CHANGES OF THE ASCORBIC ACID CONTENT IN CABBAGE AS RESULT OF PROCESSING

MODIFICAREA CONȚINUTULUI ÎN ACID ASCORBIC LA VARZĂ CA URMARE A PROCESĂRII

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Abstract. *Ascorbic acid, an antioxidant important for human diet, found in many horticultural products, its contents depending on interaction with other chemical compounds present, correlated with maturation period and conditions of storage and processing. Determination of vitamin C was performed on one variety of cabbage, cabbage - raw, cabbage samples taken from the technological process and the finished product. Vitamin C content was determined by reflectometry method using Reflectoquant meter. Were measured and other parameters such as pH, acidity, salt content. Processing involves followed by lactofermentation process, knowing the literature that it reduces the ascorbic acid content, this is confirmed by the results. Following analyzes showed that ascorbic acid was decreased from 47,61 mg/100 g raw material to 22,53 mg/100g finished product.*
Key words: ascorbic acid, ascorbatoxidase, lactofermentation, cabbage

Rezumat. *Acidul ascorbic, un antioxidant important pentru alimentația omului, se găseşte în numeroase produse horticole, conținutul său depinzând de interacțiunea cu ceilalți compuşi chimici prezenți, corelat cu perioada şi condițiile de maturare, de depozitare şi de prelucrare. Determinarea vitaminei C a fost efectuată pe un singur soi de varză, varza – materie prima, probe de varză prelevată de pe fluxul tehnologic cât şi la produsul finit. Conținutul în vitamina C a fost determinat prin metoda reflectometrică, folosind aparatul de măsură Reflectoquant. Au fost determinați şi alți parametri cum ar fi: pH-ul, aciditatea, conținutul în sare. Procesarea urmărită implică un proces de lactofermentare, cunoscându-se din literatura de specialitate că acesta reduce conținutul în acid ascorbic, acest fapt este confirmat şi de rezultatele obținute. În urma analizelor efectuate s-a evidențiat ca acidul ascorbic a scăzut de la 47,61 mg/100 g materie primă la 22,53 mg/100g produs finit.*
Cuvinte cheie: acid ascorbic, ascorbatoxidază, lactofermentare, varză

INTRODUCTION

L-ascorbic acid occurs in fruits and many vegetables. In plants, L-ascorbic acid is essential for photosynthetic activity during the detoxification of superoxide and hydrogen peroxide in chloroplasts, in the absence of catalase. L-ascorbic acid is also involved in the regeneration of α-tocopherol.

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L-ascorbic acid is an anti-darkening substance in food, because of its antioxidation properties (Cioroi, 2007).

Vitamin C plays a major role in the manufacture and defense of our connective tissue, the elaborate matrix that holds the body together. It serves as a primary ingredient of collagen, a glue-like substance that binds cells together to form tissues (Gaby and Singh, 1991).

Vitamin C helps the immune system to fight against foreign invaders and tumour cells. Vitamin C also supports the cardiovascular system by facilitating the metabolism of fats and protecting tissues from free radical damages, and it assists the nervous system by converting certain amino acids into neurotransmitters (Schectman, 1991).

As an antioxidant, Vitamin C's primary role is to neutralize free radicals. Since ascorbic acid is water soluble, it can work both inside and outside the cells to control free radical damages (Cioroi, 2007).

Lactic fermentation is an aerobic process that fermentable glucides are metabolized by the action of microorganisms enzyme equipment in lactic acid, as the main product, and secundary products, such as diacetyl: acetoin, acetic acid, ethanol and CO_2 (Banu, 2008).

NaCl solution creates an osmotic pressure difference. Some of the glucides existing in the cabbage (3 to 6%) pass in the salty liquid, forming a favorable environment to start the lactic fermentation (Beceanu, 2010).

Lactic fermentation has three phases: heterofermentative phase (turbulent); homofermentative phase (slow) and the final phase (without training the CO_2).

The first phase is characterized by the presence of heterofermentative bacteria (*Leuconostoc mesenteroides, Bacterium coli),* which convert glucides into lactic acid, acetic acid, ethanol, and mannitol, with obvious CO_2 release, metabolizing a part of proteins. The titratable acidity increase to 0,7-1% (expressed as lactic acid) forming esters that prints the specific flavor of pickled. The first phase is called turbulent, sparkling, preliminary and lasts 4-6 days, after which heterofermentative bacteria ceases its activity, being inhibited by increasing pH and and its catabolic products (acids, alcohols). The tripping Optimal temperature is 15-20° C, below 15°C the process starts more difficult (but the pickles shall remain strong), over 30° C the fermentation process is too short and causing the phenomenon of autolyzer (softening).

Phase two (proper fermentation) is provided only by the homofermentative bacteria (*Lactobacillus plantarum, L. cucumeris*), which converts the remaining glucides and the mannitol into lactic acid, with a low CO_2 emission. The acidity increases up to 1,5-2%, and the pH decreases ultimately to 4,1-4,2, destroying the bacteria active by this time. The phase is also called primary or extended and lasts 3 to 4 weeks. Typically require lower temperatures and ventilation (decanting). With the second phase may be considered the pickling finished.

The third phase (alteration) is the result of bacteria (*Lactobacillus brevis and L. pentoaceticus*), which also may raise the acidity up to 2,5%. In the end can be observed the formation of pellicular yeast - "flower" (*Oidium lactis*), which gradually consumes the lactic acid content and causes acidity decrease, gradually reducing the conservability. At temperatures of 5-10° C the process is slowed (Beceanu, 2008).

MATERIAL AND METHOD

The analyzed material was collected from the S.C. Contec Foods S.R.L. Tecuci. In this study were determined the ascorbic acid content, the ascorbatoxidase, the pH and salt content. Samples were analyzed in the raw material (the first stage of technology-reception), during fermentation process and from the finished product. The samples have been shipped in vacuum polyethylene bags at low temperature, and then stored in a refrigerator at 2 to 4°C until analysis.

Technological process of pickled cabbage includes the following phases: reception, sorting, cleaning, calibration, washing, cutting, preparation of fermentation vessels), preparation of brine fermentation vessels loading, brine adding, closure of fermentation vessels, fermentation, decanting, the control and assessment of fermentation, conditioning, storage and delivery of the finished product.

In the elaboration of this study the following methods were used:

- to calculate the content of ascorbic acid has been used the titrimetric method in accordance with STAS 5950;
- the pH has been set using the pH meter according to SR EN 1132;
- for the determination of ascorbatoxidase has been used titrimetric method with potassium iodate;
- the salt content has been determined using Mohr's method.

RESULTS AND DISCUSSIONS

The nutritional value products consevated by lactofermentation and hiperchlorunation its lower, because the strongly saline solutions used dissolve the vitamins, the aminoacids and the mineral salts. Applied desalting process contribute to a reduction content of minerals salts, water-soluble vitamins and other water-soluble components. As part of this process takes place also changing the food organic properties: changing the color and consistency.

In figure 1 is represented the ascorbic acid dynamics. Ascorbic acid content is influenced by the process of fermentation and salt content.

The content of ascorbic acid in cabbage, raw material, is 47,61 mg/100 g product. During the lactofermentation process is recorded a decrease of vitamin C content, which is due to its oxidation and dilution in liquid fermentation. So after three weeks since the introduction of cabbage in fermentation tanks, the ascorbic acid content dropped to 39,8 mg/100 g product, and in the liquid fermentation the ascorbic acid is 6,98 mg/100 g. At the end of the technological process, the content of ascorbic acid for pickled cabbage reach 22,53 mg/100 g, and in the covering liquid is 20,31 mg/100 g (fig. 1).

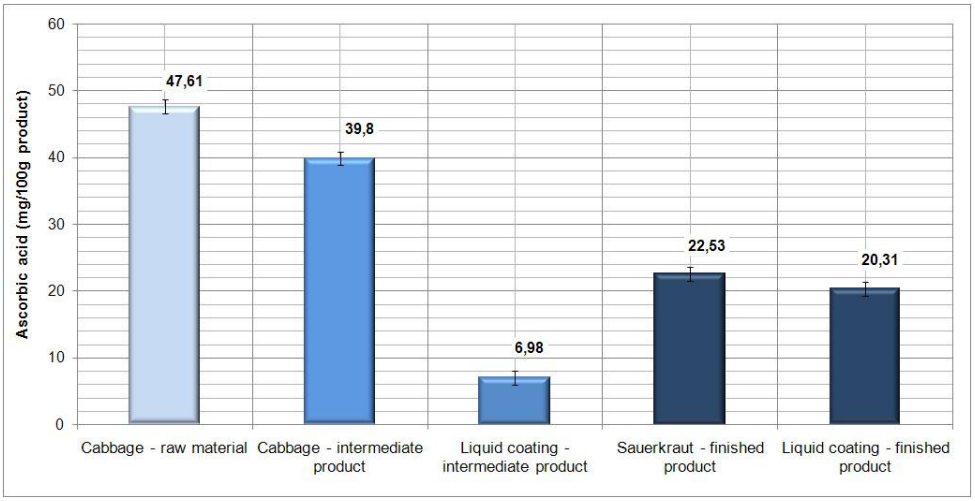

Fig. 1 - Ascorbic acid content during the technological flow

In figure 2, is the development of lactic acid formation in the flow path. According to the literature, at a pH between 4,1-4,2, it is considered completed the obtaining of pickled cabbage.

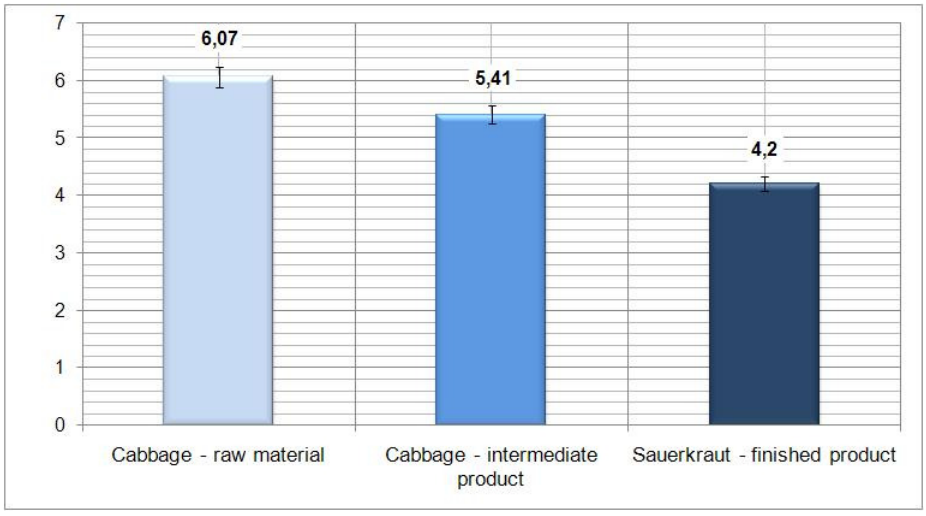

Fig. 2 – The variation of pH value

At the raw material is recorded a pH of 6,07, and during lactic fermentation, its decreases to a value of 5,41 and to the end of the process it reaches at 4,2.

From the chart above, we can see that after determining the pH of the finished product, its value is within the allowed limits.

High concentrations of NaCl increases osmotic pressure and changes in nutrient balance. In this case stops the growth of microorganisms through microbial cell dehydration and metabolic processes disorders.

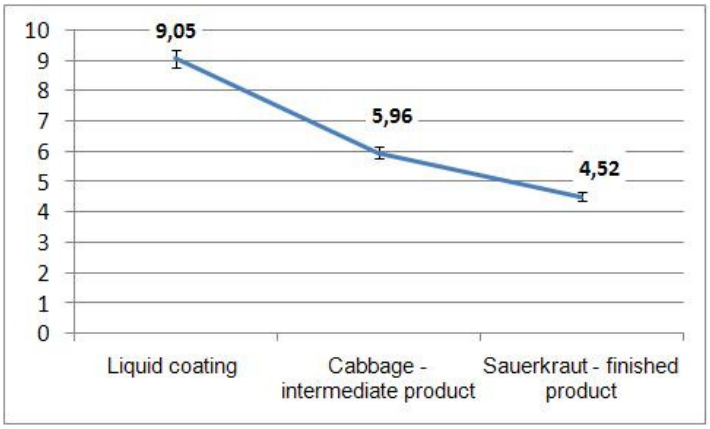

Fig. 3 – The graphic representation of NaCl

As can be seen in figure 3, the initial solution has a concentration of 9,05% sodium chloride. For intermediate product, was obtained a value of 5,96% sodium chloride and 4,52% for the finished product.

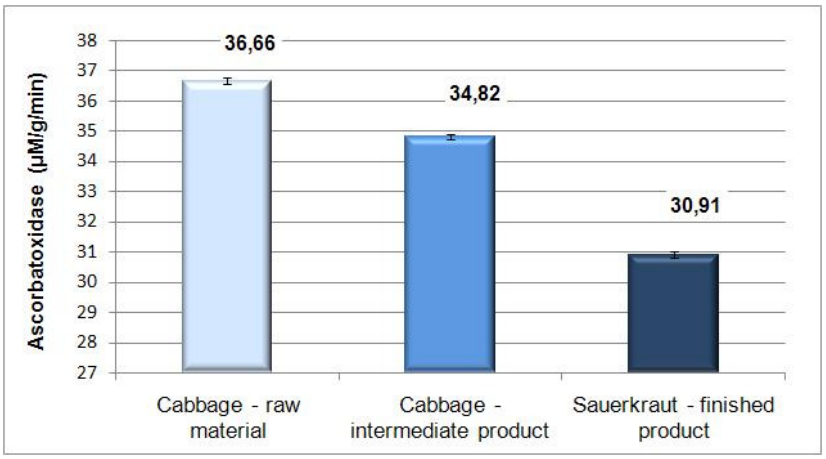

Fig. 4 - The graphic representation of ascorbatoxdases dynamics

The ascorbatoxidase activity is present and registered a decrease during the technological flow. At the raw material was determined a activity of 36,66µM/g/min and until to achieve pickled cabbage, the enzyme diminuation is almost insignificant (30,91µM/g/min for the pickled cabbage).

CONCLUSIONS

1. By processing the cabbage as pickled cabbage, unlike other technological processes, the ascorbic acid content is kept in excess and it can be found in product and liquid coatings.

2. Through lactic acid fermentation, the medium becomes due to the formation of lactic acid thus ensuring conservability to the product

3. The ascorbatoxidase activity is reduced during the process flow and its can be found also in the finished product.

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