Building and Sustaining Hygienic Design for Food Processing

-Perspectives for the new generation of food scientists-

Alejandro Echeverry, Ph.D.
Assistant Professor | Food Safety
Department of Animal and Food Sciences
Texas Tech University

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Outline of Presentation

1. Introduction
2. Everyone needs to help
3. Current programs/syllabus in food science
4. Future professionals
5. Suggestions
1. Introduction

Hygienic Design......

What’s the importance?

1. Listeria Outbreak
2. 2 deaths
3. >350 Products; 42 brands
4. 250 people layoff
2. Everyone needs to help!

1. Who is going to help us?

   - HACCP TEAM, of course!!!!!!!!!!!!
     - Food Technologists
     - Food Scientist
     - Ind. Microbiologists/Food Microbiologist
     - Meat Scientists
     - Dairy Scientists
     - R&D
     - Nutritionists
     - Food /Agricultural Engineers

What they need to know:

1. Metallurgy / Materials
2. Process engineering
3. Safety Engineering
4. Production Engineering
5. Maintenance
6. Mechanical Engineering
7. Thermal processes
8. Rheology
9. Fluid Mechanics
10. Quality Assurance
3. Schools with Food Engineering/related Programs (Undergraduate)

**Different Areas of Emphasis:**

- Biosystems Engineering | Forest engineering
- Manufacturing
- Packaging Science
- Agricultural Engineering
- Bioproducts and Biosystems
- Dairy/Meat/Grains/Poultry/Vegetables

Source: [http://study.com/articles/Food_Engineering_Colleges_and_Degree_Programs_How_to_ChOOSE.html](http://study.com/articles/Food_Engineering_Colleges_and_Degree_Programs_How_to_ChOOSE.html)
3. Example – Auburn University

- BSEN 3240 Process Engineering
- BSEN 3530 Agricultural Production and Processing Facility Technology
- BSEN 5550 Principles of Food Engineering
- BSEN 7280 Food Thermal Processing
3. Example – Clemson University

Food Science / Packaging Sciences

- FDSC 4080 Food Process Engineering
- FDSC 4300 Dairy Processing and Sanitation
3. Example – Iowa State University

Agricultural and Biosystems Engineering – F.E. Option

- EM 324 Mechanics of Materials
- ABE 415 Ag & Biosystems Eng. design

**Undergraduate Curriculum in Biological Systems Engineering**

**Food Engineering Option**

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<th>First Year (32 cr.)</th>
<th>Semester 1</th>
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*Please check the current catalog and Schedule of Classes for most recent offerings.*
3. Example – Kansas State University

Food Science Program

- FDSCI 305 Fundamentals of Food Processing
- GRSC 540/541 Engineering applications for grain/food products
3. Example – University of Minnesota

Bioproducts and Biosystems Engineering

<table>
<thead>
<tr>
<th>Elective Courses</th>
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<tbody>
<tr>
<td>BBE Mechanical and Structural Design</td>
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<tr>
<td>IE 5513 Engineering Safety</td>
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<tr>
<td>FSCN 4332 Food Processing Operations</td>
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Food Engineering

Addressing the growing need for safe and healthy foods and healthy lives

Food engineers design and develop processes and products that address the world’s growing demand for safe and healthy foods and healthy lives. From developing new and innovative bioprocessing solutions for food processing, machinery, packaging, ingredients, instrumentation, and control, food engineers create cost-effective systems and solutions.

Food engineering students can tailor their education to their personal interests and career objectives. Graduates will be prepared for careers in the food processing and related agricultural products industry. Graduates will also be prepared for continuing their education at the graduate level in engineering, science, medicine, law, and business.

**Degree**

Students in this program will graduate from the College of Science and Engineering with a Bachelor of Bioproducts and Biosystems Engineering (BBE) with an emphasis (or major sub-plan) in Food Engineering (which will appear on the official transcript). Students can apply for admission to BBE through either the College of Science and Engineering or through the College of Food, Agricultural and Natural Resource Sciences (listed as Pre-BBE).
3. Example – University of Nebraska-Lincoln

**Food Science Program & Biological Systems Engineering**

<table>
<thead>
<tr>
<th>Semester 1: Fall</th>
<th>Semester 2: Spring</th>
<th>Semester 3: Fall</th>
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<tr>
<td>BSEN 100 Introduction to Biological Engineering</td>
<td>BSEN 112 Computer Aided Problem Solving</td>
<td>BSEN 205 Engineering Properties of Biological Materials</td>
<td>BSEN 110 Computer Aided Design</td>
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<tr>
<td>CHEM 113 Fundamental Chemistry I</td>
<td>MATH 117 Calculus I</td>
<td>CHEM 216 &amp; CHEM 217, or CHEM 256 &amp; CHEM 257</td>
<td>CHEM 215 Thermodynamics of Living Systems</td>
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<td>ENGR 10 Freshman Engineering Seminar</td>
<td>PHYS 201 General Physics I</td>
<td>CHEM 210 Technical Communication I</td>
<td>CHEM 120 Fundamentals of Biology I</td>
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<td>MATH 106 Calculus I</td>
<td>ENGR 20 Sophomore Engineering Seminar</td>
<td>MATH 221 Calculus II</td>
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<td>HECH 223 Engineering Statics</td>
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- **Mech 373 Engineering Dynamics**
- **BSNE Instrumentation and Control**
- **BSEN 470 Design in Agricultural and Biological Systems Engineering**
3. Example – Brigham Young University (Utah)

Manufacturing Engineering Technology

BYU Brigham Young University

Manufacturing Engineering Technology

About Undergraduate Graduate Accreditation Internships Donations Innovating - Travel

Alejandro Echeverry, Ph.D

- MFG 331: Metals Processes
- MFG 355: Plastic Materials and Processing
- MFG 431: Tool Design
- ME EN 250: Science of Engineering Materials
3. Current Programs – TTU’s Food Science (Undergraduate)

B.S. in Food Science

- FDSC 3305 Principles of Food Engineering
4. Future Professionals….what can we do for them?

- Include and reinforce the need for Hygienic design in as many courses as you can
- Topics might need to be food product-specific
  - Adapt available reference materials
  - Create new classes!
New Class: Hygienic Design of Food Processing Plants

• Equipment and Process Needs
• Regulations
• Prevention of Deliberate contamination
• Minimum Hygienic Design Requirements
• Factory Layout Impact
• Segregation

Specific Areas:
• Airflow
• Wall Finishes
• Ceilings
• Floors
• Drains
• Electricity supply
• Piping
• Lightning
• Exhaust & Dust Control
• Entries and Exits
• Steam Production
• Storage Areas
4. Use of Reference Materials in Class
4. Use of Reference Materials in Class
4. Use of Reference Materials in Class – Adapt guides to other food products
Flow Analysis – Dimensionless Block Diagram

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Note: The diagram shows the flow analysis with dimensionless blocks and symbols indicated by arrows. The numbers represent different flow paths and nodes in the system.
Flow Analysis – Dimensionless Block Diagram
What NOT to do with students…..

Requirement for plant “X”:

•“ “18-8 stainless Steel shall be AISI 300 series or better…”

•It’s a designation given by the American Iron and Steel Institute to stainless steel….”

•“The AISI 300 series stainless steels are all variations on the original 18-8 alloy…”

•You know, 18% chromium, 8% nickel….
5. Suggestions

Academia:

1. Encourage students subscription to trade magazines
5. Suggestions
5. Suggestions

Academia:

2. Encourage students to become members of professional organizations and to participate and volunteer in their groups and committees.

Dairy Quality & Safety Professional Development Group

Mission Statement: To promote the production and processing of safe, high quality dairy products and to develop program topics and symposia for presentation at the IAFP Annual Meetings.

Sanitary Equipment and Facility Design Professional Development Group

Mission Statement: To serve as a forum for the advancement of hygienic design and construction of food processing equipment and facilities.

Food Hygiene & Sanitation Professional Development Group

Mission Statement: To provide information on the developments in hygiene and sanitation in the food industry.
5. Suggestions

Academia:

2. Encourage students to become members of professional organizations and to participate and volunteer in their groups and committees.

Dairy Foods
Concerned with quality control, compositional standards, product and process development, equipment and plant design, sanitation, sensory evaluation, biotechnology of dairy cultures, and development and implementation of marketing strategies.
5. Suggestions

Industry & Trade Organizations:

1. Increase access to students
2. Internship Experience
3. RFP / RFA
   - White Papers / Guides
   - Evaluation / validation of Materials (biofilm formation, cleanability)
   - Sponsor Hygienic Design Series in trade magazines / case studies
4. Support Programs / Endowed Positions
5. Suggestions

Industry & Trade Organizations:

2. Provide scholarships for educational events
3. Follow up & request feedback / experience / current projects
Alejandro Echeverry, Ph.D.
Assistant Professor | Food Safety & Food Engineering
Department of Animal and Food Sciences
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E-mail: alejandro.echeverry@ttu.edu