

HACCP PLAN FOR THE "SERBIAN SAUSAGE" TRADITIONAL SEMI-DRY PRODUCT

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Background

Hazard Analysis and Critical Control Points (HACCP) is a conceptually simple, science based system whereby the food safety hazards can be identified and evaluated by the meat establishment, which then institute controls necessary to prevent those hazards from occurring or keeping them within acceptable limits, monitor the performance of controls and maintain records routinely. Its established control systems are focused on prevention rather than relying on end-product testing. Any HACCP system is capable of accommodating changes, such as advances in equipment design, processing procedures, as well as technological developments. It can be applied throughout the food chain from primary production to final consumption or it can be tailored to address individual product or process. HACCP is the best system currently available for maximizing the safety of meat and meat products, as well as food in general, which is why it has been recommended for use in the food industry and promoted by the governments and scientific groups for more than a quarter of previous century. Today, HACCP is accepted by WHO, USDA, FDA, EU (Directive 93/94), Codex Alimentarius Commission (CAC), Danish Standard (DS 3227) and ISO 15161:2001 (QMS and HACCP).

Objectives

The aim of this paper is to present M.P."Carnex" experience on possible model of HACCP plan - developed for "Serbian sausage", traditional, semi-dry and very popular meat product in Serbia. At the beginning of the year 2001, top management of M.P."Carnex", a leader in Serbian meat industry (*daily output of more than 100 t*), made a decision to set higher performance standards that establishment must meet in providing conditions necessary to improve a products safety. Having in mind that M.P."Carnex" is wellknown plant and widely recognized for the high quality of products, which has been confirmed by numerous prestige awards in country and abroad, it is obvious that HACCP system will be implemented upon a solid foundation of existing operating procedures and approved GMP. These conditions are considered to be prerequisite to the development and implementation of HACCP system and HACCP plans.

Methods

All activities, regarding HACCP system development and implementation, are conducted according to recommended international codes by the CAC, as well as guidelines and requirements of Food Safety and Inspection Service, working ahead of expecting exporting agreements. In the same time, meeting all requirements of new versions of standard JUS ISO 9001:2001 and standard ISO 15161:2001, which regulates projected HACCP and Quality Management System, was essential.

Results and discussion

There was a widespread agreement that farm-to-table production of the meat plant requires a farm-to-table strategy for the control of food safety hazards throughout the continuum of animal production, slaughtering, processing, storage and distribution of meat products. Therefore, the endorsement of HACCP implementation concept by the top management of the meat plant was a natural solution and immediately after the decision was made, the HACCP team leader (together with the consultant) has determined a plan and dynamics of all activities. A commitment by management indicated an awareness of the benefits and costs of HACCP, including costs of education and training of employees and benefits regarding better use of resources and timely response to problems. Multidisciplinary HACCP team, which included HACCP-trained persons, was assembled and its primary tasks were to accomplish all the preliminary steps. That understood to describe over the 150 meat products, their method of production, distribution and storage, to identify the intended use and consumers of the products. Also, it meant to develop and verify more than 40 process flow diagrams and to group products using the process categories. The result of the last step mentioned was a number of 10 process categories named as following: 1) Slaughter--all species; 2) Raw products; 3) Salted and cured meats; 4) Frozen products; 5) Not heat treated--shelf stable; 6) Fully cooked--not shelf stable; 7) Heat treated--shelf stable; 8) Thermally processed--commercially sterile; 9) Production of spices, curing mixtures, additives and their mixtures; 10) Production of fat and fat-related products.

After the HACCP team confirmed the processing operation against the flow diagram during all steps of process and modified the flow diagram where appropriate, it was a time to list all of the hazards that may be reasonably expected to occur at each step and to conduct a hazard analysis to identify for the HACCP plan which hazards (biological, physical or chemical) are of such a nature that their elimination or reduction to acceptable levels is essential to the production of a safe food. The determination of a CCP in the HACCP system was facilitated by the flexible application of a decision tree, used for guidance. Critical limits was specified and validated where possible for each Critical Control Point and criteria used include measurements of temperature, time, moisture level, pH, Aw, available chlorine and some sensory parameters such as visual appearance and texture. Application of seven HACCP principles included establishing of: Monitoring System for each CCP, Corrective Actions, Verification Procedures and Documentation and Record Keeping procedures. The overall result was a system of more than 40 different HACCP plans and among them one concerning a safe production of "Serbian sausage" which we intend to present closely.

In the process of hazard analysis within HACCP plan for "Serbian sausage", using rich experience gained from yearly production of over 300 tons of this product through 50 years and relevant literature as well, HACCP team had identified five critical control points: four of them within biological/microbiological hazards (CCP-1B, CCP-3B, CCP-4B, CCP-5B) and one among chemical hazards (CCP-2H).

Within the process of Receiving of ground, cured (chilled) pork meat two critical control points, CCP-1B and CCP-2H, were identified. Meat must be received at temperature of 4 -7°C, or bellow, to maintain in chilled state and reduce potential risk of pathogen growth. That is why the receiver will check the temperature of each load of meat received and results will be recorded in the Product Temperature Receiving Log. Receiving supervisor will take product temperature once per shift and will review Product temperature Log as well as other HACCP records for this CCP: Thermometer Calibration Log and Corrective action Log within same period of time. All thermometers used for monitoring and verification will be checked daily for accuracy and calibrated if necessary within 1°C accuracy as necessary. In case of non-compliance corrective actions understand that receiver will hold meat that exceeds 7°C and notify supervisor and condemned meat will be denatured at the plant.

Further more, conservation effect of curing mixture (NaCl / NaNO₂) used for the pork meat received, in the same time represent critical

control point **CCP-2H** as a chemical hazard. Maximal granted share of sodium nitrite in final products is limited by the domestic Book of regulations - Quality of meat products and is up to 0,02% . Henceforth no additional sodium nitrite is added in the making process of this product, we must establish in this point a **CCP-2H** concerning consumer protection from toxic impact of sodium nitrite with a critical limit of up to 0,02%. That is why receiver will check the amount of sodium nitrite of each load of meat received and results will be recorded in the Product Amount of Nitrite Receiving Log. Receiving supervisor will take product amount of nitrite once per shift and will review Product Amount of Nitrite Log as well. Sodium nitrite determination will be conducted in certified plant laboratory using calibrated equipment. In case of non-compliance, corrective actions understand that receiver will hold meat that exceeds 0,02% of NaNO₂ and notify supervisor and condemned meat will be denatured at the plant.

Another critical control point, **CCP-3B**, was identified within the process of **Cooking & Smoking**. It is common practise to use proper finished internal temperature based on time/temperature schedule to reduce risk of pathogen (*Listeria monocytogenes*, *Escherichia coli* O157:H7, *Salmonella*, *Staphylococcus aureus* etc.) survival. That's why the finished internal temperature of min. 72°C for 120 seconds (sufficient to achieve > 7 log reduction in *Salmonella* as indicated in validated time/temperature tables) was promoted as a critical limits for this CCP. Smokehouse operator will continuously monitor verified parameters with Temperature/Time Monitoring Device to assure that critical limit are met. Continuous temperature recording chart named Cooking Chart for each batch is only one among others HACCP records regarding this CCP, including Time/Temperature Log, Deviation/Corrective action Log and Temperature Monitoring Device Calibration Log. This understand that supervisor will observe technician perform monitoring activities once per shift and that in case of reported deviation he will segregate and hold all affected products and with expert consultant within the plant make a decision whether to completely reprocess all products through the entire cooking cycle or to reject and condemn them. After that HACCP Team will identify and eliminate cause of deviation bringing CCP under control and take measures to prevent recurrence. Maintenance supervisor will verify accuracy of the temperature recording charts once per shift and will check Temp./Time Monitoring Device and calibrate it if necessary within 1°C accuracy.

Critical control point, **CCP-4B**, was identified within the process of **Chilling**. Inadequate chilling procedure "opens the door" for growth and toxigenesis for surviving pathogens/spores like *Clostridium perfringens* and *Clostridium botulinum* which heat shocked spores can become vegetative cells that proliferate causing subsequent toxigenesis in the food or human intestine. As a critical limits for this CCP we chose, within 90 minutes from the time the cooking cycle is completed, to reduce maximum internal product temperature of 72°C to 12°C in five hours and then from 12°C to 4°C in ten hours. Cooler operator will continuously observe adequate chilling parameters to ensure that critical limits are met. Cooler temperature will be monitored and recorded continuously using temperature record charts and temperature of the product will be checked for five randomly selected samples per batch and recorded in the Product Chilling Log every two hours for each lot, by the cooler operator, until 12°C is reached. HACCP records for this point understand: Cooler Temperature Recording Chart; Product Chilling Log; Corrective Action Log and Thermometer Calibration Log. Therefore, it is obvious that HACCP supervisor will review the product chilling log and cooler temperature recording chart once per shift and that Maintenance supervisor will verify the accuracy of the cooler temperature recording chart once per shift and will check all thermometers used for monitoring for accuracy on daily basis and calibrate them if necessary to within 1°C accuracy. In case of reported non-compliance HACCP supervisor will reject or hold products dependent on time and temperature deviation. If the products are not condemned process authorities recommendations will be followed. After that HACCP Team will identify and eliminate cause of deviation bringing CCP under control and take measures to prevent recurrence.

The last critical control point, **CCP-5B**, was identified within the process of **Cold storage**. There is no need to further stress the importance of maintaining the product temperature at or below a level sufficient to abate psychrophilic pathogen growth (e.g. *Listeria monocytogenes*). That's why the temperature of finished product storage areas not exceeding 4°C is set as a critical limit for this CCP. It will be monitored by the maintenance personnel of the storage areas every two hours and results will be recorded in Room Temperature Log. Maintenance supervisor will verify the accuracy of the room temperature log once per shift and will check all thermometers used for monitoring for accuracy daily and calibrate them if necessary, recording the results in Thermometer Calibration Log. If a deviation from critical limit occurs, no product that is injurious to health or adulterated will enter commerce and the cause of the temperature exceeding 4°C will be identified and eliminated. After the corrective action is taken CCP will be monitored hourly to ensure that it is under control. If the cause of the deviation is equipment failure, the preventive maintenance program will be reviewed and revised, if necessary. All actions taken will be recorded in Corrective Action Log paper.

Conclusion

In the present time, HACCP system (all HACCP plans) in M.P."Carnex" is in the process of implementation and expecting validation. There are chances that unforeseen hazards may occur at any place and any time and if it does - this establishment will: 1. Segregate and hold the affected product; 2. Perform a review to determine the acceptability of the affected product for distribution; 3. Take action, when necessary, to ensure that no product that is injurious to health or otherwise adulterated, as a result of the deviation, enters commerce; 4. Perform or obtain reassessment by an HACCP trained individual to determine whether the newly identified deviation or other unforeseen hazard should be incorporated into the HACCP plan; 5. At the end of validation process if the results are satisfying, the next step will be certification of HACCP system, under the competent certification body.

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