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News

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7th Symposium on Advances in Dairy Product Technology held in Shell Beach, CA.

This year's focus was on the latest trends in dairy ingredient utilization. The symposium which was held February 7-8, 2005 at the Cliff's Resort in Shell Beach, CA was one of the best attended with over 100 in participants from 17 states, according to organizer Professor Phillip Tong.

The program was designed to provide useful marketing insights and technical information for suppliers and end users of dairy ingredients. As more and more consumers are looking for foods that offer nutrition and wellness, food manufactures are looking for ingredients that offer those benefits as well as functionality in their food system.

Donna Berry, a consultant to Dairy & Food Communications, was the first speaker and spoke about the new markets for dairy ingredients. According to a trend report from HealthFocus, 94% of shoppers are health active shoppers. This means they select foods for healthful reasons at least some of the time. Marketers are changing their focus and are no longer marketing foods as "diet foods" but rather as "free" of undesirables. Health and convenience are the focus for today's product development as well. Dairy ingredients fit well into this trend and can be utilized in just about every category. One specific opportunity for concentrated and dried dairy ingredients is in edible films that can provide foods with a barrier to oxygen, moisture and oils migration. There are also new whey protein isolates that are stable in low-acid aseptic and retort beverages in concentrations of 10% or more. New whey proteins are being processed with higher phospholipid content and include active nutritional components such as immunoglobulins, sphingolipids and conjugated linoleic acid. Other innovative products include whey protein concentrates that can be used as a replacement for flour in lower-carbohydrate baking and hydrolyzed whey proteins that offer nutritional advantages in the area of cardiovascular health.

Dairy Management Inc.'s Vice President of Business Development, Alan Reed, gave information on assistance available to food manufactures. DMI has worked with leading quick serve restaurant chains to offer single serve flavored milk and cheese friendly sandwiches, promoted the 3-A-Day and other major dairy campaigns, as well as funded research including dairy and weight loss. They partner with the food and beverage industries to deliver new or improved products containing dairy ingredients. They provide confidential application, technical, and marketing support for dairy ingredients. This has been key to companies who may not be familiar with opportunities provided by using dairy ingredients.

A talk on bioguided opportunities to deliver health benefits through dairy ingredients was given by Joe O'Donnell who is the executive director of California Dairy Research Foundation (CDRF). He spoke of the nutritional benefits of milk in the areas of protection, prevention, and metabolic performance. Milk aids in the protection of intestines from the consequences of toxins, poisons and metals. It also aids in the intestinal immune system to recognize foreign pathogens. Milk promotes the successful

digestion, absorption and storage of nutrients, the storage of energy appropriately, and the development of a healthy microflora. Bio-guided processing is designed to retain these unique biological and nutritive values. Some of the options for bio-guided processing focus on retention of bioactivity are affinity based, enzymatic, and microbiological. These novel technologies are making it possible to identify and study these "functionalities" as not previously thought possible. He concluded by referencing an article from Food Technology (58:44-48) that stated today's food production and processing are evaluated in terms of yield and efficiency. Tomorrow the processing schemes will be designed around effective delivery of the nutrients in food.

Lindsay Allen, Director of the USA-ARS Western Human Nutrition Research Center spoke about nutrient fortification needs and opportunities from a global perspective. ASF (Animal Source Foods) such as milk and meat are a major source of many essential nutrients and the only dietary source of B-12 and D. Low ASF intake causes multiple micronutrient deficiencies, poor growth and development etc. Milk is an excellent source of calcium, vitamin B-12, vitamin A, riboflavin and folate and consistently improves growth when supplemented in developing countries. In one study meat and milk snacks improved growth, cognitive function and activity, and B-12 status in Kenyan schoolers. Increased awareness of nutritional importance of ASF, and approaches to increase intake, is critical. Other strategies to provide the micronutrients are supplementation (largely impractical) and food fortification. There is a global movement to fortify staple foods with micronutrients. Fortified milk is an excellent method of delivering additional nutrients where required. Obvious candidates include: Vitamin A and D; iron and zinc; B vitamins; fluoride; and other regionally important nutrients e.g. selenium.

The final talk of the morning was given by Ram Chaudhari, the senior executive vice president, chief scientific officer of Fortitech, Inc. His talk was titled "Micronutrient Fortification in Dairy Based Products." He stated that fortification is a reliable, safe, and low cost way to improve food value. It enables the consumer to vary components in a healthy diet more easily. Selection of optimal ingredients to achieve "Proper" nutrient system is critical. He talked about the various ingredient categories such as micro nutrients, beneficial fatty acids, firbers & indigestible starches, pro and probiotics, phytochemcials and other nutraceuticals, but went into more detail on vitamins and polyunsaturated fatty acids. There are challenges with stability and the relationship between bioavailability and interactions. He suggested in order to minimize interactions, it is good to have vitamins and minerals separate as two different premixes. If for processing reasons, one wants to make a premix containing vitamins, minerals and trace minerals, then, depending upon the application one can encapsulate some of the vitamins and minerals. In conclusion he stated that manufactures need to ensure product integrity and quality. Conservative fortification and the development of a sound rationale are a part of the product planning process.

The afternoon session began with a talk by Assistant Professor Scott Rankin from the University of Wisconsin in Madison. His talk was on defining and controlling the cause of browning in sweet whey powder (SWP). His research to date shows pH history appears to have major role in storage browning. Nitroblue tetrazolium (NBT) assay may have potential as predictive test for browning of SWP as well as proteolysis which is another strong predictor. Many interactions can occur, e.g. moisture. When liquid, HMF pathways are favored at acid pH; browning *precursors* accumulate. Precursors are hydrolyzed when water is abundant, actual browning averted. Water is removed and accumulated precursors slowly continue to brown product unless the product's pH is less than 6.0. There are many indications that improved liquid whey pH control will preserve SWP whiteness. He suggested in the future we need to identify the nature of pigments and their precursors, survey SWP using NBT; validate potential and evaluate/control other factors eg proteolysis, microbial growth (sugars) etc.

The session on understanding dairy ingredient quality was continued by Professor Lisbeth Goddik from Oregon State University in Corvallis. Her talk was on the flavor and physicochemical properties of sweet whey powder based on the impact of location, storage, and seasonality.

Feed and state of lactation are both reasons for seasonal variability. In Oregon cows have calves throughout the year. Though grazing is common, an effort is placed on keeping feed constant throughout year. Consistency is an essential quality parameter. It is possible to produce sweet whey powder with consistent quality parameters throughout the year. This is a significant advantage on the export market.

She was able to identify aroma compounds in sweet whey powder using instrumental analysis and sensory analysis. The primary whey powder aroma comes from short chain fatty acids, aldehydes, sulfur containing compounds and ketones. The primary whey powder flavors were characterized as caramelized, cooked, sweet, and cardboard flavor.

Her study looked at normal fluctuations in whey powder processing parameters to see if they have an effect on whey powder quality. She found that whey powder hygroscopicity is influenced by pH and temperature of whey concentrate during the crystallization step. No clear relationship was observed between lactose form, amount of crystal lactose and hygroscopicity.

Quality parameters for whey powders vary greatly. Microbial quality may be un-acceptable. Quality parameters for one processor appeared consistent throughout a year while some seasonality was observed in other samples. Some samples deteriorated quickly due to Maillard Browning while others deteriorated slowly. No differences in taste and aroma were observed during storage for up to 18 months. Variations in crystallization time does not appear to influence powder quality. Variations in acidity and crystallization temperature have minor impact on powder characteristics. Finally, Modified angle of repose is a simple method for estimating whey powder quality.

The next talk was on bovine genomics and what it could mean for new ingredients. It was given by professor Rafael Jimenez from the Dairy Products Technology Center at Cal Poly State University. He discussed the idea that milk has evolved to be precisely designed to complete its mission as the only substance designed by nature solely to deliver nutrition and health the mammals. DNA underlies almost every aspect of animal production and health.

DNA-based tests are among the first applications of the new genetic discoveries. Gene tests can be used to classify animals that produce certain kinds of products or that are resistant to disease. This information is already used in marker assisted selection or to segregate animals that produce certain quality of products. Using genetic selection to improve cheese yield is another practical application. Genetic testing for the variants of milk protein genes can identify cows producing kappa-CN B and beta-LG B milk proteins which yield 5-10% more cheese.

Development of gene and protein indices, i.e. lists of all molecules present in a given tissue at a given time, for example: all the genes expressed during lactation and all the proteins present in milk, and understanding how they interact with each other and with the environment. Annotation is adding biological information to genome sequence. This is a very complex task, and the process for doing this is rapidly evolving. Annotation of gene products in milk includes structure, function, regulation, interactions, metabolic networks as well as biological activity in nutrition and health. The technological challenges are to observe the nature of ‘Wellness” and to understand how it works without destroying it in processing and then to be able to imitate and design.

Prior to the final talk of the fist day, Dr. David Barbano from Cornell University was presented the William C. Haines Dairy Science Award. He is the first recipient of this award which is named for

William (Bill) Haines of Dairy Management Inc. to honor individuals who have worked in support of the dairy science. U.S. and international scientists who have made a significant contribution to dairy science and the betterment of the dairy industry through research and development in the field of chemistry, biochemistry, microbiology, technology, nutrition, and/or engineering are eligible for the award, which includes a plaque, a cash prize of $1,000, travel expenses and the opportunity to make a presentation at a dairy industry event co-sponsored by the CDRF. His presentation was on new opportunities for commercialization of milk protein fractionation products as food ingredients.

The first step in milk fractionation was taken more than 100 years ago with the development of the mechanical cream separator. This allowed almost complete removal of the fat portion from milk. In the 1960 and 70's reverse osmosis and ultrafiltration technologies began to be applied in the dairy industry. Ultrafiltration has been used to separate proteins from lactose and soluble minerals. Types of membrane filtration include reverse osmosis, which has the smallest pore size, ultrafiltration, and microfiltration, which has the largest pore size.

More recently, small pore microfiltration has been used to separate casein from milk serum (soluble) proteins. These technologies will have a lasting impact and role in the dairy industry, as we have seen for cream separation. Membrane fractionation technologies will continue to develop and we will begin to other separations with membranes. In the future we may see separation of milk fat globules by size and/or separation of individual proteins by molecular weight and size.

Ion Exchange technologies have been used to process groups of proteins separated by membrane filtration and further separate and isolate individual milk proteins. A recent commercial example is lactoferrin isolation from whey. In the future, the individual proteins, both macro and micro concentrations, in milk will be separated for use as functional ingredients in food and nonfood systems. This can be applied to both the serum (soluble) protein and casein fraction of milk. Milk Serum (Soluble) Proteins have no residual coagulant, color, or starter. All bacteria is removed and there is no glycomacropeptide (peptide produced by the action of rennet during cheese making.) We have removed 95% of the serum (soluble) proteins from skim milk with a 3 stage MF system using a permeate diafiltration approach.

The L-value (whiteness) of milk decreases with decreasing ratio of casein to true protein. This is very dramatic in skim milk. However, the differences L-value (whiteness) may be difficult to detect by sensory analysis in 2% and were not detected in 3.3% fat milks. The impact of changing the casein to true protein ratio on relative viscosity at 4oC was large. Changing from about 20/80 to 80/20, at constant true protein concentration, produces a change in relative viscosity that is as large as changing from skim to 3.3% fat milk.

Fractionation of the solids components of skim milk and the ability to ship liquid concentrate fractions longer distances will present challenges to classified pricing within the Federal Milk Market system.

In conclusion, he stated that fractionation of the solids components of skim milk will provide an opportunity to develop a wide range of new value added dairy based beverages (e.g., modified protein levels, modified casein to serum protein ratio, modified protein to other solids ratio) and food/beverage ingredients. We have a lot of the technical details and experience with various pieces of the milk fractionation system. However, the optimal way to integrate these pieces in the context of the structure of the US dairy industry and the customers served by the dairy industry remains to be achieved.

The day ended with a wine and cheese reception hosted by the U. S. Dairy Export Council.

The second day of talks kicked off with a lecture by Charles Onwulata who is the Lead Scientist at the Dairy Processing Unit for USDA-ERRC. His topic was texturized whey protein as a new ingredient and application.

Benefits of whey protein fortifying with whey proteins improves the nutritional value and consumer appeal of foods such as snacks, cereals, beverages, and meats. Adding whey proteins to foods that are low in protein content improves the overall protein profile, particularly in foods derived from grains and beans that are low in lysine. Also, regulatory peptides released by enzymatic proteolysis of whey proteins are potential modulators of intestinal digestion of foods, and may provide nutritive benefits such as nutrient uptake, immune defense, and opioid and antihypertensive activities (Pihlanto-Leppala, 2001). The major whey protein components –lactalbumin and -lactoglobulin, contain bioactive sequences which show angiotensin I-converting enzyme (ACE) inhibitory activity.

Texturization is the process of creating structure and texture in biomaterials through the use of various technologies such as extrusion. Food proteins melt and flow at different temperatures and are easily shaped into new structures in an extruder. Extruder design and extrusion parameters can be set by the operator to yield very different product variations from similar formulation. Vegetable proteins such as Soyfoods are texturized by extruding them through an acid or alkali bath into fiber bundles and shaping them through further processing into different structured meat-like products. Whey proteins have similar potential for texturization. They have the added advantage – better acceptance! The protein quality is not degraded by texturization, but improved.
Texturized whey proteins are new ingredients created by the extrusion effects of pH/Moisture/Temp

Whey proteins may be part of the solution to the growing problem of obesity if sufficient quantities can be included in foods to replace carbohydrates. Proteins provide a net metabolic energy balance, an increase in muscle mass and suppression of appetite.

Further research is needed to understand how texturization affects the nutrients, protein quality, protein availability, flavor, and color of these products. High-moisture extrusion texturization holds the promise for creating texturized whey protein products. In developing a means of creating desirable textural properties, it is imperative that the beneficial properties of whey proteins such as flavor and protein quality are preserved. But taking a cue from texturized vegetable proteins, particularly the market potential, it is a sure bet that resourceful science and business will materialize the idea of texturized whey protein, providing consumers another choice of healthful products. Adding texturized whey proteins in various forms to foods boosts their nutritional profile, reduces the number of calories from carbohydrates, and opens a new market for whey protein suppliers. With the increasing demand for products with less gums and binders, which are mostly carbohydrate based, and need for consumable or biodegradable wrappers, it is conceivable that modified whey proteins could be molded as foods and food wraps might come into play. Here again, the extrusion and molding technology can be adapted to unique whey protein biopolymers.

The organizer of the symposium, Dr. Phil Tong was the next speaker. He spoke about the whey protein nitrogen index and protein standardization. He explained that the Whey Protein Nitrogen Index (WPNI) is a measure of the amount of whey protein soluble in saturated NaCl solution; expressed as mg WPN per g powder. It assumes that whey protein would be insoluble (lower WPNI value) if it is denatured in the powder. Traditional use of the WPNI is as an indirect measure of extent of denatured whey protein (the higher the value the lower the amount of denatured whey protein). Since the whey proteins are relatively heat labile, a high WPNI value (or relatively high soluble whey protein content) indicates low denatured whey protein and hence low heat treatment. This is a relatively simple test to assess heat treatment which provides classification of nonfat dried milk according to degree of heat treatment. It also provides criteria for selection of milk powders for end-use (functionality).

There are some limitations of WPNI. One is reproducibility; turbidity development is variable and unstable. Another is correlation to functionality, it does not account for inherent variability of whey protein content of milk or absolute whey protein content. NPN variation is not considered and the values are per gram of powder so moisture and fat variation of powder not accounted for.

Codex Alimentarius allows for downwards standardization of skim milk powder with lactose or milk permeate (contains significant NPN & minerals). Minimum protein content is 34% on solids nonfat basis (or equivalent to 31.8% protein on a "as is basis" in SMP containing 5.0% moisture, 1.5% fat) Protein standardization has the potential for more consistency in product composition and performance for end users. In addition, lactose utilization and improved SMP manufacturing profitability and/or cost reduction for suppliers. It provides the capability to more effectively meet minimum and/or higher protein standards of market. Protein standardization would increase the need for improved methods to classify milk powder to communicate performance needs. It would impact the use of lactose vs. permeate (contribution of NPN, moisture, and minerals.)

In conclusion, NFDM/SMP WPNI values, its heat classification and its functionality can be influenced by protein content and method of protein standardization. Protein standardization of milk powder is economically attractive. Standardization of SMP to lower protein to lactose ratio will improve acceptability of domestic SMP for RSCM application.

Bernie Horton, President of Horton International gave a presentation on what's new in terms of permeate and lactose. He stated that USDA production data for 2003 show 340 million lbs of WPC product solids were made. If we assume all was WPC 34, at 5 lbs permeate per lb WPC, that means 1,700 million lbs of permeate solids were generated. USDA production data for 2003 also show 588 million lbs of lactose were made. If assume 91 – 95% comes from permeate, yield is 70%, a generous value, and permeate solids are 85% lactose, that means 914 million lbs of permeate solids were not used to make lactose. Where did they go? Mostly to animal feed applications such as bovines (cows), swine (piglets/pigs) poultry (chicks, chickens, turkeys) and companion animal (dogs, cats, etc.)

In the case of cows it is concentrated by RO or RO/NF combination for direct feeding as a liquid, for use in liquid feed supplements or for mixing with dry grains. Lick blocks or pellets have potential in that we may be able to add medicaments so have "added value." With pigs, whey powder has been the common feed ingredient, but lactose and dried permeate are moving up. China is now using only 0.15 kg *per* pig versus 1.15 kg *per* pig in USA and EU-15. Price and marketing are key! Lactose may reduce the pH of the lower gut (ceca) by the formation of lactic acid in poultry. It may promote the growth of beneficial micro-organisms (*lactobacilli* and *bifido* bacteria) in the gut. At 50 gms lactose/bird (starter feed only), lactose potential is > 2 million MT per year. It prevents growth of salmonella (and other pathogenic bacteria.) Edible lactose acts as an "enhancer." Will dried permeate perform as well? The potential is huge. However, price sensitivity not clear. For cats, if not dogs, add lactoferrin to add value.

Food ingredients include dried permeates, demineralized permeates, lactose, delactosed permeate, sweeteners, sialyllactose, galacto-oligosaccharides and polysaccharides.

What's new in processes/technologies is nanofiltration, evaporation/spray drying, demineralization-ion exchange (w/nf), adsorption, fermentation, conversion processes and enzymatic processes.

Demineralization in the form of ion exchange can be used in conjunction with NF to produce 50-90% demin powders from permeates. Soften permeates before evaporation. Use in conjunction with NF to greatly improve the regeneration picture for the IX resins.

Kriby Hayes, Assistant Professor at Purdue Universtiy, began the session on ESL/UHT diary product considerations with his talk on proteases in dairy ingredients and their implications on product quality. He explained that there are active plasmin in most dairy products. Less plasmin in caseinates than low heat or instantized NFDM powders and that high heat process inactivates plasmin. Acid whey products have more plasmin than sweet whey (but highly variable). Proteases in milk provide product characteristics and activity. Methods used to study proteases include differentiation with capillary electrophoresis and visualization with SDS or Urea-PAGE.

Product storage time and characteristics allow plasmin to be active. Plasmin activity in milk results in decreased intact protein. In conclusion, plasmin is present and active in dairy ingredients and induced proteolysis occurs in products made with dairy ingredients. The quality of food product containing dairy ingredients may be altered due to plasmin-induced proteolysis. When assigning the importance of plasmin in your product consider the following product characteristics pH, water activity, process temperature, storage temperature, and length of shelf-life

To finish this session, Ted Benic the General Manager for Dairy Systems for TIC Gums, gave a talk on the stabilization of dairy based systems exposed to high temperature processing. High heat processed dairy products include cream (culinary and whipping),1/2 and 1/2 cream, flavored milk, resale ice cream mix, soft serve mix, shake mix, and dairy based beverages (smoothies). General functions of stabilizers/emulsifiers are to bind water to build flow viscosity, control ice crystal development and provide gels and suspending properties. They also aids in air incorporation and control as well as control formation of emulsions. They provide product uniformity during shelf life, give mouth feel and palatability of product and aid in freeze/thaw stability.

Stabilizers also refered to as colloids, hydrocolloids and gums. They are water binders and can absorb up to 200 times their weight in water. Synergistic in nature, they can form gels or matrix alone or in combination with other gums or salts. Stabilizers control ice crystal growth and provides freeze thaw stability and come as natural, synthesized and organic.

Several have unique qualities such as carrageenan ability to control separation and gelling. Alginates are good for “whippability” and gelling. MCC provides very low viscosity and freeze thaw. Xanthan can provide high viscosity with low levels of use and also gels with other gums i.e.. locust bean. Many times, especially in high temperature dairy products, different gums are needed to achieve the desired characteristics of the finished product.

Emulsifiers are generally vegetable derived, and are commonly used in combination with gums to provide additional stability to dairy by-products. They are faster and more uniform in overrun incorporation and control. They provide drier extrusions and slower melt down as well as a smoother body and texture. Basic types of emulsifiers for use in high temperature dairy processing include mono & diglycerides, polyoxylethylene, lecithin, egg yolks, and gum acacia.

Several mineral/salts blends can be used as stabilizing and emulsifying aids. They are crucial for UHT and retort processing. These blends can act as buffering systems for low acid products and strengthen the protein matrix for high heat exposure. They also improve emulsion strength and aid in neutralizing.

There are things that stabilizers/emulsifers can not do, such as mask off flavors, alter major body and texture defects already in the product, and cover-up production problems or variations. Too much stabilizer/emulsifier can make a product too gummy or chewy. Cause excessive viscosity or create problems and even damage to equipment. It can bring about erratic overrun or shrinkage during storage. It can produce a crumbly body or give an unnatural melt down as well as impart off flavors.

All stabilizers/emulsifiers, while similar in ingredients, vary in their specific types of gums and emulsifiers as well as percent of amounts are intended for a specified end function. For example: Soft serve stabilizer/emulsifier may have the same ingredient legend as a whipping cream stabilizer/emulsifier but performs quite differently.

Challenges for high temperature processing shelf life stability are separation, aged viscosity, and age gelation. For acidified products it's protein stability. Stabilization of ultra high temperature dairy products will pose a challenge for many processors. Rely on your suppliers for support.

In the final session on technology and dairy ingredient applications, Jeroen Wouters the Business Development Manager USA & Canada for NIZO Food Research gave a presentation on innovation of the functional properties of dairy ingredients. His work is on innovative flavor concentrates and the identification of key aroma compounds as well as the selection of bacterial strains and dairy ingredients.

Gouda cheese flavor development was looked at with gas chromatography to profile volatile compounds over a period of six months. For bacterial genome sequencing an analysis of total genome (including plasmids) of a bacterium was done. This gave insight in the total pool of genes and genetic elements present in target organism. They found correlations with peptidase activity patterns sorted by PepN activity. There was weak correlation between PepN and PepXP and no correlation between PepA and other peptidases. Conversion of leucine yields 3-methylbutanal. 3-methylbutanal is key flavor compound in most (hard-type) Cheeses and is malty/chocolate-like.

Screening dairy strains on enzyme activities involved in leucine conversion. For dairy derived cheese flavor ingredients strain selection was based on peptidase activity, 3-methylbutanal production, thio-esters formation, roquefort aroma production, and selection of dairy ingredients basis (whey based). The application of flavor concentrates is optimization of drying treatment, split stream cream fermentation and briefly matured, low fat or processed cheese and flavor perception analysis. Innovative dairy flavor concentrates developed via characterization of key components of selected cheese. Additionally through development of cheese flavor ingredient based on dairy substrates and HTS strain selection (e.g. on basis of peptidase activity, 3-methylbutanal production, thio-esters formation, roquefort aroma production). The use of end-product (powder, paste) in various applications also aided in their development.

However, there are several optimisation issues with whey processing. They include curd fines content, fat content, bacterial quality, nitrate and nitrite content, dry matter, sedimentation and fouling. The benefits are efficient process, constant product quality and higher yield.

Efficient Design and Control of Agglomeration in spray Drying machines (EDECAD) aims at improving control of the agglomeration process and developing tools to predict product properties. It also strives for designing and optimizing spray drying equipment.

Next Véronique Lagrange, the Director of Strategic Research & Business Integration for the U.S. Dairy Export Council-USA gave a talk on food aid programs worldwide as an opportunity for market development.

USDA helps provide agricultural commodities through direct donations and concessional programs. Food aid is provided through four major programs: (1) PL480, Title II - Food for Peace, (2) PL480, Title III – Food for Progress, (3) Section 416(b) – donations of surplus commodities acquired by CCC, and (4) McGovern-Dole Intl. Food for Education.

Most donations are through private voluntary organizations to a wide range of developing countries. They are in the forms of direct feeding programs, school feeding programs, and monetization programs.

These programs can provide nutritional support and therapeutic support (HIV/AIDs). They create new markets, but cause commercial displacement for both US and non US products. As well as, cause poor image of US commodities. Safeguards exist against unsafe use, such as breastfeeding replacement, but have limits.

An ad-hoc approach can minimize displacement by working with PVOs at programming level. By educating PVOs to ensure responsible use and liaise with US AID, USDA, World Food Program (WHO). The results are successful but short-term programs. Benefits for populations are not optimized and do not translate into demand creation.

A strategic approach was used by the Soy Industry with World Initiative for Soy in Human Health (WISHH). Their idea was that increased soybean utilization can help meet the nutritional needs of the world population while benefiting those who produce soybeans. Their strategy consisted of a billion dollar donation effort as an opportunity to use soy on a large scale for human consumption in developing countries. This took advantage of the situation to develop systematic programs to increase consumption of soybeans in developing countries. They identified development programs where soy can be used to fortify diets and created new uses for high value soy products. They supported private voluntary organizations (PVOs) and demonstrated soy's benefits for HIV/AIDs (work with USAID, USDA). Then they promoted commercial soy food markets in developing countries (increase consumer awareness of benefits). Examples of programs they used are textured soy proteins in school feeding program (400,000 children, Ivory Coast), soy beverages in school lunches (Indonesia), USAID-funded nutritional support services / people with AIDs (Honduras), WHO (WFP)-funded trials with soy in Tajikistan, Pakistan, Afghanistan, market development: Egypt, Turkey, and emergency feeding operations.

USDEC's role is to be at the service of the US dairy industry to identify opportunities and help set priorities and to leverage resources through collaboration with other commodity groups. They also want to see if there is industry interest in supporting long-term strategy. The U.S. dairy industry needs to look at food assistance programs strategically. They need to actively support programs that will lead to medium/ long-term commercial market development. In addition, work with domestic and international decision makers to create programs that position dairy as protein of choice for fortification, therapeutic support and support application and nutrition research to document benefits and feasibility.

Bruce Blanchard the Sales Manager for GEA Filtration, Niro Inc. gave the last presentation of the symposium. His talk was on the latest developments in manufacturing technology for dairy ingredients. He explained that technological innovation is a function of (a few) market drivers including economic, social, and political. Economic drivers include energy costs, technology costs, consolidation, market maturation (commoditization), and competition. Health issues such as weight control and an aging population are one social driver. Another is in respect to the environment and the feeling of increased responsibility to future generations. Political drivers such as globalization backlash include retaliatory trade volleys like protectionism and isolationism.

There are several resulting (current) trends. One such trend is a holistic design approach. This is the optimization of all inputs and outputs. It sometimes results in sub-optimization of certain operations to the benefit of the whole. Another is market niche-manship when economies of scale converge with economies of scope. This includes product differentiation and customization, branding and product proliferation and service expansion. Additionally, hedging is a product category entrance into otherwise unattractive markets. Examples of hedging are playing to nationalistic sentiments and anticipating sociopolitical agendas. A further illustration of a resulting trend is a more sophisticated process plant design and operation which includes minimizing inputs. It also maximizes some outputs (products) while minimizing others (effluents). A more flexible process plant design provides investment protection against missed hedges or short product life-cycles. There are also further opportunities for food industry encroachment on the pharmaceutical sector.

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The Dairy Products Technology Center (DPTC), established in 1986, is a program within the College of Agriculture at Cal Poly State University, which conducts education, research, and outreach activities to provide solutions to help manage risk, facilitate innovation, and defend equity in the dairy foods industry and related business sectors. For further information visit our website at www.calpoly.edu/~dptc.

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