

Brita REHBERGER*, Bern, Switzerland

Latest research on the health and nutritional benefits of whey protein

4th International Whey Conference in Chicago

The 4th International Whey Conference (IWC) took place on 11th to 14th September 2005 in Chicago. It was the aim to discover the latest research on the health and nutritional benefits of whey protein and to learn its newest techniques of processing and application. Food and beverage formulators can use these findings as an advantage in new product development using whey proteins to make products that taste good, that offer better nutrition and provide unique functionality.

It appears to be the challenge of the future for the dairy industry to use the outstanding potential of the raw material whey. During the presentations at 4th IWC, visions of whey as the "golden liquid" or "the better half of milk" were given. Whey proteins contain all the essential amino acids needed for the human body.

Whey processing

Several different technologies have been used to concentrate the protein in whey and remove fat, but the two that are currently used commercially are ion-exchange and microfiltration. The resulting whey protein isolates (WPI) are at least 90 per cent protein, are essentially fat-free, and contain little or no lactose.

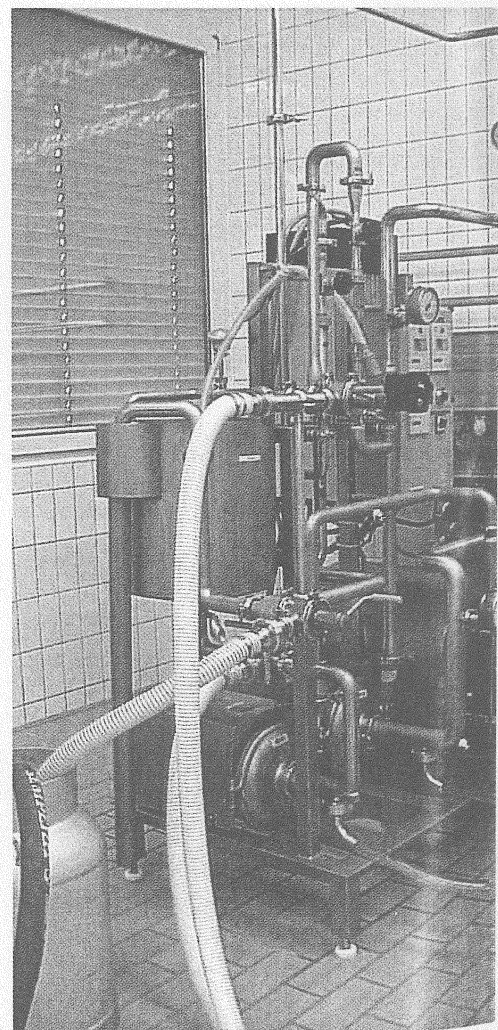
In the ion-exchange process, which is most commonly used in the USA, the whey is acidified until most of the proteins have a net positive charge. The whey is then mixed with a resin, which has a negative charge. The positively charged proteins bind to the resin, allowing everything else to pass through. After the unbound materials which mostly are fat and lactose are

washed out of the resin bed, the pH is increased to release the bound proteins. These are then concentrated by ultra-filtration (UF) and spray-dried. WPI prepared by ion-exchange normally contains the full complement of β -lactoglobulin, the principal whey protein, but much of the α -lactalbumin and some of the immunoglobulins and other protein components are lost.

In the microfiltration process, fat is removed from whey by the use of special membranes that allow the proteins and other soluble components to pass through while retaining the fat globules. The lactose and soluble minerals are then removed by UF and diafiltration (DF). Unlike ion-exchange, the microfiltration process allows the whey proteins to be recovered in their natural proportions in the final product. At equivalent protein contents, microfiltrated WPI tends to be lower in fat content, while ion-exchange WPI tends to be lower in lactose. It may be of particular interest that glycomacropeptide (GMP) is not usually retained in WPI prepared by ion-exchange, but at about 25 % of GMP are retained during microfiltration. GMP is nutritious for the body, as it helps control gastrointestinal diseases.

During spray-drying agglomerates of powder particles are formed that determine the instant properties of the powder as for example the ability to dissolve easily, quickly and completely. Powder should be free-

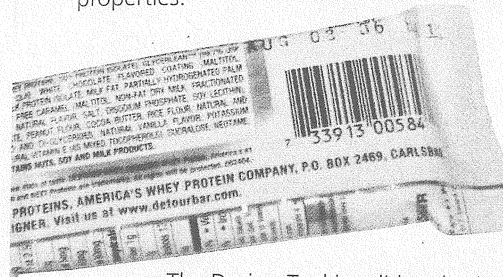
flowing and dust-free, which is important for industrial use. Agglomeration during spray-drying is considered to be a difficult process to control. The main cause of this is the complex interaction of the process variables. For a better understanding and control of the agglomeration process, a project, presented at the 4th IWC, was



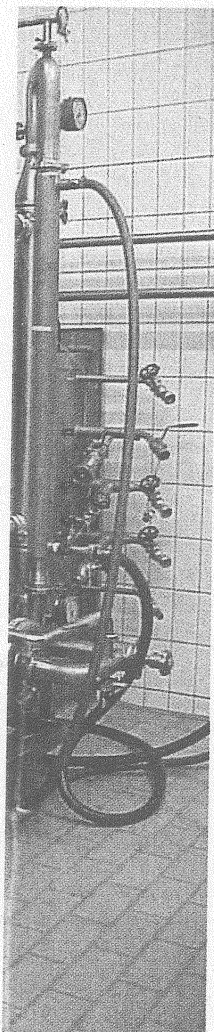
Pilot Plant ALP

* Agroscope Liebefeld-Posieux, Swiss Federal Research Station for Animal Production and Dairy Products (ALP), Schwarzenburgstrasse 161, CH- 3003 Bern, Switzerland, Tel: +41 31 323 84 03, Fax: +41 31 322 82 27, e-mail: brita.rehberger@alp.admin.ch

carried out with the aim to develop an industrial validated computer model to predict agglomeration in spray-dryers. The main result of this project was a so-called "Design-Tool" which establishes relationships among the configuration of the drying installation, process conditions, product composition and final powder properties.



The Design-Tool is validated using spray-drying trials carried out on a pilot plant using WPC. Agglomeration in spray-dryers can now be simulated. This can be used by the industry to improve the quality of products and to increase the productivity of such equipment. Simulation models for spray drying equipment are widely used for reducing processing costs.



The role of whey protein in muscle metabolism and weight management

Whey proteins are both easily digested and have excellent metabolic efficiency, giving the protein a high biological value. They also contain the highest concentration of branched chain amino acids (BCAAs) available from any natural food protein source. During exercise, skeletal muscles take up BCAAs from the blood and break them down into glucose for energy, therefore BCAAs are unique among amino acids in their ability to provide an energy source during endurance exercise. The use of whey products as ingredients in sport foods has been increasing steadily with improvements in the technological capabilities of the industry to produce commercially attractive whey protein concentrates and WPI.

Whey protein provides a ready supply of amino acids that effectively stimulates muscle protein synthesis and, when coupled with resistance, provides a potent anabolic signal.

Furthermore a study showed, that beverages containing both carbohydrates and protein (in intact or hydrolysed form) produced more optimal profiles to facilitate rapid recovery in the exercised muscle. Both the hydrolysed and intact protein beverages are conducive to protein synthesis post-exercise and offer greater benefits for recovery compared with carbohydrate-only recovery beverages.

Recent clinical trials and epidemiological studies have shown that optimal dietary intakes of dairy products may protect against excess adiposity, while low calcium intakes increase the risk of obesity. Dairy is more than twice as effective as calcium per se in inhibiting adiposity. In addition lactose has a low glycemic index, which assists in controlling hunger and promoting weight loss. A diet containing high amounts of protein may help weight management through a variety of mechanisms: higher protein intake may help to maintain lean body mass, a high protein diet may have appetite-suppressing effects and raised intake of protein may help to maintain bodyweight after a period of weight reduction.

Immune health and chronic disease

Whey proteins are unique in their ability to optimise a number of key aspects of immune function. Although the exact mechanisms are not yet fully understood, whey proteins appear to modulate immune function by boosting glutathione production in various tissues and preserving the muscle glutamine reservoir. Glutathione is the centrepiece of the body's antioxidant defence system that regulates many aspects of immune function. Muscle glutamine is the essential fuel of the immune system. Therefore, the incorporation of whey proteins into the diet may help promote a strong immunity and protect the health of active people of all ages as well as those with a compromised immune system.

Hypertension is a risk factor of morbidity and mortality world-wide. Anti-hypertensive medications can cause significant side effects and are costly. Previous research indicates that a diet rich in fermented foods (especially dairy

products) can significantly lower blood pressure. Whey proteins can be broken down into various bioactive peptides through proteolysis. This process can occur during gastrointestinal digestion, by fermentation of milk, or through controlled reactions in the laboratory or whey processing facility. Certain bioactive peptides may protect against hypertension through angiotensin converting enzyme (ACE) inhibition and opioid-like activity. Bioactive whey peptides may also be involved in inhibiting platelet aggregation and lowering cholesterol levels. Amongst bioactive peptides other whey components such as calcium, magnesium, zinc, B-vitamins, and certain lipid fractions may also help reduce the overall risk of cardiovascular disease.

Regardless of the method of hydrolysis, in order to exert anti-hypertensive activity, the peptides must be absorbed from the intestine in an active form. So the processing of these peptides is vital to their activity: Severe heat treatments will have a negative affect on the bioavailability of whey peptides, so processors must carefully monitor production parameters. A careful selection of enzymes for proteolysis will result in maximum biological activity and limit development of bitter flavour notes.

Further nutritional research areas

To be an effective prebiotic, selectivity of the fermentation is essential. Most current attention and success has been derived using non-digestible oligosaccharides. Various data have shown that for example galactooligosaccharides (GOS) although resistant to digestion, are specifically fermented by bifidobacteria. During controlled feeding studies, ingestion of these prebiotics causes bifidobacteria to increase and become numerically dominant in feces. Lactose from whey is an important precursor for GOS, which can be produced through a transgalactolysation reaction by an enzymatically hydrolysis. Prebiotic components have been introduced into infant formulas just recently. A recent study showed that the addition of lactose-derived GOS to an infant formula is effective and safe and can be considered as bifidogenic.

The world-wide food market

Keywords of the world-wide food market concerning product launches nowadays are "functional", "wellness",

"indulgence", "fun", and "convenience". The use of whey has become a clear trend. Whey proteins provide a high nutritional value and offer a wide range of physico-chemical properties that can be used to design the final properties of the food application individually and allow the development of new products. Furthermore it allows the optimisation of existing products with considerable cost improvement while improving quality. Innovative new products recently introduced in the marketplace were possible because of advances in whey technology. To bring a new product to market requires expertises in modern technology, know-how in analytical methods for determination and quantification of the functional components, and the knowledge about the nutritional value of the component.

When developing formulations for new products, the best recipe components, including the proper stabilizer blend as well as the optimal manufacturing technology must be selected. So, controlling ingredients and processing interactions and utilizing newly developed whey protein solutions presents the key in creating a formula that has great flavour, texture and a long shelf-life. In general, whey proteins offer a blander, milder, slightly milky flavour profile.

There is a wide range of special whey additives and other nutritional milk ingredients for application in desserts, dips, spreads, dressings, ice-cream and frozen desserts, bakery products, ready-to-drink and powdered beverages, nutritional bars, dairy products, snacks and confectionary applications. Consumers are still looking for two main functions: good flavour and taste and good texture.

Summary

Milk is rich in functional and nutritional properties. A better understanding of the positive health benefits and the high quality of whey protein and other milk components among consumers will mean tremendous growth opportunity for the whey and dairy industry.

Therefore, the conference was a chance to learn all there is to know about these value-added ingredients. Everyone walked away with new ideas to drive future product development.

EDM

REFERENCES

- Proceedings of the 4th IWC,
11th to 14th September, Chicago

20 years of Gernep Labelling Systems

Over the past 20 years since the company's formation in Barbing/Germany, Gernep has become a widely established and well-known provider of labelling systems.

The company was launched in 1985 by the two managing directors Helmut Gerstberger and Berthold Neppel. Both partners contributed their experience in mechanical engineering and machine building in the field of beverage industry. Originally, the idea for the Gernep company foundation was to concentrate on the production of labelling systems for the beverage industry. In the course of the years, however, Gernep has required high international reputation and has extended its original business also to the labelling of a great variety of products in the food- and non-food sector.



The product range includes labelling machines for wet- and hot-glue labelling as well as systems with self-adhesive labels. All systems are based on a well-proven modular design which allows the most flexible combination of components and offers high labelling precision. One important factor for the successful fulfilment of our customers' requirements is the company's organisation which combines the processes of planning, production and assembly "under the same roof". Due to this concept, labelling systems can be offered which meet the specific requirements of our customers with regard to their company size, market segment and marketing approach. The product range is completed by a variety of accompanying services. This includes assistance in the selection of suitable label designs, prompt supply of spare parts, excellent maintenance services performed by in-house trained service engineers. If required, a network of national and international partners is available for the realization of full-range bottling plants.

Two new production halls have been completed this year. With these new halls, the production area of Gernep has been extended by a further 1,500 m² (see photograph). □