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New, innovative process for cheese making

Standardised raw milk is fractionated and concentrated by microfiltration. Fresh, soft and semi-hard cheeses can be produced very easily from this concentrate. The new, versatile process is also economically very attractive: less investment in plant and infrastructure, fewer stages in the process, labour-saving production, higher grade by-products (unacidified permeate with native whey proteins) and the option of continuous production. At several practical demonstrations, which aroused great interest, many professionals were impressed by the high quality of the different cheeses.

New versatile process

A new, extremely simple process for making cheese has been developed at the Dairy Research Station in Liebefeld (FAM): raw, standardised milk (0.5–4.0% fat) is microfiltered through a 100 nm membrane (picture 1). Key factors here are the temperature, pressure and flow conditions, whilst the pressure difference across the whole membrane is kept constant (UTP:

Picture 1: The milk was concentrated in this microfiltration plant



Picture 2: The milk concentrate can be poured into any desired mould



Picture 3: It can also be divided into portions

uniform transmembrane pressure). During microfiltration, casein and fat are concentrated.

A concentration factor of five to eight (depending on the desired dry mass in the cheese) results in a concentrate, which can be used directly for producing soft cheese or semi-hard cheeses. After the addition of cultures (starter and surface cultures), rennet extract (ca. 0.2‰) and salt (ca. 1%), the concentrate is poured into the desired mould and coagulated for five to 20 minutes at 35 to 38 °C. After coagulation, the mould is turned out, the cheese is acidified and then ripened (picture 2). Any desired ingredients can be added before coagulation, and the cheese can be divided into portions after coagulation (picture 3).

What is actually new about it?

New about this process is that, unlike ultrafiltration (filter pores only five to 80 nm), the whey proteins are not concentrated. This allows much more favourable concentration (higher flux, smaller filter area) and a higher final concentration, so that semi-hard cheeses without curd formation can also be

produced. Using diafiltration, if necessary combined with specific thermal pre-treatment of the raw milk, the percentage of whey protein and also the lactose concentration in the vat milk can be precisely regulated.

The percentage of whey proteins in the cheese is therefore depending on heating of the milk, as in traditional cheese making. This means that with the new process it becomes possible to make cheese which is very similar to traditionally made cheeses in terms of composition and quality. The loss of fat and casein through the permeate is negligible.

In the FAM trials, the soft cheeses (pictures 2 and 3) were actually comparable with conventionally made products as regards quality and composition. In the semi-hard cheese sector, liquid filled cheese of promising quality can be made 1, too (Bachmann and Schafroth 2001 and 2002).

Technological and economical advantages

In future, full concentration by means of microfiltration could become the key technology for continuous cheese production. The advantages are obvious:

- less investment in plant and equipment
- labour-saving production
- smaller quantities of rennet and cultures per kg of cheese

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Picture 4: Practical demonstration of the new process at the FAM

- significantly better flux performance than with UF-concentration
- continuous production without curd formation
- continuous mould filling and portioning
- high-grade permeate: no copper, no rennet, no glucomacropeptide (GMP), unacidified, practically germ free, with native whey proteins
- higher yield: no loss of casein and fat through permeate and whey
- innovative cheese possible in any mould with a variety of ingredients
- cheese comparable with conventionally made products in terms of quality and composition

At several practical demonstrations at the FAM (picture 4), which aroused great interest, many professionals were impressed by the simplicity of the process and the high quality of the fresh, soft and semi-hard cheeses produced.

Various products also underwent a small marketing test. The total of 160 test subjects were in the main random passers-by. Their opinion of the products was very positive. In discussions, many people were enthusiastic about the characteristics, variety and possible uses of the cheeses.

Profitability depends very much on the extent to which the MF-unit can be used and the price at which the cheeses can be sold. Since the cheese is of high quality and new options are available with regard to moulds and ingredients, products with high added value are certainly feasible.

Table 1: Rough chemical composition and nutritional value of the milk concentrate compare with mascarpone

Test characteristic	Unit	Milk concentrate	Mascarpone (www.dcwnet.org)
Water	g/kg	630	450
Fat	g/kg	160	470
Protein	g/kg	160	40
Calcium	g/kg	5.3	1.1
Potassium	g/kg	1.5	0.9
Sodium	g/kg	0.3	0.6
Energy	kcal/kg	2070	4 440

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Industrial, traditional and domestic applications

The most obvious application is undoubtedly continuous cheese production. It has already been carried out with the "Cheesemaker 02" (picture 5). The process leaves all production options open such as the making of traditional cheese varieties or the creation of new cheese products with the advantage that further savings can be made by not using the classical cheese moulds.

The continuous production, measuring and filling method gives maximum flexibility with regard to the range of cheese varieties and moulds as well as to production output and increased capacity.

That is why the new process not only makes sense in an industrial context, but is also worth considering in small and medium-sized undertakings (SMUs), because smaller filtration plants are also on the market. These can be used in a very versatile way for the production of different concentrates (DM [dry matter], whey protein and fat stages, ingredients), so that a high degree of utilization can be achieved. SMUs could specialise in the skilled production of semi-finished products (cheese based, protein based, food ingredients etc.) for the catering trade and food producers. Moreover, niche products give high added value.


A completely new form of application could be developed in private households.

The concentrate keeps well when chilled and can also be frozen. It is therefore possible to sell the concentrate directly to households or catering units. In this way anyone can make their own cheese: with an individual mould and any ingredients. Cheese making then becomes easier than baking.



Picture 5: The first industrial application: "Cheesemaker 02" prototype

Concentrate as semi-finished product

The MF concentrate can be used to make other products apart from cheeses: the texture of the milk concentrate is like mascarpone, the difference being that it has three times less fat and four times more protein and calcium. The energy content is less than half (table 1). Therefore, from the nutritional point of view, the composition has several advantages compared with mascarpone. Since the concentrate contains neither emulsifiers nor preservatives, no E-numbers have to be declared. Like Mascarpone, the concentrate can be used in very different ways. It can be eaten plain or acidified (with starter culture). Using additives, endless combinations are possible either „sweet, fruity“ , or „piquant, spicy“. The concentrate is also ideal for further processing in the preparation of cold or hot dishes. It can be combined with almost all foods; there are no limits to the imagination (Bachmann and Schafroth, 2002b). 

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FachPack 2003

8th to 10th October 2003,
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FachPack 2003

The trade fair for packaging and labelling technology takes place under the motto of "well-packed in Nürnberg". Lining up at the start parallel to FachPack are PrintPack – a trade fair for package printing and packaging supplies production – and LogIntern – a trade fair dedicated to in-plant logistics. With a good 1,000 exhibitors (2001: 991), the exhibition trio aims at reflecting the complete process chain from packaging production and package printing to logistic processes in the company. FachPack radiates far beyond the German-speaking regions and is set to again confirm its good reputation as one of the major packaging trade fairs in Central Europe. In spite of the relatively stable trend, the whole packaging industry is marked by considerable structural reorganization. Besides the changing statutory framework, such as the introduction of a deposit on disposable drink containers in Germany, the packaging industry in Europe is subject to the influence of the advancing globalization of markets linked with an ever increasing degree of concentration.

The mood of consumers in large parts of Europe is just not good. Buyer sentiment is becoming harsher – and not only because consumers have less money in their pockets. The customers' needs have shifted. Buying food, for example, must also be something exciting and emotional, if the decision is not to be based on price alone.

What new concepts science and industry have developed, for example, for integrating technological functions and product, logistic and consumer information into attractive packages, are shown at FachPack + PrintPack + LogIntern in Nuremberg.

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Zusammenfassung

Milch wird über Mikrofiltration aufkonzentriert. Aus dem Konzentrat lassen sich Frisch-, Weich- und Schnittkäse herstellen. Der Prozess bietet wirtschaftliche Vorteile: geringe Investitionen in Anlagen und Infrastruktur, geringer Arbeitskräfteeinsatz, hochwertige Nebenprodukte (ungesäuertes Permeat mit nativen Molkenproteinen), Möglichkeit zur kontinuierlichen Produktion. Die Qualität der so hergestellten Käse hat bei verschiedenen Demonstrationen auch Käsefachleute überzeugt.



Résumé

Au moyen de la microfiltration, on peut concentrer le lait et à partir de ce concentrat fabriquer très simplement des fromages fraîches, à pâtes molle ou mi-dure. Du point de vue économique, ce procédé est très intéressant: moins d'investissements en installations et infrastructure, une production qui demande moins de travail, des sous-produits de grande valeur (perméat non acidifié avec des protéines natives du petit-lait) et la possibilité de fabriquer en continu. A l'occasion de plusieurs présentations pratiques, qui ont rencontré beaucoup d'intérêt, bon nombre de spécialistes ont été impressionnés par la qualité élevée des différents fromages.