CALIFORNIA DAIRY RESEARCH CENTER

Dairy Products Technology Center (DPTC)
California Polytechnic State University–
San Luis Obispo, CA
www.dptc.calpoly.edu

University of California–Davis

OVERVIEW

The California Dairy Research Center is a comprehensive effort to bring the full capabilities of the Dairy Products Technology Center (DPTC) at California Polytechnic State University at San Luis Obispo and programs at the University of California at Davis to support the dairy industry from farm to table. Working with the California Dairy Research Foundation whose purpose is to promote research and development activities that benefit dairy producers and processors in the consumer marketplace, the scientists, technologists and other experts at the two universities continue to work with industry to provide innovative solutions that support the nation's dairy industry. The California Dairy Research Center conducts applied and strategic research and development in the areas of product technology and utilization, ingredient technology and utilization, product health enhancement, food quality and food safety. Its applications and outreach programs provide services to facilitate innovative uses of dairy foods and ingredients by the food industry. Facilities at DPTC are modern and state of the art, equipped with advanced and routine analytical equipment, pilot plants and a commercially licensed dairy processing facility.

RESEARCH FOCUS

The California Dairy Research Center offers significant expertise in and resources for research involving dairy products and ingredients. Research is industry-driven and can address the specific needs of companies in research or applications. Current research includes:

- Cheese technology (e.g., flavor, texture, yield, functional properties)
- Milk, dairy ingredients and dairy products quality and shelf life
- Process development (e.g., membrane processes, UHT and other heat treatments)
- Product development, dairy ingredients applications and flavor lexicons
- Dairy nutrition and health (e.g., probiotics, bioactives, milk genomics)
- Dairy quality assurance (e.g., food safety, environmental stewardship)

DAIRY INGREDIENTS APPLICATIONS PROGRAM

(Cal Poly State University, San Luis Obispo, CA)

This program provides technical support to manufacturers, users and marketers of dairy protein, dairy carbohydrate, and dairy fat-based powders and concentrates [nonfat dry milk (NFDM), skim milk powder (SMP), milk protein concentrate (MPC), whey protein concentrate (WPC), delactosed permeate (DLP) and milkfat]. It involves transfer of existing research information, preparation of information bulletins, providing solutions/information on technical product applications issues and conducting targeted short-term projects to address specific applications needs. Approximately 8,000 sq. ft. of processing area is available in the pilot plant facilities. Applications support and specialized analytical capabilities are also available. The plant is fully equipped for all traditional unit operations for the manufacture of dairy foods and ingredients and is licensed by the state of California for commercial manufacture of dairy foods. Four analytical labs support work in areas of microbial, physical and chemical analyses of dairy foods and ingredients.

For additional information, visit *www.dptc.calpoly.edu/facilities.html*

FACILITIES AND EQUIPMENT

DAIRY PRODUCTS TECHNOLOGY CENTER

California Polytechnic State University, San Luis Obispo

CONTACT: **PHILLIP S. TONG, PH.D.**
Director
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FACILITIES AND EQUIPMENT

EQUIPMENT:

- HTST—270-600 gph for ice cream mix, milk, etc., and associated cold milk separator, batch tanks, pasteurized surge tanks, CIP systems, etc. (HTST is a legally sealed unit by the state of California)
- Microthermics UHT (direct and indirect heating) with clean-fill hood and aseptic homo (25 l./hr.)
- Continuous ice cream freezer (Hoyer Frigus SF 600) (50-150 gal./hr.)
- Ingredient feeder (Hoyer Addus FF 2000 C2) (10-200 l./hr.)
- Sawvel cup filler—pint to 3.5 oz.; 35 cups/minute (pint)
- Emery Thompson batch ice cream freezer (40 qt.)
- Egli continuous pilot-scale butter churn (1-2 lbs./min.)
- PMS 30-gal./hr. HTST with two-stage homogenizer
- Technogel 100-l./hr. continuous ice cream freezer
- Marriott Walker rising film evaporator (100 lbs./hr. evaporative capacity)
- Open-water jacketed cheese vats (Stoelting 500 gal., Stoelting 3 to 50 gal., Kusel 2 to 100 gal. with drain table)
- 2 Universal 50-gal. specialty cheese vats
- 150-gal. Damrow Double-O enclosed cheese vat
- Blentech process cheese cooker (50 to 100 lbs.)
- Stefan process cheese cooker (5 lbs.)
- Suprema pasta filata system (mixer/molder and cooker/stretcher)
- Koch vacuum packaging system (1- to 40-lb. block)
- Miscellaneous tanks and pumps
- High-shear Silverson mixer
- 4 Groen process steam kettles (40 to 60 gal.)
- 2 APV conical bottom swept-surface processors (100 gal.)
- Legal batch pasteurizer system (200 gal.)
- 4-booth sensory evaluation area with test/preparation kitchen
- Controlled atmosphere cold storage (approx. 3,000 sq. ft.)
- Cold storage (-15 to -40°F) (approx. 200 sq. ft.)
- Spiral-wound DDS UF and RO system (50 to 100 l./hr.)
- Niro Pilot R-12 MF/UF/RO system (60 to 90 gal. feed/min.)
- Niro Filterlab spray dryer FLG-60 (60-lb./hr. water evaporation rate, capable of drying milk, whey and agglomeration)
- Small pilot-scale supercritical carbon dioxide fluid extraction system

SUPPORTING ANALYTICAL EQUIPMENT

Fast-Performance Liquid Chromatograph	Separation analysis and isolation of proteins from milk, whey and dairy products
Capillary Electrophoresis	Analysis of proteins, DNA and RNA
Pulsed Field Gel Electrophoresis	DNA-based differentiation of probiotic lactic acid bacteria
Gel Electrophoresis Acrylamide	Analysis of proteins and peptides: native, denaturing, urea, gradient and two-dimensional
Preparative Isoelectric Focusing	Isolation and characterization of proteins
Gel Densitometer	Individual protein concentration determination
PCR Thermal Cycler	DNA characterization, bacteria identification and determination, gene manipulation, etc.
ELISA Plate Reader	Multiple antibody and enzymatic assays for milk product component analysis or microbiological safety
Membrane Transfer Platform	Northern, southern and western blots of RNA, DNA, and protein analysis and identification
Dot Blot Instrument	Antibody and enzyme quantification and titration
Ultracentrifuge	Sedimentation of milk and cellular components
Contrast Phase Microscope	Microbiological analysis of spores
Digital Imager	Quantification and recordkeeping of dairy product sample structure and composition
Pilot Plant Scale Affinity Chromatography Column	Large scaleup of laboratory affinity chromatography procedures
Pre-coat Filter System	Removal of particulate from liquid streams, such as skim milk, whey or permeate
GC/MS	Flavor and other compound characterization and identification

SUPPORTING ANALYTICAL EQUIPMENT

High-Pressure Liquid Chromatograph (HPLC)	Peptide analysis from cheese ripening
Laser Diffraction Particle Size Analyzer	Particle size and particle size distribution of dry dairy powders, emulsions and colloidal dispersions
TX.T2 Analyzer	Texture profile analysis, firmness, etc.
Formagraph	Coagulation studies
Hunter Colorimeter	Whiteness, color intensity and hue, appearance of dairy foods and ingredients
Differential Scanning Calorimeter (DSC)	Thermal properties of milk components
Dynamic Stress Rheometer	Flow properties, gel strength, viscosity
Block Digestion and Distillation System	Nitrogen/protein analysis
Autotitration System	Determination of buffering capacity
High-Throughput Nitrogen Analyzer	Quantification of total milk protein, casein and whey protein content of foods

NOTE 1:

In addition to the specialized equipment available, DPTC routinely conducts chemical (fat, protein, ash, total solids, pH, etc.), physical (viscosity, color, etc.) and microbiological (APC, yeasts, molds, coliform, lactobacilli, etc.) analyses and related research, plus the development of dairy foods and ingredients.

NOTE 2:

In addition, Cal Poly works with several entities on campus (Materials Engineering, Biological Science, and Food Science & Nutrition) for more specialized expertise, instrumentation, process equipment, etc.

Ongoing collaboration with the Cal Poly Environmental Biotechnology Institute (Dr. Raul Cano, director) provides access to the following capabilities:

- High-throughput DNA sequencing (gene or chromosome sequencing and species identification)
- Fatty acid methyl ester (FAME) analysis (used to determine strain relatedness of microorganisms of significance to dairy/food industry)
- Terminal restriction fragment polymorphism (TRFP) (characterization of changes in microbial communities)

UNIVERSITY OF CALIFORNIA–DAVIS

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EQUIPMENT:

- Heat exchangers
- Holding tubes
- Evaporators
- Jacketed stainless steel vats
- Spray and freeze dryers
- Swept-surface heat exchangers
- Homogenizers
- HTST
- Ice cream freezers
- UHT capability
- Canning and blanching equipment
- Walk-in cold rooms and freezers
- Chest freezers (-120°F)
- Magnetic resonance imaging equipment
- Analytical equipment and lab capabilities
- Packaging properties labs

COURSES, SYMPOSIA AND EVENTS

- Annual International Symposium on Milk Genomics & Human Health: *www.cdrf.org*
- Annual Symposium on Advances in Dairy Product Technology—Concentrated & Dried Dairy Ingredients: *www.dptc.calpoly.edu*
- Annual Cheese Short Course: *www.dptc.calpoly.edu*
- Annual Milk Processing Technology Short Course: *www.dptc.calpoly.edu*
- Annual Dairy Science and Technology Basics for the Farmstead/Artisan Cheesemaker: *www.dptc.calpoly.edu*
- Annual Dairy Cleaning and Sanitation Short Course: *www.dptc.calpoly.edu*
- Annual Frozen Dairy Desserts Manufacturing Short Course: *www.dptc.calpoly.edu*
- The International Milk Genomics Consortium (IMGC) provides a collaborative and interactive pre-competitive resource platform for researchers and research end-users to accelerate the understanding of the biological process underlying the mammalian milk genome: *www.cdrf.org*
- Dairy 101: *www.dptc.calpoly.edu*

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