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Remediation of by-products from slaughtered animals in regard to new regulations*

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A b s t r a c t: 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 safe animal waste disposal increases with the intensification of animal breeding and with development of meat processing plants.

Solving of the problem of safe animal waste disposal is very important. It is irreplaceable, preventive veterinary and sanitary measure used in control of livestock diseases and zoonosis. Nowadays, it has an important role in environment protection.

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

It was emphasized that facilities for animal wastes processing should be treated from two aspects: as processing plants aiming at the environment protection and as possible environment polluters.

Key words: *by-products of animal origin, safe disposal, utilization of by-products, environment.*

Introduction

Fundamental task of agriculture is the production of adequate quantities of high quality foods and raw materials of organic origin for the existing World's population and for rapid increase of that population of about 93 million people per year (*Kenedy*, 1993). Even growing demands for food production impose the needs for more efficient managing of economic resources that such production entails. Management of agricultural resources is crucial for survival of mankind, i.e. for the economic, cultural and social development of the society.

Safe disposal of inedible animal wastes was treated differently during its long history until today, when it obtained an exceptional significance. Today, it is considered as irreplaceable veterinarian-sanitary and preventive measure in suppression of spreading of infectious animal and human diseases (*Ristić et al.*, 2003). Even more and more is emphasized its role in rehabilitation and protection of the environment.

With respect to realization of this, arises the necessity of organized collection, storage and disposal of animal by-products from slaughtering, by their technical processing in specialized plants, which produce from this raw material (depending on category foreseen in the Directive EU 1774/2002) high-quality animal feed or raw materials for biofuel production (biogas, biodiesel) with the complete protection of the environment (*Ristić et al.*, 2007; *Okanović et al.*, 2007).

In order to realize the complexity of this problem, we described in this work the contemporary

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position and solutions for this problem, what, in fact, represent the objective of this study.

Importance of safe disposal of animal by-products

There is growing need for finding of the solution for safe disposal of animal by-products by their utilization and processing into animal feeds and biofuels, because of the intensive livestock production and increase of capacities of industrial slaughterhouses, building of new small slaughterhouses, of meat processing plants and increase of the volume of international trade of commercial animal products (*Okanović et al.*, 2006).

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

- the epidemiologic-epizoothiological aspect,
- aspect of the environment protection, and
- economic aspect.

a) Epidemiologic-epizoothiological aspect

Keeping in mind that animal by-products (inedible by-products of animal slaughtering, dead animals and other waste generated on livestock farms) must be treated as potential sources of infectious diseases of humans and animals, special significance must be directed to the issue of their sanitary disposal (*Ristić et al.* 2006, *Okanović et al.*, 2008a).

In case of animals that dead due to infectious diseases, before their death bacteraemia, vitaemia (salmonellosis, red wind, swine plough and other carriers) were found. Because of that, each dead animal and inedible slaughterhouse by-product should be regarded as the highest possible source of infection.

Animals and humans can be infected from the environment by direct contact with animal by-products, primarily with unprocessed or inadequately processed animal products, food contamination through air or by mediation of other vectors (insects, rodents, dogs, wild animals, birds), or in some other way. Under distinct conditions, the opposite cases can occur – transferring of diseases form people to animals. Such conditions create some kind of the infectious circle with moving of infection provokers in the environment between humans and animals, with or without distinctive mediator (*Prince i et al.,* 2003).

Exceptionally dangerous are animals that dead from the infectious diseases whose carriers are sporoes, such as anthrax and the gas edema. Sporogenous forms are very resistant to the environmental factors, so their survival life is long-lasting. If the dogs or wild animals are allowed to plunder parts of the infected animals, diseases carriers can be transferred over larger areas and considerably contaminate soils, representing high and long-term danger for animals of that region, as well as for human health (*Okanović et al,* 2010a).

According to *Ristić et al*., (2008), number of the recognized zoonoses in the World is high (about 180), and we are witnesses of the appearing of new ones which, until today, were not registered as zoonoses (lime-boreliose, Ebola hemorrhagic fever, ehrlichiosis and since 2005 officially the bird flu as well).

In recent years, global epizoothiologic and epidemiologic situation with respect to communicable diseases and zoonoses has been considerably changed. That was influenced, of course, by definite number of facts, such as rapid development of communications, accelerated development of technology and raw material exchange, inadequate utilization of animal wastes, wars, economic crises and other.

According to the World Health Organization data, present epizoothiologic – epidemiologic situation in the World indicates the fact that high number of communicable diseases show trends of expansion, so that it can justifiably be said that future of human population belongs to communicable diseases that day by day take their tribute on distinct parts of the World.

Cited data confirm that animal by-products from epizoothiologic and epidemiologic points of view represent high danger with respect to animal and human health, what necessitates the need for rapid and efficient and, at the same time, safe disposal of the mentioned materials.

b) Aspects of the environment protection

Today, more attention is directed to the protection and improvement of human environment, because it is under the threat due to creation and accumulation of waste materials. The country strives to produce the highest possible quantities of products in order to satisfy human needs for the best possible standard of living and to create optimal conditions for maintaining of sanitary conditions. Nevertheless, together with welfare aspects that are necessary to human population, 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 human and animal health (*Ristić* 2000; *Okanović et al.,* 2008a).

It seems that the aspirations for something better can have adverse consequences. This is fully applicable on agricultural and livestock production, which have survived many changes. Such tendency is enabled with industrial preparation of feeds and with even higher automation and mechanization of livestock production. Dead animals and inedible slaughterhouse by-products, as waste materials created in the production process, must be disposed safely, or, otherwise, they can become a serious obstacle 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, in a way that it begins to hinder intellectual and operative capabilities of humans and disables the possibilities for their recreation (*Okanović et al.,* 2007).

Dead animals and inedible slaughter by-products, like all organic substances, are susceptible to very rapid degradation. Such process is accompanied by the creation of products of decay, mainly of gases (ammonia, hydrogen sulphide, mercaptans), but also of other products of decay, such as fatty acids, aromatic acids and other substances (*Okanović et al.*, 2008b).

Animal wastes during putrification contaminate not only the atmosphere, but also the soil, food and water. The greatest part of blood flows into the sewage, i.e. in waste water, and only small share of blood is collected and processed. Water courses are physically polluted, and at the same time, in such environments, blood appears as nutrient for microorganisms, many of which are pathogenic strains to humans and animals. Biological oxygen demand of blood, according *Baras et al.* (2007), is about 100,000 mg O_2/L. In the year 1982, contamination of water courses with waste blood in SFR of Yugoslavia was about $57 \cdot 10^9$, what 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 insects and rodents. They enable spreading of infections and substantially contribute to degradation of visual acceptance of environment in which they live. Aesthetic unacceptability of environment threatened is one of the problems that deserve even more space and time.

The environment, especially air and water, can be contaminated even in the process of safe disposal of dead animals and inedible by-products of slaughtered animals and their processing into feed and raw materials for chemical industry. Because of that „the facilities for animal wastes processing“, according to *Ristić et al* (1998; 2008b) should be considered from two points of view – as facilities serving for environment protection, i.e. as manufacturing plants and, at the same time, as environment polluters.

Polluters deriving from the process of safe disposal of by-products are:

- scattered inlet raw materials,
- waste waters,
- waste gases,
- organic dust, and
- contaminated solids not adequate for processing.

Scattered input raw materials in the facility for safe disposal of animal wastes, if they are not removed on time, can be the significant sources of environment pollution and they can complicate normal technological process in the factory.

Waste waters in factories for processing of animal wastes appear in reception part, processing (final) part and in the station for cleaning and disinfection of transportation vehicles. Waste water obtained in reception part must be collected and sterilized using thermal or chemical processes and, together with other waste waters, transferred into separate facility for waste water treatment (*Nježić and Okanović,* 2010).

With respect to the facilities for animal wastes processing, they should fulfil two basic functions – to protect the environment from pollution cause by animal wastes and to generate sanitary safe products and, during the designing of the facility and during its regular operation, as well as during the unwanted incidents, to implement regular measures for protection of the environment. (*Ristić and Okanović*, 2008).

All above-mentioned indicates that the methods of disposal of dead animals and of inedible by-products used so far, in spite of all advancements, suffer from many problems associated with the absence of unique solutions, so that in this domain today, at the beginning of 21st century, we still find a mosaic of procedures known from relatively long history of disposal of this kind of organic materials. It is understandable that such situation does not satisfy contemporary needs, either from the aspect of suppressing of cattle contagion, or in connection with the improvement and intensification of livestock production and the environment protection (*Ristić et al.*, 2008b; *Okanović et al.,* 2008b).

Disregard of the rules on safe disposal of polluters reflects on soil, atmosphere, surface and underground water quality in the neighbourhood, i.e. on climate and, further, on plant and animal life and on health of human population, in other words, on the eco-system as the whole.

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 incurring certain costs which have to be incorporated in the price of obtained products. If waste of animal origin is not processed (recycled), it is lost raw material that could have been incorporated in production of protein - energetic feed, technical fat for chemical industry or of fuels of high calory value (*Okanović et al.*, 20010).

According to the European Union directives included in the Regulation (EC) Nº 1609 (2009), by processing of sanitary safe inedible by-products generated in slaughtering of animals (Category 3 materials), it is possible to obtain:

- protein, protein-mineral and energy products aimed for feeding of animals,
- technical fats,
- feathers for textile industry,
- skins, horns, hoofs and hairs.

and from dead animals (Category 2 materials):

- meat-and bone meal as an energy component,
- technical fat as an energy component, or raw material for further processing in chemical industry or for production of bio-diesel, and
- biogas, compost.

Safe disposal of the described animal wastes (Category 1 material) by combustion at high temperatures (over 850°C) enables obtaining of hot water or steam as energy component for processing plant that uses warm water or steam and ash as the material used for construction of roads. Products (meat- and bone meal and fat) obtained by processing of Category 1 materials are suitable for use as energy fuel, i.e. as fuel for direct combustion in architecturally separated facilities, respecting the corresponding legislative rules.

We shall mention only that with respect to 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 manufacturing of meat products. Special processing procedures enable their use as raw materials in pharmaceutical industry or for production of functional foods (*Matekalo-Sverak et al.*, 2007; *Okanović et al.,* 2008b).

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 procedure enables obtaining of feed of high protein content, which mostly contains high quantities of essential amino acids, vitamins and mineral substances, and particularly iron (*Okanović et al.,* 20010c; *Ristić et al.*, 2009).

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

Methods of rehabilitation of animal wastes

Each period of economic development and of scientific cognition in human and veterinary medicine leaves its contribution in understanding and solving of 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 infectious organisms, with, at the same time, prevention of contacts of humans with the contagious materials. It was realized in different ways:

- burying on animal graveyards,
- disposal of dead animals in landfill/pits--repositories,
- combustion in special furnaces, and
- technical processing.

Changes in the modes of rehabilitation, according to *Ristić et al.,* (2008a), occurred with the incidence of neurodegenerative diseases of animals and humans 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 as stated in the Regulative of European Parliament on inedible animal by-products (*Regulative (EC) Nº 1774*/2002).

According to the contemporary regulations in the European Union (*Regulative (EC) Nº 1609*/2009)), animal waste can be safely disposed, depending on the category, in the following way:

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 of described contagious diseases,
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 fulfils requirements/conditions for such method of safe disposal,
4. processing in production of compost and biogas, and
5. heat treatment and processing into feed.

Prerequisites for choice of some of the available methods of safe disposal that correspond to our region lie in recognizing of basic characteristics of different utilization methods.

Burying is one of the oldest methods of safe disposal of dead animals, which does not fully achieve the goal of the fastest possible extermination of contagious materials, because decay processes of organic substances in the ground are relatively slow, depending also on the ground quality. Burying of dead animals and inedible by-products obtained from slaughtered animals represents insanitary and uneconomical method of their safe disposal. The existing data on resistance of carriers of contagious diseases in decaying materials clearly indicate that burying of corpses of animals which died as consequence of contagious diseases is not safe disposal, and it represents conservation of contagious diseases carriers for the period of several decades. Burying of corpses as a method of disposal can be, according to the cited authors, tolerated only as emergency solution in case when there is no possibility for applying of heat methods because of inapproachability of terrain, as well as for corpses of small animals (pig, lamb, dog, cat, rabbit and similar). There is objective hazard, if dead animals are buried improperly, that the contagious material can be transferred with underground water to the neighbouring region. Because of that, Scientific Committee of European Union prescribed that only dead pet animals can be buried, on orderly arranged/organized graveyards for pets or dead animal not heavier than 50 kg; the owner can bury it on his property, 2.5 meters from the border with neighbouring property and in inhabited settlement 20 meters from the neighbouring building (with exception of spaces where difference of levels of surface and underground water does not exceed maximal value of 1 meter). Well constructed graveyard for pets is satisfactory mode of safe disposal for urban settlements, where significant numbers of pet animals appear.

Combustion of dead animals and inedible raw slaughter by-products is safe, but the most cost--effective method of safe disposal of the infected materials (*Ristić et al.,* 1997).

Co-combustion (co-incineration) of animal by--products (Category 1 materials) and of products obtained from by-products of processing of Category 2 materials – meat and bone meal, is the safest and economically justified method of safe disposal of dangerous animal waste.

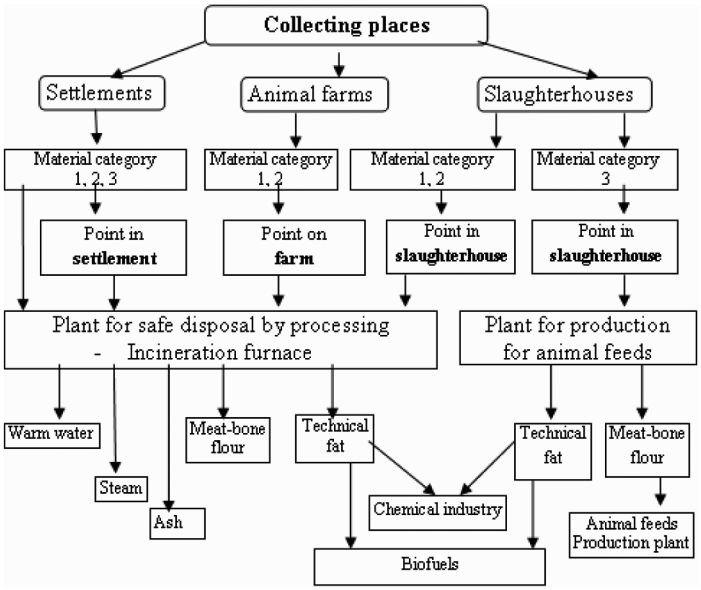
Safe disposal of animal waste by its processing and production of biogas represents one of the alternative methods for safe disposal of category 2 and 3 materials. This method of safe disposal of animal waste is relatively cost-effective, because it needs heat processing of animal waste, i.e. the corresponding infrastructure for biogas production with complicated technological process of bio-fermentation and biogas production.

According to *Ristić et al.,* (2006), without any doubt, the newest and the best method of safe disposal of animal waste is technical processing of separate categories into products for chemical industry, bio-fuels and feed for specific species of animals.

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 requires orderly constructed plants with adequate capacities, which should assure permanent and continuous supply of raw materials. This confirms the importance of recognizing the raw materials fundaments for each facility, i.e. organizing of epizoothiological and economically acceptable region, which should enable obtaining of adequate quantities of animal wastes that should allow designing and construction of modern facility for their safe disposal (*Ristić et al.*, 2008a).

Exceptionally important is to emphasize the need for transferring of animal wastes from the place where they were generated to the storage place as fast as possible, as well as the need for rapid performing of the processing procedure. This is very significant, not only from the epidemiologic-epizoothiologic aspect or from environment protection aspects, but equally from the aspect of the technical processing. Namely, fresh raw materials are processed easier, with generation of lower quantities of waste gases and obtaining of better quality products (*Okanovic*, 2009.)

In such collecting cycle, organizing collection of animal wastes represents very delicate problem; the successful operation of the processing plant depends on the solution of this problem. This problem, in any case, is relevant to both plant that process raw materials of animal origin and livestock farms and slaughterhouses that generate such raw materials. Also, local municipal communities have important role in solving of this problem. They are, according to the existing legislative rules on suppression of contagious diseases, obligated to organize safe disposal of animal waste in their region. In



Scheme 1. Organizing of collection storaging and safe disposal of animal wastes
Shema 1. Organizacija sakupljanja, čuvanja i neškodljivog uklanjanja životinjskog otpada

other words, organization of collecting of mentioned raw materials should be based on contracts between plants for safe disposal and processing of animal wastes and local municipal communities or their corresponding organizations (slaughterhouses, animal farms etc.).

The accepting of safe disposal of animal waste by processing and incineration excludes classical forms of disposal (holes, animal graveyards), except in exceptional occasions, so that locations for such facilities, should be foreseen nevertheless. It is valuable to add that, in the most cases, unsolved issue of training of participants in such activities, their inadequate number or inadequate qualifications, lack of equipment with the corresponding vehicles for transportation of dangerous things, further complicate the problem (*Ristić et al.*, 2010).

Legislation in the EU and Serbia

In the European Union, area of by-products of animal origin (animal carcasses and by-products from the facilities for slaughtering and meat processing and preparation of meat products) is regulated by Regulation (EC) No 1069/2009 and Regulation (EC) No142/2011, which are implemented since March 2011.

On the territory of Serbia, treatment of by-products of animal origin is regulated by Veterinary Law (Official Journal of RS No. 91/2005). In accordance with the Law, local authorities organize zoo-hygienic service on their territories, which remove animal corpses from public areas and run facilities for the cultivation, possession or transport of animals and their transport to the facility for collection, processing or destruction of by-products of animal origin in a manner that does not represent a risk to other animals, humans or the environment. Amendments to the Law stipulate the obligation of the local government to establish a facility for collection of animal carcasses and collection of small quantities of other by-products of animal origin from the animal slaughtering facilities and food of animal origin from households.

It is prohibited to throw corpses into rivers or other waterways or drains or leave them on the roads, open space, in the woods or elsewhere. Animal corpses and other by-products of animal origin must be collected, processed, or destroyed in the facilities for processing, treatment or destruction of animal corpses and other by-products of animal origin and only in exceptional cases, by-products of animal origin can be buried or burned on the animal cemetery or landfill/pit, which meets the requirements.

In dealing with waste of animal origin, producers of secondary products of animal origin are included, legal entities involved in their collection, processing and destruction, as well as the Ministry responsible/competent for veterinary care.

Veterinary and sanitary conditions for the construction of facilities for collecting, processing and destruction of by-products of animal origin are regulated by the Regulation on safe disposal of animal corpses and by-products of animal origin and the conditions to be met by facilities and equipment for collecting, safe disposal and determination of the cause of death and transport means for the transport of animal carcasses and animal waste (Official Gazette of SFRJ No. 53/89).

In order to taking measures to prevent the occurrence, detection, prevention of spreading, prevention and eradication of transmissible Spongioform Encephalopathy (Official Journal of RS No. 17/2006) wastes of animal origin, depending on the hazards are, classified as the Category 1, Category 2 and the Category 3. Category 1 material carries the risk associated with transmissible encephalopathy spongioform diseases (all communicable diseases from spongiform encephalopathy, including „mad cow disease") and Category 2 material carries, the risks associated with other animal diseases and zoonoses.

Category 1 material must be burned at temperature of at least 850°C.

To comply with the conditions regulating the field of waste products of animal origin, a draft regulation is prepared, which shall regulate/issue the manner of classification, treatment of by-products of animal origin, methods of their processing, hygienic conditions, the method of loading, unloading and reloading, veterinary and sanitary conditions for the construction, form and content of the register which is kept in the facilities for collecting, processing and destruction of by-products of animal origin, treatment of by-products in exceptional cases, the manner of implementation of official control and self-control, and the conditions for animal cemeteries and graveyards/pits and way of burying and burning of secondary products of animal origin.

Conclusion

Agricultural and food industry by-products, if without any value, are disposed of on landfills, lagoons, buried in arid terrains or thrown in open water courses, thus contaminating the environment.

Keeping up with laws and regulations, measures on safe disposal of contaminants must be strictly complied, to protect the quality of soil, air, surface and underground waters, plant and animal life, as well as the health of human population.

The most rational solutions of waste disposal are processing into feed, or raw materials for chemical industry and production of biofuels. By manufacturing of feed from sanitary safe raw materials (animal by-products belonging to Category 3 materials) added value is created, with assurance of the rational development of livestock production and of protection of the environment.

Application of biofuels contributes to reduction of oil consumption (i.e. of imports), reduction emissions of detrimental gases, stimulation of sustainable development of rural regions and increasing of available quantities of high-quality animal feed.

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 dead animals, by their technical processing, is a valuable task. This contributes to prevention of spreading of contagious diseases, to prevention and rehabilitation of the environment and to rational use of waste materials.

References

Baras J., Turubatović L., Matekalo-Sverak V., 2007. Cleaner production is the pathway to sustainable development. Tehnologija mesa, 48, 1–2, 83–92.

Kennedy P., 1993. Arhve Magazin, 3–8.

Matekalo-Sverak V., Turubatović L., Babić J., Trbović D., Milićević D., 2007. Utilization of powdered hemoglobin in formed meat products. Proceedings, 53rd ICoMST, Beijing, China, 431–432.

Naredba o preduzimanju mera za sprečavanje pojave, otkrivanje, sprečavanje širenja, suzbijanje i iskorenjivanje Transmisivnih Spongioformnih Encefalopatija 2006. „Službeni glasnik RS", broj 17.

Nježić Z., Okanović Đ., 2010. Environmental protection in meat industry, Food and Feed Research, 37, 1, 31–36.

Okanović Đ., Zekić V., Petrović L., Tomović V., Đžinić N., 2006. Ekonomičnost proizvodnje svinjskog mesa u polutkama, Tehnologija mesa, 5–6, 237–241.

Okanović Đ., 2007. Economic signifficance of production and processing of pork, I International Congress: „Food technology, quality and safety", XI Symposium NODA: „Technology, quality and safety in pork, Proceedings, 1–7.

Okanović Đ., 2008. Harmless removal of slaughterhouse by-products introduction, XII Internacional ECO-conference, Proceedings 313–320, Ecological Movement of the City of Novi, Novi Sad.

Okanović Đ., Ristić M., Delić S., 2008a. Sporedni proizvodi poljoprivrede i prehrambene industrije i kvalitet životne sredine. Kvalitet, 65–68.

Okanović Đ., Ristić M., Delić S., Lilić S., 2008b. Ekonomska analiza opravdanosti investiranja u pogon za preradu krvi. Biotehnologija u stočarstvu, 24, 635–641.

Okanović Đ., Mastilović J., Ristić M., 2009a. Sustainability of food production chain, Tehnologija mesa, 50, 1–2, 140–147.

Okanović Đ., Ristić M., Kormanjoš Š., Filipović S., Živković B., 2009b. Chemical characteristics of poultry slaughterhouse by-products, Biotechnology in Animal Husbandry, 25, 1–2, 143–152.

Okanović Đ., Ristić M., Popović M., Tasić T., Ikonić P., Gubić J., 2009c. Chemical characteristics of cattle slaughtering by-products for technical processing, Biotechnology in Animal Husbandry, 25, 5–6, 785–790.

Okanović, Đ., Milićević, D., Ristić, M. 2010a. Prilog za proračunavanje količina sporednih proizvoda zaklane živine, Veterinarski glasnik, 64, 5–6.

Okanović Đ., Ristić M., Kormanjoš Š., Matekalo-Sverak V., Lilić S., Palić D., 2010b. Quality of inedible by-products

of animal slaughtering intended for inclusion in pet food, 14th International feed symposium "Feed Technology, Quality and Safety", Proceedings, 262–268, Novi Sad.

Okanović Đ., Ristić M., Kormanjoš Š., Nježić Z., Lilić S., Grujić R. 2010c. Chemical and nutritional quality of slaughter pigs by-products. Quality of Life, 1, 1, 55–60.

Okanović Đ., Tica N., Zekić V., Vukoje V., Milić D. 2010d. Profitability of investment in plant for processing animal waste. Technics Technologies Education Management, 5, 2, 296–300.

Pravilnik o načinu neškodljivog uklanjanja životinjskih leševa i споредних производа životinjskog porekla i o uslovima koje moraju da ispunjavaju objekti i oprema za sabiranje, neškodljivo uklanjanje i utvrđivanje uzroka uginuća i prevozna sredstva za transport životinjskih leševa i otpadaka životinjskog porekla 1989. „Službeni list SFRJ" broj 53/89).

Prince M. J., Bailey J. A., Barrowman P. R., Bishop K. J., Campbell G. R., Wood J. M., 2003. Bovine spongioform encephalopathy. Review of Science Technology, 22, 1, 37–60.

REGULATION (EC) No 1069 2009. of the European Parliament and of the Council.

REGULATION (EC) No 142 2011. of the European Parliament and of the Council.

Ristić M., Filipović S., Radenković B., Sakač M., Kormanjoš Š., Ćurčić R. 1997. Waste gases arising in rende plats for animal and fish waste, Acta Veterinaria, Beograd, Vol.47 Nº 1, 33–40;

Ristić M., Radenković B., Sakač M., Omorac-Dvornić A., Pelagić-Radanov V., 1998. Uticaj objekata za preradu animalnih otpadaka na životnu sredinu. Tehnologija mesa, 3–4, 194–204.

Ristić M., Radenković B.., Đorđević M., 2000. Monografija „Neškodljivo uklanjanje uginulih životinja i nejestivih sporendih proizvoda zaklanih životinja", Triton-Public, Beograd.

Ristić M., Sakač M., Filipović S., 2003. Animalni otpaci i njihova sanacija u Srbiji, Međunarodna eko-konferencija: Zaštita životne sredine gradova i prigradskih naselja, 397–401, Novi Sad.

Ristić M., Filipović S., Sakač M., Lukić R., 2006. PROJEKAT Neškodljivo uklanjanje nejestiivh sporednih proizvoda životinjskog porekla i uginulih životinja preradom u kafilerijama otvorenog tipa i osnovni pokazatelji rentabilnosti prerade, Tehnološki fakultet, Zavod za tehnologiju hrane za životinje, Novi Sad.

Ristić M., Filipović S., Sakač M., 2007. Usaglašavanje postupaka sakupljanja, transportovanja, prerade, upotrebe i uklanjanja sporednih proizvoda životinjskog porekla koji nisu namenjeni za ishranu ljudi, sa propisima Evropske Unije, Projekat, Institut za prehrambene tehnologije u Novom Sadu, 13–25 i 30–34.

Ristić M., Okanović Đ., 2008. Processing of animal wastes and environment, XII Internacional ECO-conference, Ecological Movement of the City of Novi, Proceedings 321–326, Novi Sad.

Ristić M., Okanović Đ., Kormanjoš Š., 2008a. Istraživanje kvaliteta proteinskog brašna proizvedenog od pratećih proizvoda zaklane živine. Tehnologija mesa, 49, 5–6, 202–208.

Ristić M., Okanović Đ., Matekalo-Sverak V., Kormanjoš Š., 2008b. Ispitivanje mogućnosti korišćenja creva svinja za proizvodnju proteinskih hraniva. Tehnologija mesa, 49, 5–6, 159–201.

Ristić M., Okanović Đ., Radusin T. 2008c. Contemporary approach to animal by-products disposal problems. Food Processing, Quality & Safety, 35, 2, 81–92.

Ristić M., Okanović Đ., 2009. Tehnologija neškodljivog uklanjanja sporednih proizvoda klanja životinja, 8. Kongres veterinara Srbije "Veterinarska medicina, život i zdravlje", Zbornik kratkih sadržaja, 224, Beograd.

Ristić M., Okanović Đ., Kormanjoš Š., 2010. Studija o sakupljanju, skladištenju, transportu i prostornom uređenju objekta za sanaciju otpadaka animalnog porekla na području opštine Stara Pazova, Naučni institut za prehrambene tehnologije u Novom Sadu, Novi Sad.

Zakon o veterinarstvu 2005. „Službeni glasnik RS" broj 91.

Sanacija sporednih proizvoda zaklanih životinja u svetlu novih propisa

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R e z i m e: Životna sredina je, danas, ugrožena stvaranjem i gomilanjem otpadnih materija u svim granama industrijske proizvodnje pa i u klaničnoj industriji. Značaj neškodljivog uklanjanja sporedhih proizvoda klanja životinja raste sa intenziviranjem stočarske proizvodnje i razvojem pogona za preradu mesa.

Rešavanje problema neškodljivog uklanjanja otpadaka životinjskog porekla ima izuzetan značaj. Danas je to nezamenjiva veterinarsko sanitarna i preventivna mera u suzbijanju stočnih zaraza i zoonoza, a sve se više naglašava njena značajna uloga u saniranju i očuvanju životne sredine..

Najcelishodniji put za neškodljivo uklanjanje otpadaka iz industrije mesa, kao i uginulih životinja, u svetu je, upravo, njihovo sakupljanje i iskorišćenje (za proizvodnju hrane za životinje, hemijsku industriju ili pogonsko gorivo), u zavisnosti od vrste i strukture sirovina i njihove kategorizacije, tehničkim prerađivanjem u specijalnim fabrikama sa savremenom opremom i tehnologijom.

Istaknuto je da je potrebno da se objekti za preradu animalnih otpadaka tretiraju dvojako: kao proizvodna jedinica u službi zaštite životne sredine i kao mogući zagađivači životne sredine.

Ključne reči: *sporedni proizvodi klanja životinja, neškodljivo uklanjanje, iskorišćenje.*

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