STUDIES REGARDING NEW WAY TO RENDER WHEY PROFITABLE

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Abstract. *Whey may be defined broadly, as the serum or watery part of milk remaining after the separation of curd resulting from the coagulation of milk by acid or proteolytic enzymes. Whey has been used by many researchers as raw material for the alcoholic fermentation process for it contains a high lactose quantity and it is widely available. One of the most simple and economical solutions for rendering whey profitable as secondary product of cheese fabrication by cheese/ dairy manufacturers is to obtain whey drinks for it has been used for long time by many researchers as raw material for the alcoholic fermenation process. One of the whey drinks proposed is whey beer made from deproteinized whey (as a byproduct of sweet cheese fabrication). The paper presents the research results in obtaining a drink from deproteinized whey resembling beer. Three samples have been experimented. The three beer samples have been analyzed from the sensorial and physical-chemical point of view as well. The second of them, containing 30% deproteinized whey has been the most appreciated. The finished product - whey beer is a product with traits similar to those of normal beer: pleasant, specific smell, hop flavour, bitter-sweet pleasant taste.*

Keywords: *byproduct, deproteinized whey, whey beer, dairy industry, lactose*

Introduction

As secondary product of cheese fabrication, rendering whey valuable represents a major problem of dairy industry that needs simple and economical solutions. On the basis of cheese consumption and production details, it is estimated that approximately 9 million tones of cheese per annum is produced within the EU, giving rise to an annual whey production figure of the order of 50 million m^3 [1, 2].

Whey may be defined broadly, as the serum or watery part of milk remaining after the separation of curd resulting from the coagulation of milk by acid or proteolytic enzymes. The type and composition of whey in dairy plants depends mainly upon the processing technique resulting in casein removal from fluid milk [1, 3].

About 50% of total world cheese-whey production is treated and transformed into various food products, of which about 45% is used directly in liquid form, 30% in the form of powdered cheese whey, 15% as lactose and de-lactosed by-products, and the rest as cheese-whey-protein concentrates [1, 4].

The world whey production is estimated to be of 10^8 tons/ year. It is an important source of environment pollution. Its biological treatment by the conventional aerobic process is very expensive and most of the dairy plants do not have a treating system. As a consequence, 47% of whey contaminates rivers, lakes and soil causing serious pollution problems [5].

To obtain whey drinks may be one of these solutions. Whey has been used by many researchers as raw material for the alcoholic fermentation process for it contains a high lactose quantity and it is

largely available [6].
It is known that whey contains 55% of the milk nutrients: lactose, soluble proteins, lipids, mineral substances (over 50% of these being NaCl and KCl), organic acids (lactic acid, citric acid), non protein nitrogenous compounds (urea and uric acid), and group B vitamins (Table 1). Until now non alcoholic drinks as well as alcoholic ones (slightly alcoholized with max. 1% alcohol) and drinks similar to beer and wine have been obtained from deproteinized whey. The paper presents the research results to obtain a drink from deproteinized whey resembling beer.

Table 1.
The typical whey composition [3]

Components	Whey type	
	Sweet whey [g/L]	Acid whey [g/L]
Dry substance, of which:	63-70	63-70
- lactose	46-52	44-46
- protein	6-10	6-8
- lipids	3	2
- calcium	0.4-0.6	1.2-1.6
- phosphate	1-3	2-4.5
- lactate	2	6.4

Materials and methods

To obtain beer under lab conditions we used deproteinized sweet whey from S.C. TOCAR PROD SRL Radauti Company that presented the following physico-chemical traits:

- total dry substance – 5.62%, of which: fat – 0.02%; proteins – 0.47%; lactose – 4.50%;
- acidity – 15.8°T;
- density – 1.028 g/L.

In the fabrication systems we used: malt, hopped malt provided by S.C. Bermas S.A. Suceava, pellets hops, sugar, caramel, *Saccharomyces cerevisiae and Saccharomyces carlsbengensis* species yeast, dry raisins. The malt wortt as raw material presented the following physico-chemical traits:

- extract content – 10°P;
- pH – 6.0;
- colour – 0.8 mL I_2 0.1n/100 mL.

The methods of analysis used in the experiments were the following:

- acidity – titrimetric method;
- dry substance content – refractometric method;
- extract content – refractometric method;
- pH–potentiometer method;
- CO_2 content – according to legislation.

The finished product- whey beer was analyzed from the sensorial point of view using the marking scale method and from the physico-chemical point of view (colour, acidity, CO_2 content).
The marking scale method consists in evaluating each sensorial property by comparing it with marking scales from 0 to 5 point and by obtaining the average mark from the tasters group.

For this purpose we established a tasting committee formed by 7 members who had been previously trained regarding the organization of tasting meeting, its purpose and the marking system used in the tasting note papers to eradicate possible errors that can occur when appreciating the analyzed samples. On the basis of the average total mark there has been led an evaluation of the quality level of whey beer samples from the sensorial point of view using a 0 to 20 points scale.

Results and discussion

The obtaining of whey beer under lab conditions followed the steps of industrial process. First of all the two raw materials whey and malt wortt have been analyzed from the physico-chemical point of view (quality reception) and then dosed according to the followed fabrication recipes (Table 2). For colour correction caramel has been used.

Table 2.
The fabrication recipes to obtain whey beer

The fabrication recipe for 1L of finished product	Sample 1	Sample 2	Sample 3
Deproteinized whey, mL	900	300	900
Malt wortt, mL	-	600	-
Sugar, g	100	100	100
Yeast, g	2*	2*	2**
Pellets hops	3	-	3
Dry raisins	+	-	+
Caramel	+	-	+

**Saccharomyces cerevisiae* species yeast*;*
*** Saccharomyces carlsbergensis* species yeast

After being blended, pasteurized and cooled at room temperature the samples have been inseminated with yeast and subjected to a first fermentation for 24 hours at a temperature of 20-22°C (room temperature). The prefermented whey beer has then been filtered, corked in 500 mL bottles and subjected to a final fermentation at a temperature of 5-6°C (refrigerator) for sample 2 and 20-22°C (room temperature) for sample 1 and 3. The three beer samples have then been analyzed from the sensorial and physico-chemical point of view. The results of the sensorial analysis are presented in table 3.
One of the beer quality characteristics, appreciated by many consumers is the foam's height when pouring beer into glass, foam that has to persist for quite a while. For checking this, there we used 2 special glasses in which whey beer cooled at 10°C was poured and soon after the foam height was measured. The foam persistence time was measured from the pouring moment untill its total disappearance. The results of the determinations made are presented in table 4.

Table 3.
The evaluation of quality level of the whey beer samples analyzed

Sample	Total average mark	Appre-ciation	Product characterizatio n
Sample 2	18.2	Very good	Whey beer has positive, specific, well distinguished organoleptic traits. It does not have any obvious flaws.
Sample 1	12.5	Satis-factory	Whey beer has specific poorly distinguished traits as well as lacks and small flaws in spite of which can be situated at the admitted product standard level.
Sample 3	13.7		

Table 4.

Checking the whey beer samples foam

Sample	Foam checking	
	Foam layer height [mm]	Foam stability [minutes]
Sample 1	45	5
Sample 2	62	8
Sample 3	50	6

Table 5 shows the results of physico-chemical analyses for whey beer samples obtained under lab conditions.

Table 5.

The physico-chemical marks for the whey beer samples analyzed

Sample	Physico-chemical marks		
	Colour [mL I_2 0,1n/100 mL]	*Total acidity [mL NaoH 1n/ 100 mL]*	*CO_2 content[g/ 100 mL]*
Sample 1	1.2	2.48	0.28
Sample 2	1.3	2.3	0.45
Sample 3	1.1	2.7	0.32

Conclusions

To obtain whey drinks represents a viable solution of its rendering valuable that can be used by cheese / dairy manufacturers in our country.

This paper aimed at rendering the deproteinized whey profitable (as byproduct of sweet cheese fabrication) to obtain whey beer.

Of the 3 proposed samples the one that was unanimously appreciated was sample 2 that contained 30% deproteinized whey.

It has been found out that lactose, the predominant component of whey does not influence the final taste of drink (the *Saccharomyces* yeast type does not metabolize lactose which has low sweetening power).

The finished product - whey beer is a product with traits similar to those of normal beer: pleasant, specific smell, hop flavour, bitter-sweet pleasant taste.

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