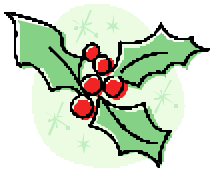
December 2000

INProcess



Happy Holidays!

A Newsletter from the Computer Integrated Food Manufacturing Center and Pilot Plant at Purdue University

December 2000
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INProcess Goes Quarterly

INProcess has undergone several new and important changes. First, the newsletter will be published quarterly in a multi-page format instead of monthly in a two-page format. Second, INProcess is now available by e-mail as well as by facsimile. The email version is formatted in PDF and allows worldwide distribution. Previously, we were limited to faxing the newsletter to the continental US and Canada. We think these changes will be beneficial to our readers. If you would like to receive INProcess by e-mail, send an e-mail message to:

CIFMC@Purdue.edu

with the subject:

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CIFMC Hires New Manager

In July 2000, the CIFMC hired Sasha Ilyukhin as Manager of the CIFMC. Sasha received a BS degree in Food Technology from Ryzan Agricultural University in Ryzan, Russia. He recently completed his MS degree from the Department of Food Science at Purdue University. Sasha's expertise is in food processing, control systems technology, and programming. Sasha will work closely with Steve Smith and manage the control system applications in the pilot plant. He will also help conduct workshops and labs, maintain the modeling and simulation lab and act as web-master for the CIFMC website. Welcome aboard Sasha!

New Equipment

- **Process Raman Spectrometer**

The CIFMC recently acquired a process RAMAN spectrometer from Fisher-Rosemount. When a molecule is exposed to intense monochromatic light, most of the energy is reflected or scattered at the same wavelength as the light source. However, a small amount of energy is absorbed according to the vibrational patterns that exist between atoms in the molecule. Each molecule has its own vibrational signature and scattered light spectra. RAMAN spectroscopy uses this principle to uniquely identify compounds. RAMAN spectroscopy has already been successfully applied to identification and differentiation of plastics for recycling.

The CIFMC is currently investigating the use of inline process RAMAN spectroscopy to determine specific chemical properties in food such as: the ratio of *cis* and *trans* isomers in hydrogenated vegetable oil, the ratio of glucose and fructose in corn syrup, the quantity of fermentable sugars in molasses, and the total acidity in fruit and vegetable juices.

The research conducted thus far has shown that RAMAN

spectroscopy leads to better control of product quality and to better detection of adulteration. Contact the CIFMC for more information on using process RAMAN spectroscopy for process measurement and control.

• Pick Heat Exchanger

Pick Heaters, Inc. recently donated a constant-flow, steam injection heat exchanger to the Pilot Plant for use in education, research and workshops. The unit is capable of delivering 20 GPM through 10-80 °F per pass. The pre-packaged Hot Water Set includes pump, sensors, single-loop auto-tune PID controller, and valve. During our tests, we have found the unit to provide accurate temperature control to within ±1°F. The unit operates very quietly. Steam is injected into the liquid through hundreds of small orifices within the injection tube. The fine "bubbles" of steam are instantly absorbed by the liquid, resulting in 100% heat transfer rates. A spring loaded piston rises or falls as more or less steam is required and eliminates water hammer associated with other types of direct steam injection. Helical flights on the chamber wall ensure thorough mixing of steam and water for total and immediate energy transfer. More information can be found on the world-wide-web at http://www.pickheaters.com/.

• Ecolab Donation

Ecolab's Food and Beverage Division has donated several pieces of cleaning equipment and cleaners to the pilot laboratory. Donated were:

- Model T Jr. Foamer capable of foaming a variety of caustic, acid and chlorinated cleaners. Used for floor and surface cleaning and sanitizing.
- Porta-Washer, Model P High Pressure washer-sprayer capable of dispensing hot water for removing difficult to remove particles.
- Quantum Caustic cleaner dispenser- an automatic delivery system for caustic and chlorinated cleaning compounds. Safely dispenses cleaners into dispensor bottles. Will keep a record of the amount of cleaners used and by whom.
- EcoCare personnel Hygiene Soap/hand sanitizer dispenser- Automatic no touch dispensor of sanitizing or liquid soap directly onto hands.
- Mikro-Spray Sanitizer Spray system- A venturi effect injector of concentrated liquid cleaners or germicides. Works with water hose pressure.
- Sanitizer, Caustic and Chlorinated Cleaning solutions.

The Ecolab products are being used extensively in classes here at Purdue. Dr. Maribeth Cousin has devoted several lab sessions in her sanitation class to cleaning techniques. In addition, we use the equipment in all of our Aseptic workshops that are conducted on campus.

Given the increasing importance of sanitation in food manufacturing and the need for continuous training, Dr. Rich Linton is planning to develop a Sanitation workshop for industry here at Purdue University.

In addition to the donation, Ecolab provided extensive training using state-of-the-art cleaning techniques. Richard Bakka, Manager of Educational Services for EcoLab, spent several days training our faculty and staff on the new equipment. For more information, visit Ecolab's website at: www.ecolab.com.

Recent Publications

The following publications represent the results of recent CIFMC research:

- Haley, Timothy A., Mulvaney, Steven J., (2000) On-line System Identification and Control Design of an Extrusion Cooking Process: Part I. System Identification, *Food Control* 11 (2) pp. 103-120.
- Haley, Timothy A., Mulvaney, Steven J., (2000) On-line System Identification and Control Design of an Extrusion Cooking Process: Part II. Model Predictive and Inferential Control Design, *Food Control* 11 (2) pp. 121-129.
- Ilyukhin, Sasha V., Haley, Timothy A., Larkin, John W. (2000) Control System Validation: Key to Automated Food Processing in the New Millennium, *Food Technology*, 54 (3)
- Haley, Timothy A., (2000) The Electronic Records Regulation: An Implementation Guide for the Food Industry. Internet Publication: (Available at our website)

Reprints of any CIFMC publications are available free upon request.

CIFMC & Multimedia Development

The CIFMC recently received a $14,000 grant from the School of Agriculture and Purdue University to purchase a digital multimedia development system. The dual 1-GHz Pentium III workstation, located in the modeling and simulation laboratory, will be used to create simulations of process equipment in a format that is both educational and entertaining. Additional computer equipment to be used with the multimedia workstation is a Sony Digital Camera, Scanner, CD Writer, and HP large document printer/plotter. The CIFMC will be working with the Computer Graphics Technology department as part of the SciMedia Initiative which develops science and engineering based educational training materials for CD ROM and web based delivery. If you are interested in receiving SciMedia materials or having SciMedia produce an electronic training course specifically for your company, contact us.

New CIFMC Website

We have a new look! Our new website now contains more information content than ever before. The site will be a virtual diary of CIFMC activities and news. The RESEARCH section has been expanded to include more details on current, past and anticipated research activities. The SUPPORT section has a separate full page dedicated to each company who are sponsors, affiliates or members of the CIFMC. These pages describe how their contributions are being used in our research, education and outreach programs. The website also sports many photos of our laboratories and equipment. In addition, slide presentations and articles are available on-line. As always, past issues of the INProcess newsletters will be available for review at any time.

A MEMBERS section will contain software and other resources available only to CIFMC MEMBER companies. Some of these resources include:

- **Thermal Process Calculations**

MEMBERS will be able to use the web to calculate process hold times, sterility values, and retort temperatures for aseptic processes, and batch and continuous retort processes. Algorithms will include Ball and Stumbo methods with a variety of options for selected cooling models.

- **News Portal**

The latest news related to process regulatory issues, food automation, and food processing will be available. We are working on a technology to "push" this news information to our MEMBER'S active screen saver or active desktop so that they receive relevant food industry news information as it happens.

- **Food Properties Database**

We are developing a web-based database of engineering properties for a wide variety of foods for use in equipment design and process modeling.

If you are interested in having access to these and other features, contact us today about becoming a CIFMC MEMBER.

Batch Control

Batching applications can be found in almost every food processing plant. In 1988, a standard (SP88) was proposed to describe a uniform approach to be used when developing control systems for batch processes. The proposal was adopted and has become codified by the Instrument Society of America as S88.01. The standard incorporates an equipment model and procedural model that describes a well defined approach to implementing batch processes. The result is that whether the application is batch retorting or batch kettle formulation, S88.01 provides a mechanism to design and implement a procedure capable of controlling the process. Many control systems have endorsed S88.01 including Fisher-Rosemount's DeltaV, Intellution's FIX, Rockwell Automation and Wonderware. Since S88.01 is becoming a so universal, processes designed under the standard can be readily supported by a wide base of engineers. Recently, Sasha Ilyukhin, CIFMC Manager attended an intensive training course in S88.01. This training combined with DeltaV's implementation of the standard allow the CIFMC to implement standard batch control in the pilot plant and to conduct training in S88. If you are interested in learning more about how S88 can improve productivity in your food process, contact us!

CIFMC Makes IFTPS Presentation

Sasha Ilyukhin delivered a presentation on *"Electronic Measurement of Mecury-In-Glass Thermometers"* recently at the 20th Annual Conference of the Institute for Thermal Processing Specialists (IFTPS). The two-day conference was attended by more than 100 people from industry, academia and government bodies. IFTPS was established exclusively for the purpose of fostering education and training for those persons interested in procedures, techniques and regulatory requirements for the processing of shelf-stable foods and for the communications of information between its members and other organizations. IFTPS provides a central organization for communications and education for its members in the field of shelf-stable food processing. This objective is accomplished through conferences, workshops and newsletters. Further, the Institute promotes study and research in the field of shelf-stable processing and its impact on the public and the industry. It is also dedicated to the responsibilities of persons concerned with or performing activities in the processing of shelf-stable foods.

Is Your PLC System Compliant with FDA Regulations?

Recent regulations promulgated in 1997 mandate that food manufacturers must meet specific provisions when making certain food processing records electronically. We have published an overview of this topic on our website at:

http://cifmc.foodsci.purdue.edu/pdf/21CFR11.pdf

Additionally, FDA and USDA will be looking for evidence of control system validation as part of process validation for regulated food processes. Since there is no consideration for a "grandfather" clause or option, all control systems regardless of whether they have just been purchased or whether they have been in service for many years will be equally scrutinized.

PLCs are perhaps the most popular and common control systems used in food processing today. However, PLCs were not designed for making secure electronic records nor were they designed with version control and software security in mind. PLCs were originally designed to replace relays, timers and counters for discrete manufacturing such that used in motion control. After successful introduction in the 1980s, PLC manufacturers began added "process" or "analog" capabilities to PLCs thus allowing them to move from the packaging side of manufacturing into the process side of manufacturing. But with the new emphasis on security for electronic records, validation and version control, it is becoming more difficult than ever to make PLCs compliant with FDA regulations.

A solution to this problem is to acquire a modern process control system that has been designed with FDA compliance in mind and interface it with your existing PLC systems. You may then delegate your electronic record-keeping requirements, validation and system revision control to the new controller

One such process control system that has FDA compliance features built in is the Fisher Rosemount DeltaV system. The DeltaV has built-in features that assure compliance with FDA regulations and can be interfaced with your current PLC systems. The CIFMC is currently interfacing its DeltaV system to its Allen Bradley PLC-5 in the pilot plant. We will demonstrate that this approach is cheaper and quicker than developing custom PLC software. As a side benefit, using DeltaV with your current PLC system will provide expanded functionality in your processes. For example, your PLC controlled process benefit from DeltaV's wide array of modern control strategies like model predictive control and fuzzy logic. For more information on bringing your PLC into the 21st century, contact us.