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INFLUENCE OF CHEESE CURDS SUPPLEMENTATION WITH ALOES ON MAINTENANCE OF STAPHYLOCOCCUS POPULATION

Jadwiga Stankiewicz, Izabela Steinka

Department of Commodity and Cargo Science, Gdynia Maritime University

Key words: cheese curds, aloe, staphylococcus

Beneficial properties of aloes elements encourage food producers to seek for new possibilities in terms of using this genus for supplementing food. The aim of the research was to evaluate the influence of *Aloe arborescens* plant addition to cheese curds on the maintenance of staphylococcus' population. To cheese curds produced in model conditions aloes in 2 forms has been added: devoid of skin and with skin. Performed researches showed a reduction of the amount of staphylococcus positive coagulants, while after a 2-week storage the curds were characterized with the absence of those pathogens. Results of the researches indicated that the application of aloes as a supplement of cheese curds provides a safety of those products.

INTRODUCTION

Cheese curds are basic elements essential for production of cottage chesses. Quality of these curds has great influence on all features of final product.

Literature data presented in 2003 indicated that 60% of technology applied to produce cottage cheeses in Poland includes methods, which disable obtaining product that is up to EU standards.

Microorganisms which contaminate cottage cheeses can originate from many different sources.

Possibility of staphylococcus growth is defined by, amongst other, effectiveness of pasteurisation of raw material used for production of curds [Kornacki *et al.,* 2002].

Treatment of curd, which is its cutting and moulding, can be the stage when danger of contamination with staphylococcus arises. That can occur especially if the mentioned treatment is carried out in open cheese tanks. [Śmietana *et al.,* 1998].

The reason of mentioned contamination may be partial contact of the raw material or already produced curd with environment. Air and man are the most common reason for contamination of curd during its production or treatment. Researches on microbiological quality of cottage cheeses indicate contamination by, amongst others, pathogenic staphylococcus.

Therefore, it is crucial to develop effective method of restraining the development of unwanted microflora in these products.

Dairy product market is constantly enriched with new products supplemented with *e.g.* onion, garlic, herbs, and chives. Many of these have biostatic and biokilling qualities [Borowski, 2005, Kostrzewa, 1999, Mojska *et al*., 2003, Wolski *et al*., 2005]. Amidst plants with beneficial properties that can be used as supplement to fermented dairy products is genus aloe. Leaves of this plant have valuable properties due to its rich chemical composition. Aloe's flesh is a mixture of many components, which include many glycoprotein, polysaccharides, polypeptides, enzymes and aloin. Another valuable components of aloe are amino acids from among which 18 has been defined 6 of which are indispensable [Jambor *et al*., 2002]. Aloe gel is peculiar vitamin preparation which includes all of B vitamins, vitamin C, A and choline [Vinson *et al*., 2003]. Possibility of use this plant as supplement to food is confirmed in literature [Umbreit, 1995]. In recent years, there has been major increase in interest in natural bioactive substances as elements of food. Many of natural additives consist of, among others, elderberry, rose hip, chicory root and aloe [Zadernowski, 2004]. Researches are being carried out on influence of addition of inulin, amaranth seeds and aloe on qualities of fermented dairy products [Grega *et al*., 2001, Kłębukowska *et al*., 2002, Steinka & Walczak, 2005].

The aim of research was an evaluation of the influence of aloe addition to cheese curds on the maintenance of staphylococcus' population.

MATERIAL AND METHODS

Curd obtained by acidification 2%-fat pasteurised milk was used as research material. Mentioned curd has been obtained under laboratory conditions in semi technical scale within 14-16 hours in temperature 24±2°C up until obtaining app. 32 – 34°SH.

Author's address for correspondence: Jadwiga Stankiewicz, Department of Commodity and Cargo Science, Gdynia Maritime University, ul. Morska 81-87, Gdynia, Poland; tel.: (48 58) 690 16 74; e-mail: jagas@am.gdynia.pl

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The milk was inoculated with lyophilized leaven made by Rhodia Food Biolacta.

The obtained curds were divided in three: one of which was control sample while remaining two were samples supplemented with aloe.

The samples where stored in cold-storage facilities under temperature 4±2°C, for 14 days. Analysis of microbiological features of control sample and samples supplemented with aloe where carried out in 7 repeated series. Marking has been done on the day the curd has been obtained, after 4, 7 and 14 days of cold storage.

Research has been carried out on 42 samples of cottage cheese curd supplemented with aloe in 10 g dose per 100 g of curd.

The aloe supplement was composed from *Aloe arborescence.* Preparation has been made according to patent application P346068 in two variations: homogenised leaves of aloe devoid of skin and with skin.

To estimate the number of staphylococcus (*Staphylococcus aureus*) substrate made by Bard-Parker RPF bioMérieux has been used. The bacteria have been incubated under temperature of 37°C for 48 h.

The number of coagulable staphylococcus was estimated after the test for presence of coagulum produced by *Staphylococcus aureus* has been carried out. Trial of coagulation with rabbit's blood plasma was carried out by resowing typical and untypical colonies from rising which occurred on substrate Bard-Parker RPF and observing it for 4-6 hrs. For coagulation reagent Bactident® coagula made by Merck has been used.

The obtained results have been statistically analyzed by computer programs Excel 2000 from Windows XP packet and Statistica 7.0 PL.

RESULTS AND DISCUSSION

Performed researches showed that size of population of coagulable staphylococcus found in the control samples was average 1.27 log cfu/g after 4 days of refrigerated storage. Increase of number that microorganism grown by 0.49 log cfu/g after 7 days of storage and reduced to 0.49 log cfu/g after 2 weeks of storage. The use of aloe leaves with skin as supplement has caused reduction of these bacteria to 0.79 log cfu/g after 4 days. Subtly increase of number of coagulable staphylococcus by 0.12 log cfu/g was observed after 7 days. Curds with aloe with skin supplement contained none of coagulable staphylococcus after 14 days of storage. The use of aloe leaves without skin has caused reduction of number of coagulable staphylococcus to 1.19 log cfu/g after 4 days and to 1.51 log cfu/g after 7 days. After 14 days of storage studied curds contained of mentioned pathogens on 0.24 log cfu/g. Aloe without skin appeared to be less effective in terms of reducing population of coagulable staphylococcus, whereas in 70% of studied samples total reduction of these bacteria has occurred (Figure 1). Size of population of uncoagulable staphylococcus found in the control samples was average 2.36 log cfu/g after 4 days refrigerated storage. Increase of number those bacteria grown by 0.43 log cfu/g and reduced to 1.11 log cfu/g after 2 week of storage. Results of the study of the influence of supplementation by aloe on population of uncoagulable staphylococcus indicated similar tendency to

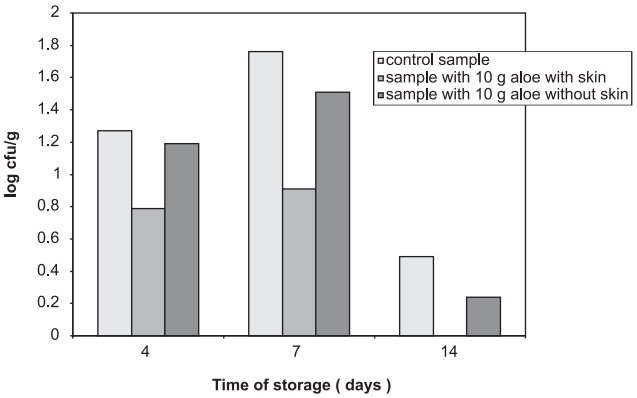

FIGURE 1. Changes of *Staphylococcus* positive coagulants in cottage curds with aloe addition.

change. Applied dose of aloe with skin caused reduction of these microorganisms to 1.65 log cfu/g after 4 days. In fact subtly increase of number that bacteria by 0.03 log cfu/g and by 0.12 log cfu/g was observed after 2 weeks of storage. Applied dose of aloe with skin caused reduction of these microorganisms by 1 logarithmic cycle after 14 days of cold storage whilst aloe without skin reduced the amount of uncoagulable staphylococcus subtly (Figure 2).

This activity can be explained with antibacterial properties of aloeemodin and aloin A and B which mainly occur in the skin of the plants form the genus Aloe [Jambor *et al*., 2002].

Aloin obtained from the leaves with skin as well as commercial aloe, which is called Curacao Aloe due to the content of mainly phenol-like chemical compounds, proved to have hampering properties towards *Staphylococcus aureus* [Anderson, 1999, Smolarz & Magiera, 2004].

The amount of coagulable *Staphylococcus aureus* was dependant on kind of supplement as well as on time of the storage. Amount of the staphylococcus uncoagulable did not indicate dependency on amount of the aloe added however it depended on time of the storage. The influence of both mentioned factors on amount of coagulable as well as uncoagulable has not been proven (Table 1).

Literature data indicates that low pH – characteristic for cottage cheeses – does not cause inhibition of the growth of staphylococcus. Minimal values limiting growth of *Staphylo-*

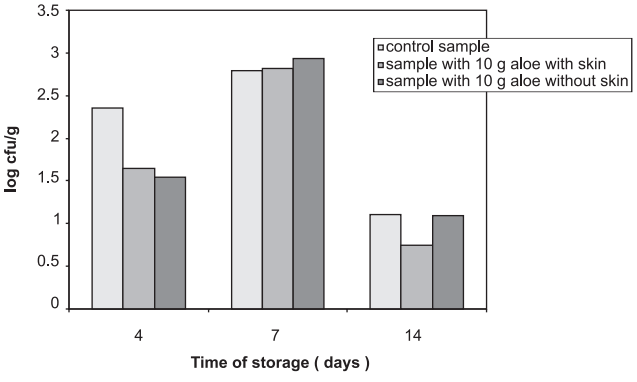

FIGURE 2. Changes of *Staphylococcus* negative coagulants in cottage curds with aloe addition

TABLE 1. Influence of the supplementation of cheese curds with aloe and time of storage on the number of staphylococcus positive and negative coagulations population (cfu/g) – analysis of variance (test F).

Variability	Number of *Staphylococcus* sp. population in curds of cheese	
	Coagulants positive	Coagulants negative
Aloe addition	4.53 *	1.34
Time of storage	16.63**	38.15**
Interaction supplement x time	0.22	1.10

significance level: *p=0.05; **p=0.01

coccus aureus is pH between 4.0 and 4.2. Reduction of the population of staphylococcus is, however, dependant on many factors, which include environment conditions as well as initial amount of cells and the temperature [Molska, 1988, Żakowska & Stobińska, 2000].

Researches on quality of cottage cheeses indicate considerable percentage of studied samples of cottage cheeses in terms of its microbiological contamination [Kornacki *et al*., 2002, Szponar & Traczyk, 2000].

Studies of Waliszewska and co indicated that it is common to observe contamination of cottage cheeses with pathogenic staphylococcus [Waliszewska *et al*., 1998]. Moreover researches carried out in years 1997-2003 by Steinka and co. also confirmed low microbiological quality of these cheeses [Steinka & Stankiewicz, 1999, 2000, 2002, Steinka & Walczak, 2005, Steinka, 2002a, Steinka *et al*., 2003, Steinka & Kurlenda, 2003a].

Studies performed by Bonczar and co on supplementing sheep's milk cheese with herbs showed that this kind of supplementation does not affect important physicochemical properties whereas organoleptic test of the herbs supplemented cheese was satisfying [Bonczar *et al*., 2000]. Widely comprehended quality of fermented dairy products depends on; right selection of raw material, applied production technology, obeying hygiene requirements and applying suitable additives. The objective of the supplements is not only improvement organoleptic qualities of the product, raise nutritiousness, improvement of the texture but also improvement of safety and hygiene of the product.

CONCLUSIONS

1. Results of researches showed that usage of aloes in both forms to the cheese curd causes desired reduction of staphylococcus positive coagulants population.

2. Supplementation of cheese curds with aloes at the stage of their production forms a safety of those products.

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WPŁYW SUPLEMENTACJI SKRZEPÓW TWAROGOWYCH ALOESEM NA ZACHOWANIE POPULACJI GRONKOWCÓW

Jadwiga Stankiewicz, Izabela Steinka

Katedra Towaroznawstwa i Ładunkoznawstwa, Akademia Morska w Gdyni

Bogactwo składników rodzaju *Aloe* skłania producentów żywności do poszukiwania licznych zastosowań tej grupy roślin jako dodatków do żywności.

Celem pracy była ocena wpływu dodatku aloesu pochodzącego z rośliny *Aloe arborescens* do skrzepów twarogowych na zachowanie populacji gronkowców. Do wytworzonych w warunkach modelowych skrzepów dodawano aloes w 2 formach: pozbawiony skóry i ze skórą. Przeprowadzone badania wykazały redukcję liczby gronkowców koagulazododatnich, przy czym skrzepy twarogowe po 2-tygodniowym przechowywaniu charakteryzowały się nieobecnością tych patogenów. Wyniki badań wykazały, iż zastosowanie aloesu jako suplementu skrzepów twarogowych kształtuje bezpieczeństwo tych produktów.