processing of materials of Category 1 are suitable for use as energetic fuel, i.e. as fuel for direct combustion in architecturally separated objects, respecting the corresponding legislative rules.

If all cited aspects were treated correctly, it is clear that organized processing and disposal of innocuous inedible slaughterhouse by-products obtained from slaughtered or died animals is of great importance for prevention of spreading of contagious diseases, successful protection and rehabilitation of the environment and for rational usage of such waste.

Classification Categorization and Approximative Quantities of by-Products in the Republic of Srpska

Considering hazards of outspreading of contagious diseases among humans and animals, and possibilities of their total or partial utilization, animal by-products are categorized in three categories. According to the investigation of numerous researchers and the Regulation No. 1069/09 of European Parliament and of EU Council, for animal feed only animal by-products classified as products of Category 3 can be used. Materials of Category [13] 1 must be safely disposed by their combustion in specially constructed furnaces or thermally processed into meat-bone flour and grease. Flour has to be safely disposed by combustion, and grease has to be processed into bio-fuel. Materials classified as Category 2 materials, with respect to the mass occurrence of the described zocenos and diseases of animals, can be made safe by one of the processing methods and so obtained protein-mineral part has to be combusted or composted, and the melted fat can be used as raw material for chemical industry [6, 14, 15, 16].

Upon review of the total slaughter of livestock in the Republic of Srpska in 2009 (www.rzs.rs.ba), and the average amount of by-products obtained by slaughtering animals [3], we give the quantities of inedible by-products of slaughtered animals.

Overview of potential quantities of non-edible by-products from slaughtered animals in the Republic of Srpska are summarized in the Table 1.

Table 1. Animal waste quantities in the Republic of Srpska in 2009 (www.rzs.rs.ba) [17]

Origin of waste	Slaughtered animals, pc	Meat/pc, kg	Meat, t	By-products/pc, kg	By-products, t
Cattle	32 866	175	10 896	44,79	1 472
Swine	76 953	68	6 921	7,18	553
Sheep	8 501	17	290	7,16	61
Poultry	7 545 310	2	15 804	0,60	4 527
TOTAL			33 911		6 613

In the Republic of Srpska in 2009, 32,866 cattle were slaughtered, 76,953 pigs, 8,501 sheep and 7,545,310 piece of animals, so as a result we have received 33,911 tons of meat and 6613 tons of animal waste. It is about 22 tons per day, 127 tons per week.

Quantity of animal waste which appears in circulation of goods (raw meat, intestines, cured products, sausages, fat) as well as quantity of died animal corpses which can be collected, should be added to this quantity. If the production of livestock and meat industry is not going to change drastically, there is 7.000 t of the animal by-products annually or cca 23.5 t daily, which should be harmlessly removed.

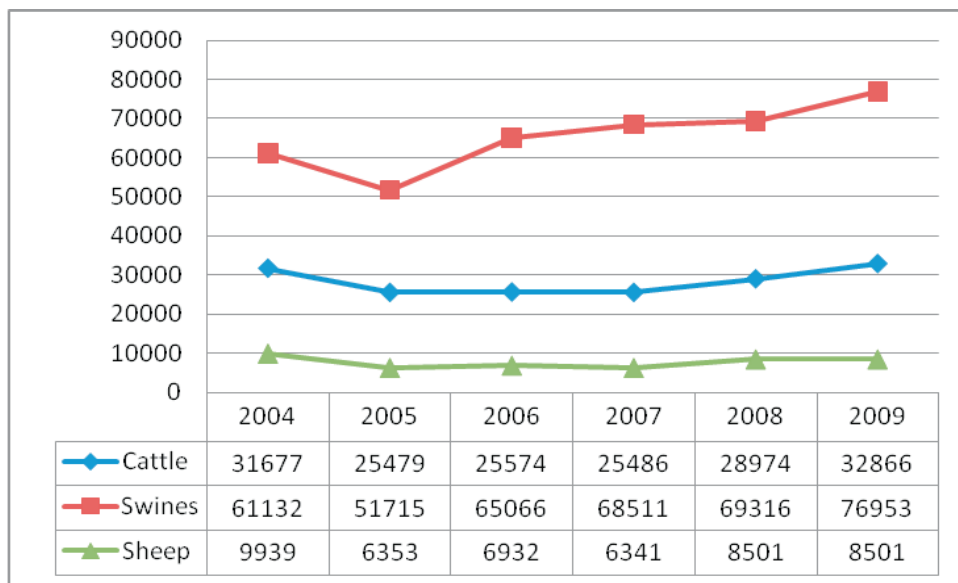


Figure 1. Slaughtered livestock in Republic of Srpska from 2004-2009. (www.rzs.rs.ba) [17]

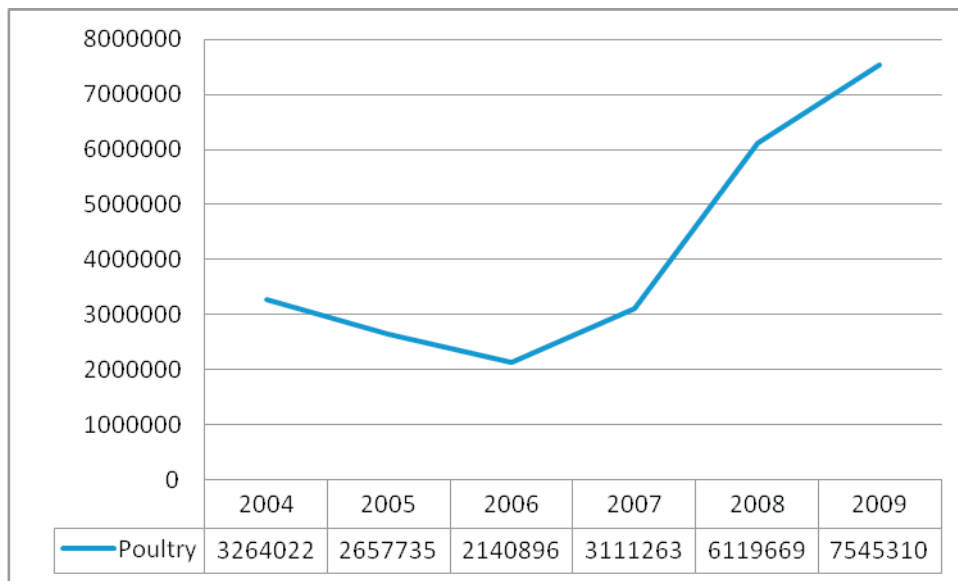


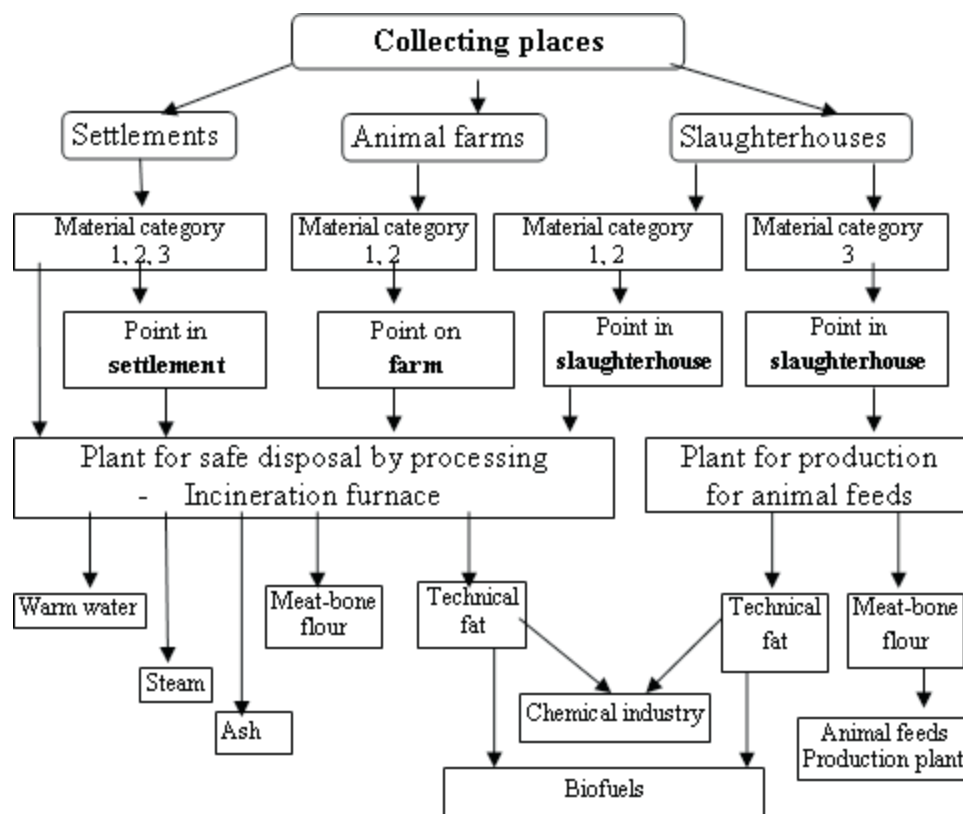
Figure 2. Slaughtered poultry in Republic of Srpska from 2004-2009. (www.rzs.rs.ba) [17]

Based on the number of slaughtered livestock in the Republic of Srpska in the last six years (Fig. 1 and 2) and trend, we can expect an increased number of livestock and thereby slaughterhouse waste. These numbers only indicate the size and significance of the problem.

Organizing of Collection

For proper sanitation of animal waste using one of the methods for their safe disposal and fully sanitary hygienic use of non-edible by-products from slaughtered animals, special importance has organized collection, storing and delivery of raw materials into facilities for their technical processing. Contemporary plant for sanitation of this kind of waste represents industrial plant with permanent and regular supplying of raw material. It is extremely important for the safe disposal of animal waste that each object has the correct recognition of its raw materials basis, i.e. formation of the collecting circle that enables obtaining of adequate quantities of animal waste of the given category [18].

Organizing of collection, storing and transportation of animal waste is shown in Scheme 1.



Scheme 1. Organizing of collection, storing and safe disposal of animal waste.

In the collection circle organization even the mode of collection of animal by-products is of complex nature, and from solving of which to a great part depends their hygienic and safe disposal and utilization.

Organization of collecting of mentioned raw materials has to be based on connection of objects for non-harmful disposal of dead animals and slaughterhouse waste (slaughterhouses, meat processing plants and animal breeding farms as well as other industries dealing with animal processing). Organization could be composed of a number of corresponding points for storing of waste within slaughterhouses and meat processing plants, as well as within settlements with larger concentrations of livestock. Point (collecting place) represents a hygienic object aimed for collection and storing of died animals and of non-edible by-products obtained from slaughtered animals. During the uprising of such points, the initiative of objects for non-harmful disposal should also be implied, gravitating to the establishment of a good organization of col-

lecting, with sanitary service accompanied by qualified sanitary technicians and all necessary equipment for collection and transportation of animal waste classified into mentioned categories [14].

Animal by-products and waste must be identified and labeled with their categories – category 1, 2 or 3 material, at their generation place, so that they remain identified during their collection and transportation. Identified raw material has to be resumed at collecting points into vehicles and transported into storage (point) for storing of animal by-products and waste separately according to their categories (materials 1, 2 or 3), or directly to processing plants.

Transportation of animal waste

Truck fleet contains special vehicles for resuming of raw materials at points of death, which accomplish transport of materials to the point of collection and from that point to the object of their safe disposal.

Non-edible by-products from great slaughterhouses (classified in categories) are directly transported into reception rooms for their safe disposal.

Vehicles take over the identified raw material on collecting places and transport it in storage (point) for keeping of animal by-products and waste classified in categories (materials 1, 2 and 3) or directly in processing plants [4].

Methods of Sanation of Animal Waste

Each period of economic development and scientific cognition in human and veterinary medicine leaves its contribution in understanding and solving problems of safe disposal of animal waste. Regardless of historical period, basic aim of the activities in this domain was to achieve rapid degradation of organic substances and to inactivate eventually present infective organisms, with, at the same time, prevention of contacts of human beings with the contagious materials.

Changes in the modes of rehabilitation happened with the appearance of neurodegenerative diseases of animals and human beings that characterize spongiform degeneration of brain – diagnosed as spongiform encephalopathy of bovine animals, i.e. the BSE, whose carrier, as it was found in the year 1986, is feed containing inadequately produced meat-and bone meal obtained from ruminants [14, 15].

According to the contemporary regulations in the European Union (Regulative (EC) N° 1069/2009), animal waste can be safely disposed, depending on their category, with the following methods:

1. burying on graveyards for pets,
 - burying on locations where organizing of other methods of safe disposal is hardly practicable because of the inaccessibility or for some other reason,
 - burying at the place of outbreaks when just described contagious diseases happen,
2. incineration of raw waste in special furnaces at high temperatures (850 – 1200°C),
3. combustion or co-combustion, after technical processing in the plant, which fulfills conditions for such method of safe disposal,
4. processing with production of compost and biogas, and
5. thermal processing into feed.

Prerequisite for safe disposal of animal waste using one of the described methods is organized collection and delivery of raw materials. Modern disposal of waste materials demands orderly con-

structured plants with adequate capacities, which should assure permanent and continuous supply of raw materials.

Exceptionally important is to emphasize the necessity of transfer of animal waste from the place where it was generated to the storage place as fast as possible, as well as the necessity of rapid performance of the procedure of its processing. This is very significant, not only from the epidemiologic-epizootiologic aspect or from environment protection aspects, but equally from the aspect of its technical processing. Namely, fresh raw materials are processed easier, with generation of lower quantities of waste gases and obtaining of better quality products [5, 8].

The acceptance of safe disposal of animal waste for its processing and incineration excludes classical forms of disposal (holes, animal graveyards), except for exceptional occasions, so that localities for such objects, nevertheless should be foreseen.

Economic side of this problem implies collection and safe disposal of huge quantities of biological materials that necessitate costs, which have to be incorporated in prices of the obtained products. If waste of animal origin is not processed (recycled), it represents lost raw material that is possible to incorporate in production of proteinaceous - energetic feed, technical fat for chemical industry or of fuels with high calorific value [19].

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Conclusion

Economic and overall development of the Republic of Srpska will have to increasingly be based on the organized research and development, which should produce permanent technological development as a development of existing and creation of new products, processes and services. The aims can be characterized as a multi-relevant in many aspects:

- Agricultural and food industry by-products, if not valorized, are disposed on landfills, in lagoons, buried in arid terrains or in open water courses, thus contaminating the environment.
- If all mentioned ecological and economical aspects are recognized properly, it becomes clear that organized solving of safe disposal of inedible by-products obtained from slaughtered or died animals by their technical processing is a valuable task.
- To the most rational solutions of their disposal belong their processing into feed, or raw materials for chemical industry and production of bio fuels. By manufacturing feed from sanitary safe raw materials (animal by-products belonging to Category 3 products), they are multiply valorized, with assurance of the rational development of cattle growing and protection of the environment.
- Application of bio fuels contributes to the reduction of oil consumption (i.e. of imports), reduction of emissions of detrimental gases, stimulation of sustainable development of rural regions

- Systematic research, integrated into all the interdependence and conditionality, ensures that aims are achieved not through partial progress in technological development, but for the sustainable solutions that will bring long-term technology development and prosperity.

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