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**Use of slaughter houses Overview of current situation**

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**2024**

**﴿ بِسْمِ اللَّهِ الرَّحْمَٰنِ الرَّحِيمِ﴾**

**حُرِّمَتْ عَلَيْكُمُ الْمَيْتَةُ وَالدَّمُ وَلَحْمُ الْخِنْزِيرِ وَمَا أُهِلَّ لِغَيْرِ اللَّهِ بِهِ وَالْمُنْخَنِقَةُ وَالْمَوْقُوذَةُ وَالْمُتَرَدِّيَةُ وَالنَّطِيحَةُ وَمَا أَكَلَ السَّبُعُ إِلَّا مَا ذَكَّيْتُمْ وَمَا ذُبِحَ عَلَى النُّصُبِ وَأَنْ تَسْتَقْسِمُوا بِالْأَزْلَامِ ذَلِكُمْ فِسْقٌ الْيَوْمَ يَئِسَ الَّذِينَ كَفَرُوا مِنْ دِينِكُمْ فَلَا تَخْشَوْهُمْ وَاخْشَوْنِ الْيَوْمَ أَكْمَلْتُ لَكُمْ دِينَكُمْ وَأَتْمَمْتُ عَلَيْكُمْ نِعْمَتِي وَرَضِيتُ لَكُمُ الْإِسْلَامَ دِينًا فَمَنِ اضْطُرَّ فِي مَخْمَصَةٍ غَيْرَ مُتَجَانِفٍ لِإِثْمٍ فَإِنَّ اللَّهَ غَفُورٌ رَحِيمٌ**

**الاية۲ من سورة المائدە**

**Declaration of Supervisor**

I certify that this research is under the title (**Use of slaughter houses Overview of current situation**

.Presented by the students:

**Ali salh Rezhin ali Fayruz muhamad Avan outhman**

It took place under my supervision at the Shaqlawa Technical College as part of the requirements for obtaining a diploma in veterinary medicine.

**Signature:**

** The name:** Assist.Proff. Dr Hassan

**Date:** / / 2024

Based on the available recommendations, I nominate the research for discussion.

**Signature:**

 **The name:** Assist.Proff. Dr Hassan - Head of department

**Date:** / / 2024

**The Approval of the Discussion Committee**

We, the members of the discussion committee, the undersigned, certify that we have seen this research decree { **Use of slaughter houses Overview of current situation**} .

Presented by the students:

**Ali salh Rezhin ali Fayruz muhamad Avan outhman**

We have discussed with the students its contents and what is related to it as part of the requirements for obtaining a diploma in (veterinary), and we found it fulfilling the requirements of the certificate.

Head of committee: Dr. Kamaran Muhammed Husien / / 2024

Dr. Dr. Dr.

Member Member Member

2024 2024 2024

**Dedication**

* To whom God sent as a mercy to the worlds... Our Prophet Muhammad, upon him be peace and blessings be upon him.
* ﻿﻿To our great family
* To our best friends

To those who:

* ﻿﻿Helped us in this project
* ﻿﻿Supported us during the hard times

**ACKNOWLEDGEMENT**

The Lord of the Worlds, who has the first and last credit for providing me with willpower and patience throughout my study period. And prayers and peace be upon the Seal of the Prophets and Messengers and the most honorable creation of God, our Prophet Muhammad. And the members of the discussion committee

Completion of this diploma dissertation was impossible without the support of several people; hence, I would like to express my sincere gratitude to all of them.

Great thanks towards my supervisor assist.proff.Dr Hassan for her aspiring guidance, invaluably constructive criticism and friendly advice during the project work.

I wish to show my appreciation to the department of Veterinary at shaqlawa technical rollege for any help during our 2 years of study.

My thanks and gratitude to my fellow student’s Postgraduate studies who were my best help and support, and to the staff of department

My thanks and appreciation to everyone who contributed to the completion of this project

### Abstract

The meat processing industry produces a huge quantity of by-products, approximately 150 million tonnes per year. The live weight of the animals is distinguished as edible, inedible, and discardable by-products, with the discardable parts equating to 66%, 52%, and 80% of the overall live weight of cattle, lamb, and pigs, respectively. Only a small percentage of those by-products are nowadays exploited for the production of high added value products such as animal feed, glue, fertilizers, etc., whereas the main management method is direct disposal to landfills. As such, the current disposal methodologies of these by-products are problematic, contributing to environmental contamination, soil degradation, air pollution, and possible health problems. Nevertheless, these by-products are rich in collagen, keratin, and minerals, being thus promising sources of high-value materials such as bioenergy, biochemical and other biomaterials that could be exploited in various industrial applications. In this paper, the possible utilization of slaughterhouse by-products for the production of various high added value materials is discussed. In this context, the various processes presented provide solutions to more sustainable management of the slaughterhouse industry, contributing to the reduction of environmental degradation via soil and water pollution, the avoidance of space depletion due to landfills, and the development of a green economy.

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**Introduction**

Great consideration has been given lately to the conversion of slaughterhouse byproducts to usable biomaterials, instead of disposal via landfilling, incineration, and burial, to minimize environmental and health issues, in addition to mitigating the depletion of space due to landfills. To reduce environmental problems due to the landfilling of by-products, consideration of the production of fertilizer, animal feed, and biomaterials should be taken as effective utilization of slaughterhouse wastes. An excellent option for handling these environmental and health problems is using an integrated biorefinery technique for the conversion of slaughterhouse waste into biomaterial, biofuel, biogas, and biochemicals [1]. Hence, by following an integrated biorefinery approach, the byproducts of the slaughterhouse can be utilized appropriately, not only to reduce pollution (contamination) but also to create job opportunities [2]. Slaughterhouse by-products are

taken to be secondary products obtained during the slaughtering and processing of livestock to get meat and by-products exist in liquid, solid, and semi-liquid forms [3,4]. Solid management is a rising concern, not only for developing countries but also for the world as a whole [4]. Worldwide, slaughterhouse industries produce a large number of organic by-products; however, conversion of by-products to usable biomaterials has great importance in facilitating a green economy and the consistent supply of biomaterials for its industries [5]. Slaughterhouse by-products are protein-rich biomass consisting of collagen (gelatine), keratin, fats, amino acids, and mineral products. The keratin and collagen parts are a valuable resource and their utilization results in consistent conversion into value-added materials, which leads to the product development of cost-effective biomaterials. In the meat processing industry, by-products make up 66% of the live load of cattle,

80% of the live load of pigs, 62% of the live load of broilers, and 57% of the live load of fish, being considered inedible by humans [6]. The meat processing industry plays a valuable role in sustaining the production of livestock, the livelihood of rural areas, and the earning of foreign currency. Slaughterhouses not only provide meat but also by-products for the people [7,8]. Worldwide, meat consumption is increasing as income levels and population growth increase. The majority of studies on the possible valorization of slaughterhouse by-products deal with their conversion to animal feeds and fertilizers. The current work goes a step beyond this, reviewing possible alternative options for the utilization of by-products in various high-added-value biomaterials. Thus, the novelty of this review is in the valorization of slaughterhouse by-products as high-value products and, at the same time, reducing problems related to waste disposal [9]. Hence, instead of landfilling or incineration of by-products, their conversion into high-value products such as composite materials, regenerated fibers, biomedical tools (tissue engineering, scaffolds, drug delivery carriers), electronics (electronic packaging, wearable electronics, fuel cells), and chemicals for various industries [10,11]. These applications may potentially consume the majority of the huge quantities of by-products produced by the meat processing industry. The review is tasked with responding to the priorities of action plans of the global strategy for sustainable development for optimization of biomass processing industries whilst ensuring economic growth with reduced environmental impact, i.e., resource-efficient, low carbon, and pre-employment growth paths [10]. Additionally, it aligns itself with a waste road map for organic by-product streams that support the maximization of the diversion of by-products from landfills towards value-adding opportunities The review shows the possibilities of utilization of abattoirs’ by-products as high-value products [12,13].

**2-Literature review**

**2.1.History of Slaughterhouse**

On 21 June 2009, SIGIR performed an on-site assessment of the abattoir project. The overall objective of this $1.1 million projecwas to design and construct an abattoir (slaughterhouse) in the Qaladze area in the province of Sulaymaniyah. The project included the construction of a slaughter hall, winter and summer halls, two guard houses, leather store, disembowelment hall, meat store, administration building, laboratory, general store, refrigeration room, and crematory.At the time of the site visit, theproject was approximately 35-40% complete. In general, the observed construction work appeared to meet the standards of the Statement of Work. SIGIR identified twoconstructiondeficiencies—an incomplete expansion joint system for the facility’s exterior and interior floor and the roof barrier, and a tripping hazard from an improperly constructed riser for a concrete stair unit. The contractor has already taken corrective actions to remedy these deficiencies.Aside from these two construction issues, SIGIR concluded that the construction work exhibited good-quality material and above-average workmanship and attention to detail. The contractor’s quality control management program waseffective. The contractor instituted a three-phase control system to ensure that construction complies with contract requirements. The government quality assurance (QA) program was effective. The QA reports were sufficiently complete, accurate, and timely. In addition to containing project specific information to document construction and highlight deficiencies, the reportsalso contained detailed photographs reinforcing the narrativeinformation. Once construction deficiencies were identified, GRN quickly contacted the contractor to determine the corrective actions needed to remedy the issues. The QA program is ensuring the successful completion of the project. To date, project results are consistent with the original contractobjectives. Once construction is completed, this facility will benefit the 120,000 city residents by providing them with access to fresh and processed meat produced in the most hygienic manner possible. [11, 12].

**2.2. Overview of the Slaughterhouse Processing Industry**

The livestock sector and meat processing industries are the highest contributors to environmental degradation and their by-products amount to nearly 150 million tonnes per year. The increasing demand for animal protein has led to the global livestock revolution, with significant implications for the environment and our health [14]. The annual slaughter capacity in Ethiopia reaches 4.6 million tonnes of beef, 1.5 million tonnes of poultry and 0.105 tonnes of fish and its by-product percentages vary from 40–60%, 10–45% and 25–70%, respectively [15]. In the meat processing industry, the majority of products consist of edible products and in-edible by-products [16]. Some of the by-products found in the slaughterhouse include tendons, skin, bones, gastrointestinal tract, blood and internal organs [11].

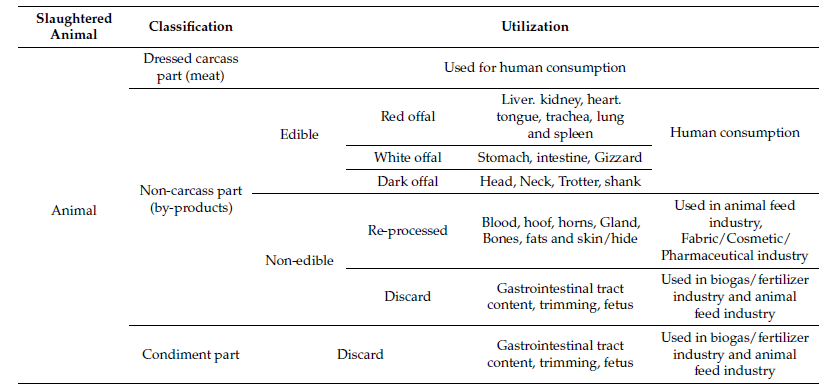
Proper utilization of slaughterhouse by-products has a positive significance for the

meat industry. Its increment should be 11.4% from beef and 7.5% from pigs from abattoir byproducts [11]. Most papers show the by-product content of cattle, lambs, and pork as 66%, 58% and 52%, respectively (organs, blood, bone, intestinal and abdominal contents, skin and fat). Almost 50% of meat processing animal by-products are not directly consumable; as a result, favorable sources of income are lost .

Most of the literature is focused on waste disposal systems; however, this review

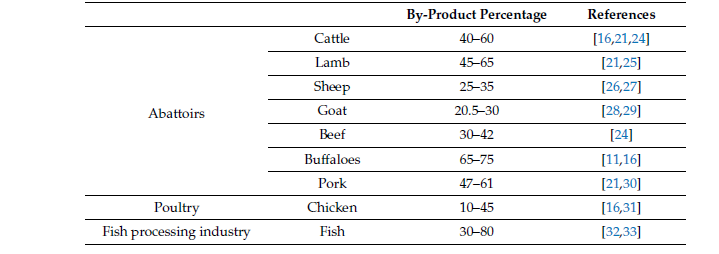
focuses on how by-products can be converted into valuable materials.

The yield percentage of the animal by-product can tremendously vary in terms of iving topographic area of the animal, sex, load weight, method of collection, and fat percent of the animals [21] Detailed classifications of animal by-products are found in Table 1. The common disposal techniques used still are controlled landfilling (by-product dump to the landfill site), incineration (thermal destruction technology), and burial.

**Table 1.** Classification of slaughterhouse by-product and its utilization area

With an increase in the world population, the demand for meat products is raising which rapidly deteriorates the environment and resources. The by-product percentage found in the meat processing industry is shown in Table 2.

**Table 2.** By product percentage of the meat processing industry.



**2.3 Current Disposal Techniques of Slaughterhouse By-Products**

The disposals of animal by-products are of critical concern not only for developing

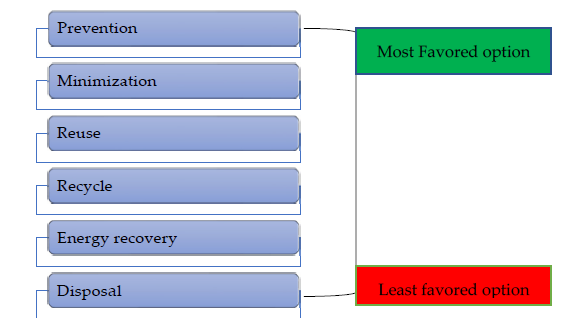
countries but also globally, as almost more than half of the by-products are discarded

and transported to the landfill site. This incurs not only levy for the government and its transportation costs but harms the development of slaughterhouse processing industry establishments [17]. Slaughterhouse by-products that are generated from the abattoirs processing industry are either disposed to landfill, incinerate, or buried. The solid byproducts are classified as solid or liquid wastes [18].

The ranking of the management techniques for any type of by-products is shown in

Figure 1. The by-products are any types of secondary products that are generated from the slaughterhouse. Mostly according to its desirability, it is recommended for people to reuse, recycle, and recover or reduce . The hierarchy explores the maximum benefits of the meat processing industry [19]. Among those different waste disposal techniques, landfills are not encouraged due to their high environmental pollution, especially in the case of slaughterhouse by-products [20].

The yield percentage of the by-products varies depending on the topographic area

(Breed) and ages of the animals, hence those by-products from cattle and buffaloes vary from 65–75% of the live load of the animal weight and the other animals account from 50–60% of the live weight and in poultry can reached to 30–40% of its live weight.

**Figure 1.** Slaughterhouse waste management hierarchy

In the meat processing industry, the non-edible by-product contents of the slaughterhouse

are most likely depending on religion, culture, health issues. Some people are not allowed to eat every edible part of the animals due to his/her medical issue [21].

All of the by-products (skin, hides, tails, horns, fetus, ears, trimming, hooves, blood, bone,

gland nails, and bristles) which are not directly consumed by the customer are called non-edible by-products

**2.4 Method Islamic of slaughterhouse**

1. Basically, the Islamic method of slaughter, which Muslims believe is the ideal one, does not involve stunning. It is carried out with utmost mercy on the part of the slaughterer, and minimum pain and suffering on the part of the animal. Official slaughterhouses should therefore develop their techniques with respect to large animals in order to ensure that these basic requirements are adequately met.

2. Pre-slaughter stunning of animals', using electric shock, is admissible if the following provisions are met:

a) The electrodes are applied to either both temples or in a frontal-occipital position

b) The voltage range is between 100 and 400 volts.

c) The electric current ranges between 0.75 and 1.0 ampere for sheep, and between 2.0 and 2.5 amperes for cattle.

d) the electric current is applied for a period of 3 to 6 seconds.

3. Since the effect and outcome of electrical stunning are closely related to the type of machine and electrodes used, standard specifications for suchThe joint Muslim World League/World Health Organization meeting held at Jeddah during Rabie al-Awwal 1106 AH/December 1985, recommended that "if it could be shown that stunning with electric shock enabled the animal to die peacefully, then it would be Islamically lawful\*. The meeting also set up a committee comprised of scholars of Islamic law (fugaha) and experts to study the effects of clectrical stunning and to verify whether it: a) mitigates the slaughter process and does not constitute a form of torture; b) does not in fact lead to death: and c) does not have any adverse effect on the animal nor cause harm to the consumer. The committee found that stunning: a) most probably mitigated the slaughter and eliminated pain: b) did not lead to death, provided that the conditions set out by the committee were met; and had no adverse effects on the (meat of the) animal nor would it cause any harm to the consumer. Section 4 gives the studies carried out by the committee and its findings.machines should be set in order to avoid the death of the animal before it is slaughtered.

4. It is essential to provide adequate technical training in the use of these machines and instruments, so as to ensure the safety of the operator and prevent misuse that might lead to pre-slaughter death or to undesirable subsequent effects on the meat.

5. Stunning by bolt-shot pistol is unacceptable, especially in the case of sheep.Instead, the animal may be constrained by putting it in a cage and then slaughtering it in the normal way prescribed in Islam. Nevertheless, should this method be applied, and the animal classified as mawguza ("beaten to death"), yet it is then slaughtered

6. Pre-slaughter stunning using carbon dioxide gas is not acceptable since it would be classified as munkhaniga, (death by suffocation) which is forbidden.

7. The Islamic requirements in the slaughter of poultry and hirds are only met by cutting the throat, esophagus and jugular veins with a sharp instrument.All necessary precautions should be taken to ensure that death is not brought about by any other means. Electrical stunning in this case would not be permissible, unless ways are found to guarantee the passage of electric current through the head only. Consumption of the meat of birds decapitated by machine is permissible.

8. Meat exporters and importers should be required to ensure that conditions of Islamic slaughter methods have been observed with respect to meat imported into Muslim countries. Slaughterers should be Muslims, as far as possible, and the slaughter should be carried out under the supervision of an Islamic body recognized by the importing country.

9. Authorities in non-Muslim cunuies are requested to allow their Muslim population the facilities to slaughter animals and birds in accordance with Islamic methods outlined above.

10. Muslims living in non-Muslim countries are urged to seek permission, within the laws of their respective countries, to conduct the slaughtering of animals according to their religion. If this is not available, they may eat the meat of animals slaughtered by Jews or Christians, which is permitted in Islam, having ensured that it is free of other forbidden meat and food.

11. Muslim visitors to non-Muslim countries. Unable to obtain meat of animals slaughtered in accordance with Islamic law, may eat the meat of animals slaughtered by Jews or Christians, having ensured that it is free of other.

**2.5. Burial and Landfilling**

The landfilling technique is the most common type of disposal method and requires

critical control to keep the odor, to minimize the environmental problem, groundwater contamination, and health issue [21]. Throwing off the by-product to the landfill site is a common practice in developing countries. However, nowadays the use of landfills is quite less due to the population growth (lack of space availability) and the occurrence of landfill gases and methane causes contamination problems, groundwater pollution, soil contamination, and air pollution as well. It is strongly believed that the landfill technique has to be eliminated and changed to the production of high value-added products.

Dead animals and other rich sources of slaughterhouse biomaterials are buried in filled pits. Pits burial requires a confined environment (especially a soil environment) for sucking the non-carcass liquids as well as for preventing other liquids and fluids to speed up the anaerobic contamination at low humidity. Pits provides a confined soil environment for absorbing carcass fluids and preventing heat loss, thus speeding up the anaerobic degradation process at the low moisture content [21].

**2.6. Incineration**

Incineration is one of the major types of thermal destruction of by-products by using

heat to decompose the by-product materials in the existence of oxygen and most of this type is employed for the solid waste management system. The merit of this system minimizes the space utilization of land by reducing the volume of solid waste by 90–93%. For developed countries, incineration is the best option to minimize the space required to landfill [22]. Hence, incineration is subjected to thermal degradation of solid waste and converted to heat, gas, ash and steam. Burning of the solid waste material by temperature up to 850 \_C and above would be performed for 20 min [5]. In a slaughterhouse, solid waste by-products are incinerated in a controlled manner. They may not cause expenses in the transportation of ash. Instead, they are used as a soil improvement.

**2.7. Utilization of Slaughterhouse By-Product: Present Scenario**

Abattoirs generate a large amount of solid as well as liquid waste and there is little

experience on the utilization of this waste . Most of the slaughterhouse processing

industries have taken landfill of the by-products as a first option [5]. However, some of them are trying to recycle and reuse (for fertilizer) animal feedstock (as a glue agent for the wood industry, for pharmaceutical application, and decorative purposes) [10]. Meat plays a sustainable role in feeding of humans worldwide and one of the indications of meat consumption globally is the rate at which a given country is going to become rich. Indeed, more the 80 billion animals are slaughtered international for meat annually [11].

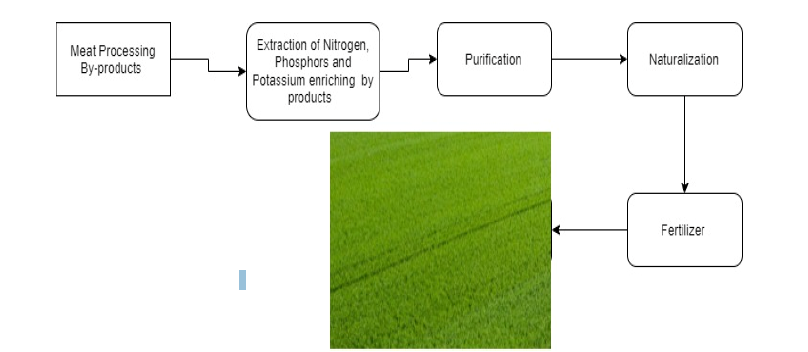
**2.7.1. Slaughterhouse By-Product for Fertilizer**

Slaughterhouse by-products are used as the production of fertilizer for crops such as

soybean and could have positive merit on minimization of contamination and pollution problems (since the by-products are rich in nitrogen content that will help as a fertilizer) .

Composting is the best option for organic waste utilization instead of using landfilling and incineration techniques. Animal source materials such as manure and residues from the abattoirs by-product and most of the time manures are derived from mammalians and milk-producing animals when the animal is slaughtered only 40% up to 60% of the live animals are converted to usable product (market product). the remaining 40% to 60% taken as by-products. Those by-products taken from slaughterhouses are mostly inedible such as feathers, bone. Hides/skins, hoofs, horns and blood are the main source fertilizers such as blood meal, fish meal and feather meal . Chicken manure with sawdust is the best organic fertilizer that is proposed to use for conditioning of soil than synthetic fertilizer. One by-product of the meat processing industry has a high organic fertilizer and high protein animal feed, N = 13.25%, p = 1.0% and K = 0.6%, and this is a result of producing the only high source nitrogen instead of that of synthetic fertilizer (even if the fertilizers are compatible with the crops and biodegradable as well) . The way fertilizers are produced from slaughterhouse by-products is shown in Figure 2.

Fertilizers productions from the meat processing industries are one option of utilizing the by-products to minimize environmental pollution and it is an economical method .Due to having more nitrogen content, it is preferable to use for composting.



**Figure 2.** Process scheme of fertilizer production from the meat processing industry

**2.8. Slaughterhouse By-Product for Animal Feed**

Most of the slaughter by-products are suitable for aforesaid application due to having

mineral matter [16]. However, the best option is to administer its conversion into blood meal, bone meal, and fish meal. Those meals are utilized as food for chicken and fish. The by-products have to be broken down into small particles for easy digestion by animals. Organic residues are preferably used for the production of animal feedstock [11]. Animal feedstock produced from the meat processing industry plays a great role in contributing to ensuring abundant organic sources, and affordable animal protein. Bio refineries currently focus on the utilization of by-products (blood, bone) to produce animal feed by catering to the poultry and cattle segment as shown in Figure 3.

Fertilizers productions from the meat processing industries are one option of utilizing the by-products to minimize environmental pollution and it is an economical method. Due to having more nitrogen content, it is preferable to use for composting.

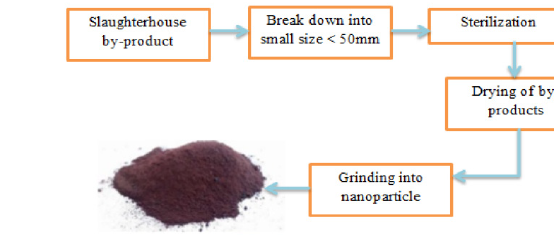


Figure 3. Animal feed production from the meat processing by-product industry [24]

**2.9. Utilization of Slaughterhouse By-Product: Prospects**

In the meat processing industry, every by-product should be utilized into high-value

Biomaterial if there is proper management of by-products characterization. Literature shows that the by-products percentage of buffaloes and castles ranges from 65–75% of a live load as compared with 50 to 60% of the live load of other animals such as sheep, goats, and pigs. However, the by-products yield from the poultry ranges from 30 to 40% of the live weight depends on the breed type and topographic area. In the abattoirs especially in Ethiopia, the majority of the wastes are produced during the slaughtering process. The slaughterhouse by-products are naturally protein-rich by-products which drive us to do on the characterization of it and utilization into high-value products as well. Traditional slaughtering process found in Ethiopia are currently going to disappearing due to their environmental and health concern and the low price of the products themselves.

Food and agricultural organization in the United States says that in 2030 the predicted meat production found in developing countries has to be 250 million tonnes among them almost 125–165 million tonnes are taken as by-products for the reason these by-products give us a potential area for the production of high-value by-products by biorefinery approach and the utilization of the by-products have importance to create better returns to the producer, reduce environmental pollution, employment generation, Increased soil fertility and conservation of resources [8]. The by-products from the meat processing industries are currently utilized as compositing, rendering and glue applications [22]. Some of the examples of how to use by-products in high-value products or biomaterials are discussed.

**2.9.1. Biogas Production**

Biogas is a renewable energy option produced through anaerobic digestion of wastes

such as livestock excreta and slaughterhouse wastes. Biogas production is treated as one of the leading processes to combat climate change as well as a waste management strategy, especially for a developing country such as Ethiopia. It is also vital in meeting future demand for energy utilizing of indigenous sources . Biogases are produced from by-products microbiologically through anaerobic fermentation. Livestock and poultry wastes are used for the production of energy in biomass since the wastes are rich in organic matter and most of the time fresh waste is more recommended and most suitable for its production [23]. Some of the by-products used for the production of biogases are the intestine; stomach and blood are the favored source of production. Biogas CH4) and 25–50 vol% carbon dioxide (CO2). The biogas which is produced from the meat processing industry is a well-known method not only for the production of energy but also minimizes the waste amount which is transported to landfills.



**Figure 4.** Potential for biogas production from slaughterhouse residues

**2.9.2. Edible Packaging**

Among the biomaterials found in the meat processing industry keratin is the most

abundant one although many reviewers deal on the utilization of keratin for medical,

fertilizer and cosmetic application it has been seen in the utilization of keratin for the production of edible packaging which is the most favored food Edible packages are produced from composites, lipids, resins, and hydrocolloids. The reason for increasing interest and research work on edible packaging is due to stable food and the convenient impact of biodegradable waste of packaging on the environment , and

keratin application is found at Figure 5.



**Figure. 5.** Utilization of keratin for production of edible packaging

**2.9.3. Tissue Engineering**

Many reviews have been carried out on utilization and characterization of keratin

Biomaterials due to their biocompatibility and biodegradability and positive impact on the body of humans until now few of those researches’ biomaterial developments are applied and used in tissue engineering. Scaffolds produced from keratin of animal hair shows that simplifying the peripheral nerve regeneration and encourage neurovascular retrieval and act efficiently in the hemostatic agent [85]. The capability of keratin-built biomaterials interpreted into the people medical setting is highly focused on further research work to elaborate on the mechanisms regarding hemostasis and nerve recovery [16] and utilization of keratin for tissue engineering is found in Figure 6.



**Figure 6.** Utilization of keratin for tissue engineering

**2.9. 4. Drug Delivery**

For numerous drugs, tenders-controlled drug delivery has been a prerequisite to

have therapeutic efficiency and to avoid its adverse effects [15]. Keratins are the best biomaterial for drug delivery of medicals for humans due to their compatibility, safe for the human body and demanded materials for health [17]. The utilization of drugs by incorporating nanomaterials is also another option to deliver drug, and due to its biocompatibility, easy to process, non-toxicity and biodegradability, keratin is very demanded biomaterial since any biomaterial for the drug delivery system must fulfil several requirements and the details are found at Figure 7.



**Figure 7.** Keratin-templated formation of the gold nanoclusters, with silver and gadolinium, for drug delivery system.

**2.10. Cosmetics Application**

In a global market currently, the skincare products produced from the fish are preferable due to moisture-retaining functions [21]. Amino acid surfactants are biosurfactants used in many personal care product formulations and preferred from surfactants that produce synthetic materials. Hydrolyzed surfactants found from fish are used for many uses such as hair softening, rinses; shampoo hair treatment agents at the same time reduce the harshness and breakage of hairs by penetrating throw-out the cuticle into the hair [23].

The main raw materials used for the production of cosmetics are fats, oils, wax and ester oils. Some surface-active agents and surfactants are used for emulsifier purposes. However, the meat processing industry by-products due to high-fat content are valuable materials for cosmetics production as well. Cosmetics produced from the meat processing.



**Figure, 8.** Production scheme of cosmetics from meat processing by-products [22].

**2.11. Food Industry**

Globally, the meat processing industry’s by-products are utilized for the production

of edible by-products for human use since they have high protein levels and mineral iron content. The slaughterhouse blood having of 80.9% water, 0.62% mineral, 0.23% lipids and 17.3%protein of the live weight of the bovine animals. In developed countries, the utilization of blood for blood sausages, blood pudding, biscuit, blood curd and breed have a long history [24]. Blood by-products are not only used for the production of human consumption products but also non-food items such as fertilizer, binders for textile application and feedstuffs for animals and the production of emulsifier, stabilizer and color additives in textile dyeing industry and the blood amount account (2.4–8)% of the live weight of the animals [9].

Midst of the animal by-products hides and bones are the main sources of gelatins and used for the production of food ingredients and dessert food too for the reason that of the elasticity, consistency and immovability used widely and besides, in the food industry, it is used also for medical pharmaceutical and photographic industry Gelatin is produced by hydrolysis of the collagen investigated from cartilages, bones, tendons, skins and bones of animals, and most gelatins are produced from pigs. However, due to cultural issue, the Islamic religion, and various health issue, the pigs’ by-product is not produced from it [8]. Its chemical structure makes it non-digestible and films made from it are more transparent and flexible (which makes them useful for food processing and paper production). The process for gelatin extracted from the meat processing industry is found in Figure 9.



**Figure 9.** Production scheme of gelatine from slaughterhouse by-product

**3. Conclusion**

The meat processing industries produce a large volume of solid and liquid waste, and from 50–65% of the live weight of the animals is not consumed by humans due cultural issue, religious issue and health problems and their disposal are either incineration or landfill which facilitates the environmental impact and contamination due to wastewater, spent air/waste gases, noise, animal waste, waste heat and residues in the end product. Those by-products are incredible resources of protein, fat, keratin, collagen, gelatine and mineral matter that could be used for the production of high-value biomaterial, biochemical and byproducts.

The utilization of by-products in cosmetics, biofuels, biodiesel, tissue engineering,

textile and composite application not only minimize the waste disposal percentage but also there will be a great reduction of soil degradation, water contamination and depletion of space utilization as well. A wide focus on research and development is a necessity to improve their utilization of by-products for the right application as explored in the review.

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پوخته‌

پیشەسازی پرۆسێسکردنی گۆشت بڕێکی زۆر بەرهەمی لاوەکی بەرهەم دەهێنێت، کە نزیکەی ١٥٠ ملیۆن تۆن لە ساڵێکدا. کێشی زیندووی ئاژەڵەکان وەک بەرهەمی لاوەکی خواردن و نەخوراو و فڕێدراو جیا دەکرێتەوە، بەشە فڕێدراوەکان یەکسانن بە ٦٦%، ٥٢% و ٨٠%ی کێشی زیندوو بە گشتی ئاژەڵ و بەرخ و بەراز، بە ڕێککەوت. تەنها ڕێژەیەکی کەم لەو بەرهەمە لاوەکیانە لەم سەردەمەدا بۆ بەرهەمهێنانی بەرهەمی بەهای زیادکراوی بەرز وەک خۆراکی ئاژەڵان، چەسپ، پێو و هتد دەقۆزرێتەوە، لەکاتێکدا شێوازی سەرەکی بەڕێوەبردن فڕێدانی ڕاستەوخۆیە بۆ زبڵدانەکان. بەم شێوەیە، شێوازەکانی ئێستای فڕێدانی ئەم بەرهەمە لاوەکییانە کێشەدارن، کە بەشدارن لە پیسبوونی ژینگە، تێکچوونی خاک، پیسبوونی هەوا و ئەگەری کێشە تەندروستییەکان. سەرەڕای ئەوەش، ئەم بەرهەمە لاوەکیانە دەوڵەمەندن بە کۆلاجین، کیراتین و کانزاکان، بەم شێوەیە سەرچاوەی بەڵێندەرن بۆ ماددە بەنرخەکانی وەک وزەی بایۆلۆجی، بایۆکیمیایی و ماددە بایۆلۆجیەکانی تر کە دەتوانرێت لە بەکارهێنانی پیشەسازی جۆراوجۆردا بقۆزرێتەوە. لەم توێژینەوەیەدا، ئەگەری بەکارهێنانی بەرهەمە لاوەکییەکانی کوشتارگە بۆ بەرهەمهێنانی کەرەستەی جۆراوجۆری بەهای زیادکراو باسکراوە. لەم چوارچێوەیەدا، ئەو پرۆسە جۆراوجۆرانەی کە خراوەتەڕوو، چارەسەر بۆ بەڕێوەبردنی بەردەوامتری پیشەسازی کوشتارگە دابین دەکەن، کە بەشدارن لە کەمکردنەوەی تێکچوونی ژینگە لە ڕێگەی پیسبوونی خاک و ئاو، دوورکەوتنەوە لە کەمبوونەوەی فەزا بەهۆی زبڵدانەکانەوە، و پەرەپێدانی ئابوورییەکی سەوز.