Overview of Reduced Oxygen Packaging
Jayne Stratton, Ph.D.
ROP Workshop

Overview of ROP
- Introduction
- Definition
- Benefits
- Misconceptions and risks

Types of Processes
- Vacuum packaging
- Cook chill
- Sous vide
- Modified Atmosphere Packaging (MAP)

Safety Concerns
- Microbiology
- Micro Applied to ROP
- Sanitation
Topics

• Introduction
  o What is ROP?

• Definitions
  o Aerobic
  o Anaerobic

• Benefits
  o Why should I use ROP?

• Misconceptions and risks
  o Outbreaks in ROP
Introduction - ROP

Food + Package → Longer Shelf life

Remove O₂
Definitions

- **Aerobic conditions**: The environment contains oxygen

Pictures courtesy of Ben Davy
• Anaerobic conditions: There is NO oxygen in the environment
## ROP Benefits

- Prevents the growth of spoilage organisms
- Prolongs Quality
- Extends Shelf Life
Growth Prevention of Spoilage Organisms

ROP creates an environment with low oxygen that prevents the growth of aerobic bacteria, yeast, molds.
ROP Benefits

Growth Prevention of Spoilage Organisms

These microorganisms are largely responsible for the “off” odors, slime, texture changes, and other forms of spoilage.
ROP Benefits

Prolongs Quality

- Reduces Fat oxidation and rancidity
- Prevents chemical reactions that produce off odors and color change
- Reduces aerobic bacterial growth
- Eliminates the risk of contamination during storage

Extends Shelf Life
Why use ROP in Retail?

ROP Benefits

- Reduces preparation and clean-up times
- Portion control problem eliminated
- Less mess, fewer utensils
- Extends shelf life
- Creates a tender/or flavorful food product, such as with sous vide.
Misconceptions and Risks

“Sealing food in vacuum packs eliminates the need to handle it properly.”

Foodborne Botulism

Food Safety News, 2017
Outbreak of Botulism Linked to Vacuum-Packed Hot-Smoked Whitefish, France

Three members of the same French family developed botulism after eating a vacuum-packed whitefish. The fish had been purchased by the family, on August 22, during a recent visit to Finland and was consumed several weeks after purchase. No leftover fish was available to confirm this hypothesis. The fish had originally been processed and packaged in Canada. Vacuum packed hot-smoked whitefish had previously been associated with botulism in multiple countries, including Finland, Germany, the USA, and Israel.

Tags: C. botulinum, clostridium botulinum, c. bot., botulism, type e, botulism type e, canada

<table>
<thead>
<tr>
<th>Year</th>
<th>Country</th>
<th>Product</th>
<th>Toxin Type</th>
<th>Cases (Deaths)</th>
<th>Factors contributing botulism outbreak</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>1982</td>
<td>Madagascar</td>
<td>Commercial pork sausage</td>
<td>E</td>
<td>60 (30)</td>
<td>Inadequate preservation</td>
<td>Viscens et al., 1985</td>
</tr>
<tr>
<td>1985</td>
<td>USA</td>
<td>Uneviscerated salted, air-dried fish (kapchunia)</td>
<td>E</td>
<td>2 (2)</td>
<td>Poorly controlled salting, lack of refrigeration</td>
<td>CDC, 1985</td>
</tr>
<tr>
<td>1997</td>
<td>Germany</td>
<td>Home smoked vacuum-packed fish (Lachsforellen)</td>
<td>E</td>
<td>4</td>
<td>Temperature abuse</td>
<td>Anon, 1998</td>
</tr>
<tr>
<td>1998</td>
<td>France</td>
<td>Commercial frozen vacuum packed scallops</td>
<td>E</td>
<td>1</td>
<td>Temperature abuse (?)</td>
<td>Boyer et al., 2001</td>
</tr>
<tr>
<td>1998</td>
<td>France</td>
<td>Commercial frozen vacuum packed prawns</td>
<td>E</td>
<td>1</td>
<td>Temperature abuse (?)</td>
<td>Boyer et al., 2001</td>
</tr>
<tr>
<td>2001</td>
<td>USA</td>
<td>Home-made fermented beaver tail and paw</td>
<td>E</td>
<td>3</td>
<td>temperature abuse</td>
<td>CDC, 2001</td>
</tr>
<tr>
<td>2002</td>
<td>USA</td>
<td>Home-made “muktuk” (from Beluga whale)</td>
<td>E</td>
<td>12</td>
<td>Unsafe process</td>
<td>Anon, 2002</td>
</tr>
<tr>
<td>2004</td>
<td>Germany</td>
<td>Commercial vacuum-packed smoked salmon</td>
<td>E</td>
<td>1</td>
<td>Consumed after “use by date”</td>
<td>Dressier, 2005</td>
</tr>
</tbody>
</table>

Misconceptions and Risks

Misconceptions and Risks

Low salt, vacuum packed fish must be kept frozen until ready to use, label said to refrigerate or freeze - RECALL

Fully cooked, vacuum packed chicken tamales processed without a HACCP plan - RECALL

Misconceptions and Risks

• Need to store frozen food in the freezer and thaw in appropriate manner

• Vacuum seal does NOT kill bacteria

• Vacuum packaging does NOT automatically make food safe and eliminate the need to take precautions
ROP Overview

Continue to be vigilant with food safety