

Meat Preservation Techniques

Meat Preservation Techniques – Study Notes

1. Why Preserve Meat?

- **Safety:** Inhibits growth of spoilage microorganisms and pathogens.
 - **Quality:** Maintains flavor, texture, color, and nutritional value.
 - **Shelf-life Extension:** Allows storage, transport, and seasonal availability.
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2. Physical Methods

Method	Principle	Typical Conditions	Advantages	Limitations
Refrigeration	Low temperature slows microbial metabolism.	0°C–4°C (32°F–39°F)	Simple, inexpensive, retains fresh texture.	Limited to a few weeks; still requires further preservation for long-term storage.
Freezing	Ice crystals immobilize water, halting microbial activity.	-18°C (0°F)	Extends life to months; retains most nutrients.	Ice crystal damage can affect texture; requires continuous power.
Vacuum Packing / Modified Atmosphere Packaging (MAP)	Removes oxygen (vacuum) or replaces it with gases (CO ₂ , N ₂) to inhibit aerobic microbes.	Ambient temperature; gas composition tailored to product.	Reduces oxidation, slows spoilage, visible product.	Anaerobic pathogens (e.g., <i>Clostridium botulinum</i>) may still grow; equipment cost.

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Irradiation	High-energy photons (gamma, X-ray) or electrons break DNA of microorganisms.	Dose 1–10 kGy for meat.	Sterilizes without heat; extends shelf life; minimal sensory change at proper dose.	Consumer acceptance, regulatory limits, potential lipid oxidation.
High-Pressure Processing (HPP)	Pressurizes product (300–600 MPa) uniformly, disrupting cell membranes.	20–30°C, 1–5 min.	Retains raw-like texture and flavor; reduces pathogens.	High equipment cost; limited to pre-packaged cuts.
Drying / Dehydration	Removes water activity (a_w) below levels needed for microbial growth.	30–70% RH, 50–80°C (depending on method).	Light, portable, long shelf life.	Can cause texture toughening; flavor changes.

3. Chemical Methods

Technique	Main Agent(s)	Mode of Action	Typical Use
Salting (Dry or Brine)	NaCl, sometimes KCl or curing salts (NaNO_2 / NaNO_3).	Lowers water activity, draws out moisture, creates osmotic stress.	Bacon, ham, jerky, corned beef.
Curing (Nitrite/Nitrate)	Sodium nitrite, sodium nitrate, sometimes combined with salt.	Inhibits <i>Clostridium botulinum</i> , stabilizes color (nitrosomyoglobin), adds flavor.	Sausages, cured ham, hot dogs.
Sugar & Spices	Sucrose, glucose, paprika, garlic, etc.	Sugar contributes to water activity reduction; spices have antimicrobial phenolics.	Dry-cured sausages, marinades.
Acidification	Lactic acid, acetic acid, citric acid, vinegar, fermented cultures.	Lowers pH ? inhibits many bacteria; can also denature proteins.	Pickled meats, fermented sausages (salami).
Smoking	Combustion products (phenols, carbonyls, organic acids).	Combines dehydration, antimicrobial chemicals,	