Sanitation at the Slaughterhouse and the Hygiene of Food of Animal Origin

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ABSTRACT— ***Nowdays, one of the most important issues is the issue of food safety. There are many problems with the control of food safety and creation of appropriate legislation that protects food of animal origin. Hygiene and sanitation should be effectively applied and should be controlled at each step during production in food processing plants. The aim of study was to evaluate the surface microorganisms in the monitored parts of the slaughterhouse before slaughter and during slaughter but also after disinfection by disinfectant Virkon S. Disinfectant was used in a 1 % concentration and applied by spraying. Virkon S was effective on all monitored surfaces except the table for organs, where were detected $2x10^2$ colony forming units per 10 cm^2 of total count of bacteria, $2x10^2$ colony forming units per 10cm^2 of coliform bacteria and $1x10^2$ colony forming unit per 10cm^2 of moulds after disinfection. The sanitation program should be thoroughly planned, actively enforced, and effectively supervised. Disinfection has its meaning since, everything that comes into contact with the raw material can contribute to outbreaks of food borne illness.***

Keywords— Disinfectant Virkon S, Microbiological swabs, Slaughterhouse, Hygiene, Disinfection

1. INTRODUCTION

Sanitation is the process which provides conditions that will ensure safe and wholesome products for human consumption. Appropriate sanitation and selection of proper and effective disinfectant is based on the knowledge of the resistance of microorganisms to the effect of used disinfectant, the efficacy of the disinfectants themselves and the impact on the environment [1]. Sanitation at a slaughterhouse requires the necessary adaptation and close links to individual production processes and technologies in order to ensure the health safety of food of animal origin and consequently to reduce the risk of production affected by poor hygiene of the plant.

The slaughterhouse is an establishment used for slaughtering of animals whose meat is intended for human consumption. Food business operators must ensure that the construction, layout and equipment of slaughterhouses where domestic ungulates are slaughtered comply with the requirements of Regulation (EC) No 853/2004 of the European Parliament and of the Council [2].

To ensure the quality of products in food operations according to HACCP requirements, the decisive factor is the control of hygiene and quality of cleaning of premises [3]. Microorganisms found in production facilities are part of the microbial contamination of the finished product [4]. The increased number of microorganisms, or the occurrence of contaminating microflora, represent the final consequence of incorrectly performed cleaning and disinfection [5].

The primary problem lies in the imperfect removal of organic residues in food production, from technological equipment, or from the working environment. Unremoved organic matter is a suitable nutrient medium for the multiplication of microorganisms, leading to undesired contamination [6]. Great emphasis is therefore placed on the whole complex of quality assurance, including production hygiene. In this system, a well-developed and functional sanitation regime has a leading place, the integral part of which is cleaning and disinfection. Sanitation is a complex of activities providing hygienic and anti-epidemiological care for food and hygiene during their processing [7]. Food sanitation includes decontamination, disinfection, rat control and insect control [8].

2. MATERIALS AND METHODS

2.1 Characteristics of slaughterhouse

In the study we focused on the evaluation of the level of hygiene in a small-capacity slaughterhouse with a

maximum weekly capacity of 5 large livestock units (LU). This slaughterhouse is located in the Košice region.

2.2 Microbiological control of effectiveness of disinfection

Evaluation of the sanitation was performed with microbiological swabs, which were taken from an area of 10 cm^2 into 10 ml of sterile saline solution and processed by the classical microbiological method. Swabs from individual surfaces (Figures 1, 2, 3) were taken before and during slaughter and after disinfection with Virkon S. The suspension was inoculated on nutrient agar - Meat peptone agar (MPA) for total count of bacteria (TCB), Endo agar (EA) for coliform bacteria (CB) and Sabouraud agar (SA) for yeast and moulds in the amount of 0.1 ml. The plates were incubated in a thermostat for 24 hours at 37 °C (EA and MPA) and for 72 hours at room temperature (SA), followed by incubation of the grown colonies. The procedure according to the valid ISO standards [9, 10, 11]. was used to determine the total count of bacteria, coliform bacteria and moulds. Individual species of microorganisms were expressed in CFU (colony forming units).

2.3 Characteristics of disinfectant Virkon S

The evaluated disinfectant Virkon S was used in liquid form, applied by spraying in 1% concentration without heating, the treatment time was 60 minutes. Virkon S is a multi-purpose disinfectant, a stabilized mixture of peroxide compounds, surfactants, organic acids and inorganic buffer. It contains potassium peroxymonosulphate used as an oxidising agent, sodium dodecylbenzenesulphonate (anionic surfactant), sulphamic acid and inorganic buffers. Virkon S is recommended for use as a disinfectant on hard surfaces in livestock facilities and in transport.

Figure 1: Knife grinder

Figure 2: Table for organs

Figure 3: Hanger for viscera

3. RESULTS

The effect of the disinfectant Virkon S in 1% concentration on the monitored surfaces (table for organs, hanger for viscera, knife grinder) before and during slaughter as well as after disinfection is shown in Table 1. Virkon S was effective on a hanger for viscera and knife grinder, where there were no bacteria after disinfection, but the presence of monitored microorganisms was confirmed on a table where $2x10^2$ CFU/10 cm^2 of total count of bacteria, $2x10^2$ CFU/10cm^2 of coliform bacteria and $1x10^2$ CFU/10cm^2 of Moulds after disinfection were detected.

Table 1: Effect of disinfectant Virkon S on evaluated surfaces before, during slaughter and after disinfection

		Table (CFU/10 cm^2)	**Hanger for viscera** (CFU/10 cm^2)	**Knife grinder** (CFU/10 cm^2)
Before slaughter	TCB	$5x10^2$	0	0
	CB	$1x10^2$	0	0
	Moulds	0	0	0
After slaughter	TCB	$2,5x10^3$	$5x10^2$	$1,2x10^3$
	CB	$1x10^3$	$1x10^2$	$1x10^3$
	Moulds	$3\ x10^2$	$1x10^2$	0
After disinfection	TCB	$2x10^2$	0	0
	CB	$2x10^2$	0	0
	Moulds	$1x10^2$	0	0

Abbreviations: CFU – colony forming units, TCB – total count of bacteria, CB – coliform bacteria

4. DISCUSSION

Hygienic condition at the slaughterhouse is one of the key factors in the production of hygienically flawless products [12]. A slaughterhouse is a device used to kill animals whose meat is intended for human consumption. In accordance with Regulation (EC) No 853/2004, food business operators are required to ensure that the layout and equipment of slaughterhouses comply with requirements of this Regulation. Slaughterhouses must be equipped with facilities for disinfecting tools with hot water at a temperature of at least 82 °C or an alternative system having the same effect.

A well-planned and implemented sanitation program in the slaughterhouse premises is very important for achieving the required hygienic standard. Sanitation is the process of providing appropriate hygienic conditions to ensure a safe and healthy product intended for human consumption, which includes hygienic precautions regarding personal hygiene, process hygiene, cleaning and disinfection [13]. The most objective indicator of the level of hygiene and sanitation is the detection of microbial contamination, which allows to evaluate the effectiveness of the disinfectant used, as well as the effectiveness of mechanical cleaning, which significantly affects the effectiveness of sanitation and take the necessary measures to improve hygiene [14]. Microorganisms detected after disinfection are generally more resistant and can pose a potential problem in terms of food safety or food degradation [13].

Failure of the disinfection may be due to the disinfectant selected being ineffective, the disinfectant being used incorrectly, or the environmental factor being affected. Disinfectants can be affected by several environmental factors, such as temperature, pH, or the presence of organic matter [15]. Disinfectants are not universally toxic to microorganisms, but to various degrees interfere with the metabolism of microorganisms and their enzymes [16]. The most objective method of evaluating the effectiveness of disinfection is microbiological control. The use of effective disinfectants minimizes product contamination, increases shelf life and reduces the risk of foodborne illness [17].

5. CONCLUSION

From the achieved results, it is clear, that the sanitation provided by the disinfectant Virkon S, used in 1% concentration, in the evaluated slaughterhouse was effective, as the evaluated disinfectant achieved a decrease in the number of monitored microorganisms and thus ensured a sufficient level of hygiene. When obtaining health and hygienically safe raw materials, the main prerequisite is the application of the principles of hygiene and thorough sanitation in operation, associated with cleaning and disinfection. The microorganisms present in the production premises form part of the microbial contamination of the finished product, since they are present on the floors, walls and surfaces of the technological equipment which come into direct contact with the raw material. Failure to respect and violate this presumption may result in primary or secondary contamination of food and consequently endanger the health of the consumer.

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