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STUDY OF UREASE ACTIVITY IN SEMI-FINISHED MEAT PRODUCTS

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Meat production is one of the fastest growing sectors of global agriculture, and poultry meat is the most accessible and expanding source of protein for people of all income levels. In connection with recent world events, such as the coronavirus pandemic, and considering its consequences, the issue of safety of "accessible" foodstuffs, among which poultry meat occupies a worthy place, is acute. For Kazakhstan, as well as for all countries, it is important to expand the range of food products that can significantly increase the immunity of the population to successfully overcome the consequences of the COVID 19 pandemic. Development of local poultry farming and import substitution are the main solutions to ensure product safety in any state. For effective development of poultry farming it is necessary to overcome one of the limiting factors - lack of modern system of safety monitoring throughout the food chain. The purpose of this work is to study the urease activity in meat semi-finished products. In this study urease activity was measured in raw and cooked meat products. As a result of the study the dependence of heat treatment with the pH index was determined. The indicator of urease activity during production allows for more detailed safety and quality assurance of meat semi-finished products.

Keywords: urease, urea, broiler, soy, meatballs, buffer solution, enzyme

ЕТТЕН ЖАСАЛҒАН ЖАРТЫЛАЙ ФАБРИКАТТАРДАҒЫ УРЕАЗА БЕЛСЕНДІЛІГІН ЗЕРТТЕУ

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Ет өндірісі әлемдік ауыл шаруашылығының ең қарқынды дамып келе жатқан салаларының бірі болып табылады, ал құс еті табыстың барлық топтарындағы халық үшін ең қолжетімді және кеңейіп келе жатқан ақуыз көзі болып табылады. Коронавирустық пандемия сияқты соңғы әлемдік оқиғаларға байланысты және оның салдарын ескере отырып, құс еті лайықты орын алатын "қол жетімді"

тағамдардың қауіпсіздігін қамтамасыз ету мәселесі өткір тұр. Қазақстан үшін, барлық елдер сияқты, КОВИД 19 пандемиясының салдарын ойдағыдай еңсеру үшін халықтың иммунитетін едәуір арттыра алатын азық-түлік ассортиментін кеңейту маңызды. Жергілікті құс шаруашылығын дамыту және импортты алмастыру кез келген мемлекетте өнімнің қауіпсіздігін қамтамасыз етудің негізгі шешімдері болып табылады. Құс шаруашылығын тиімді дамыту үшін тосқауылдардың бірін - азық-түлік тізбегі бойынша қауіпсіздікті бақылаудың заманауи жүйесінің жеткіліксіздігін еңсеру қажет. Бұл жұмыстың мақсаты ет жартылай фабрикаттарындағы уреаза белсенділігін зерттеу болып табылады. Бұл зерттеуде уреазаның белсенділігі шикі және пісірілген ет өнімдерінде өлшенді. Зерттеу нәтижесінде термиялық өңдеудің pH көрсеткішіне тәуелділігі анықталды. Өндірістегі уреаза белсенділігінің көрсеткіші ет жартылай фабрикаттарының қауіпсіздігі мен сапасын егжей-тегжейлі қамтамасыз етуге мүмкіндік береді.

Негізгі сөздер: уреаза, мочевина, бройлер, соя, фрикаделька, буферлік ерітінді, фермент.

ИССЛЕДОВАНИЕ УРЕАЗНОЙ АКТИВНОСТИ В МЯСНЫХ ПОЛУФАБРИКАТАХ

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Производство мяса является одной из наиболее динамично развивающихся отраслей мирового сельского хозяйства, а мясо птицы - наиболее доступным и расширяющимся источником белка для населения всех слоев доходов. В связи с последними мировыми событиями, такими как пандемия коронавируса, и учитывая ее последствия, остро встает вопрос обеспечения безопасности "доступных" продуктов питания, среди которых мясо птицы занимает достойное место. Для Казахстана, как и для всех стран, важно расширить ассортимент продуктов питания, способных значительно повысить иммунитет населения для успешного преодоления последствий пандемии КОВИД 19. Развитие местного птицеводства и импортозамещение являются основными решениями для обеспечения безопасности продукции в любом государстве. Для эффективного развития птицеводства необходимо преодолеть один из сдерживающих факторов - недостаточность современной системы мониторинга безопасности по всей пищевой цепи. Целью данной работы является исследование уреазной активности в мясных полуфабрикатах. В данном исследований активность уреазы измерялась в сырых и варёных мясных продуктах. В результате проведённого исследования определена зависимость термической обработки с показателем pH. Показатель уреазной активности при производстве позволяет более детально обеспечить безопасность и качество мясных полуфабрикатов.

Ключевые слова: уреаза, мочевина, бройлер, соя, фрикадельки, буферный раствор, фермент

Introduction

A peculiarity of soybean seed properties is the presence of urease and lipoxidase enzymes in their protein composition. Soybean ureases have undoubtedly been a milestone in science, a subject of research since the early 1900s. The many properties of these proteins have shown that ureases are much more than enzymes that hydrolyze urea and present a wide range of interesting biotechnological applications. The study of the toxic properties of plant ureases may be of great interest for the development of alternative strategies for crop defense against several natural enemies [1, 2].

Ureases are metalloproteins that catalyze the hydrolysis of urea to ammonia and carbamate. The latter rapidly decomposes spontaneously to form carbon dioxide and a second ammonia molecule. Plant ureases occupy a special place in the history of science, participating in some important milestones of biochemistry [3, 14, 15].

Urea is frequently incorporated into animal feed, and the combination of unprocessed soybeans with urea results in the release of ammonia under the influence of urease, which is an unfavorable consequence of mixing feeds. In ruminants, ammonia swiftly enters the bloodstream and can precipitate adverse effects, including diminished feed intake and impaired animal performance, and in extreme cases, death from ammonia poisoning [4, 5, 9].

To ensure that nitrogen is added to animal feed while protecting animals from the formation of toxic levels of ammonia, pretreatment of soybean meal is necessary. Heat treatment is the primary method used to eliminate or reduce the effects of soybean anti-nutritional and/or toxic factors, including urease, but these treatments should be minimized because of the potential to destroy important seeds [6, 7].

Several treatments were effective in inhibiting urease activity, including steam heating at 102°C for 40 min or at 120°C for 7.5 min, boiling at 92°C for 60 min, and dry heating at 100°C and 2 kgf/cm2 for 60 min. All these treatments abolished urease activity and also reduced a number of anti-nutritional factors [8].

The study of urease activity in meat semi-finished products is of great importance, as the urease activity index allows for more detailed monitoring of the safety and quality of meat semi-finished products during production [10, 11]. Despite the long-standing use of soybean flour in meat semi-finished products, the study of urease activity in such products remains relatively underdeveloped. Therefore, this study is pertinent for manufacturers of processed meat products.

Materials and research methods

The objective of this study is to examine the activity of urease in semi-finished meat products.

The object of the study is meat meatballs from broiler meat and soybean meal of different concentrations with the following qualitative indicators (Table 1).

Table 1. Main qualitative indicators.

Indicators, (%)	№1	№2	№3	№4
Moisture retention capacity, %	61±0,05	63,5±0,05	68±0,05	67,7± 0,05
Moisture content capacity, %	62±0,02	65±0,02	69,5±0,02	68±0,02
pH	6,60±0,02	6,82±0,02	6,59±0,02	6,63±0,02

In this study, the activity of urease was quantified in raw and cooked meat meatballs. The urease assay is based on the increase in pH resulting from the release of ammonia from urea by residual urease enzymes in soybean. The urease test was conducted in accordance with the following procedure: ten milliliters of urea buffer solution (pH = 7.0) was added to 0.200 grams of finely ground soybean (test sample), and ten milliliters of phosphate buffer solution was added to 0.200 grams of the same sample (clean sample). Both solutions were incubated at 30°C for 30 minutes with stirring. In the presence of significant urease activity, a notable increase in pH was observed in the test solution, which was attributed to the release of ammonia from urea. Following the incubation period, the pH of the solutions is rapidly determined, and the difference between the pH of the test solution and the pH of the blank is calculated as an indicator of urease activity.

Results and discussion

The results showed that raw meat meatballs had higher urease activity than cooked meatballs. The loss of urease activity in the whipped meat is due to denaturation of the enzyme during the cooking process. This increases the digestibility of soy and hence increases the adsorption of nutrients in our body. In addition, meat meatballs with 30% soy had higher urease activity than meatballs with 15% soy. Obviously, as the concentration of soy in meat meatballs increased, urease activity increased (Table 2).

Table 2. Changes in urease activity after 7 days

Tested products	№1	№2	№3	№4
1	2	3	4	5
pH (control)	6,50	6,60	6,50	6,50
pH (raw product)	7,96	8,30	7,35	7,14
pH (final product)	6,60	6,82	6,59	6,63

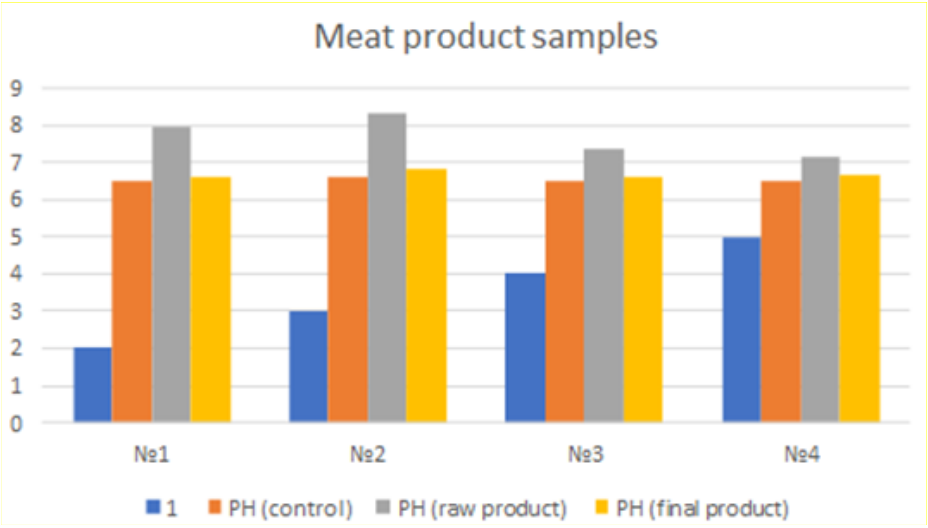

Figure 1. Changes in urease activity after 7 days

Control samples are those in which no urea buffer solution was introduced. In the absence of urea, the urease enzyme is unable to function. Accordingly, the pH of the control samples is within the expected range. The addition of urea to the reaction mixture results in the metabolization of urea by the urease enzyme, leading to the production of a basic pH. The measurement of urease activity allows for the identification of sample processing, including whether the samples have undergone heat treatment. The application of heat results in the irreversible denaturation of the urease enzyme [12,13].

Conclusion

As a result of this study, it can be concluded that in the urease assay, if the samples were heat treated, the pH of the sample will be the same as the control sample because urea cannot be metabolized. In raw soybean samples, the urease enzyme is fully functional, and therefore urea will be metabolized.

A regulatory process for the assessment of urease activity in human products does not currently exist. This type of assay is typically conducted on animal feeds to evaluate the impact of the production process on urease activity. The processing of soybeans results in the destruction of anti-nutritional factors and an increase in the efficiency of weight gain per unit of feed.

It is inadvisable to consume broiler meat in semi-finished products containing soy raw material unless the requisite heat treatment has been applied. It is thus recommended that products containing soy raw materials be subjected to heat treatment at the appropriate temperature prior to consumption.

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