THE CHALLENGE OF SODIUM REDUCTION IN FOODS

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FUNCTIONS OF SALT IN PROCESSED MEATS

- Preservation
- Safety
- Swell muscle protein to bind water and fat resulting in the succulence/juiciness associated with processed meats
- Extracts salt soluble proteins which then form irreversible gels upon heating to encapsulate moisture and ‘emulsified’ fat
- Flavor

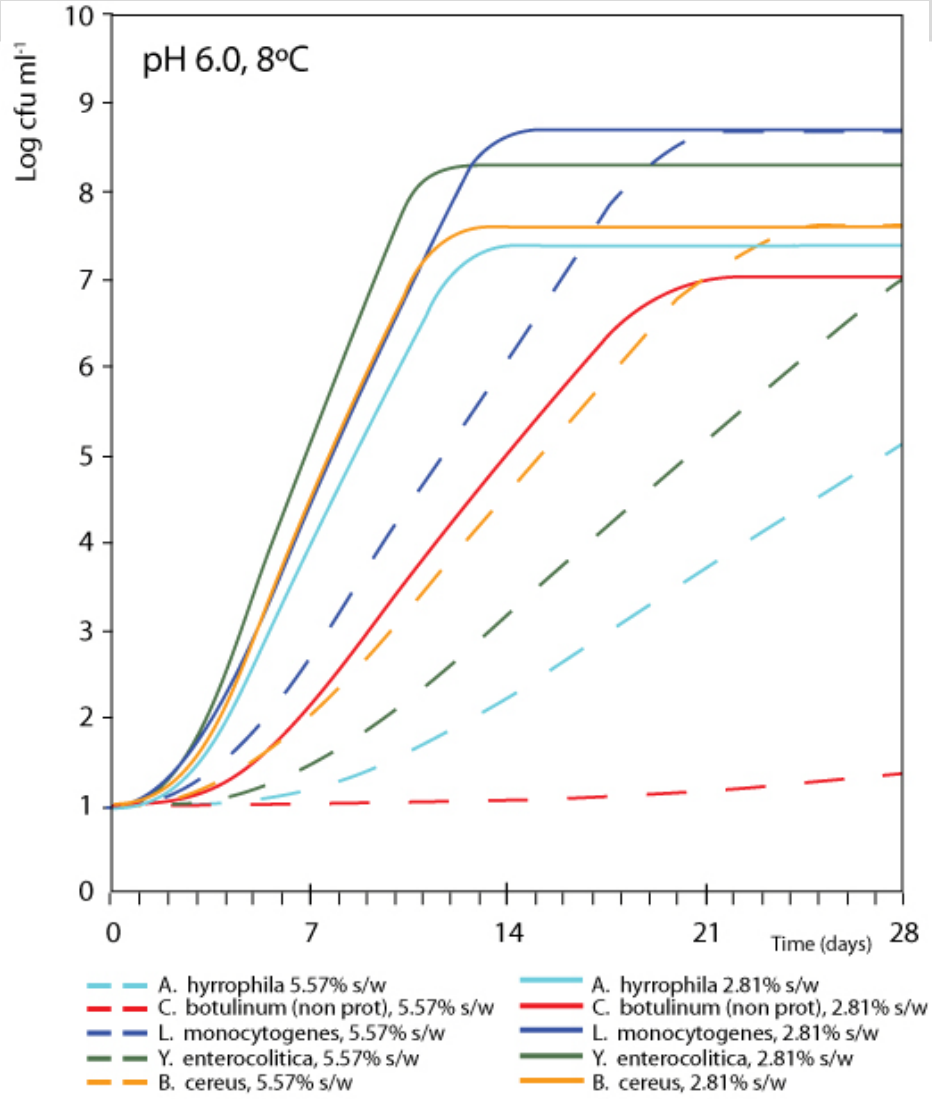
SALT AND MICROBIAL FOOD SAFETY

- Salt inhibits the growth of pathogenic bacteria
- It has been the most widely used food preservation tool for centuries, dating back to 1000B.C.
- It functions by the reduction of the water activity of the product in which it is used
- A reduction of water activity is tantamount to the reduction in the availability of water for bacterial growth

Factors Affecting Growth and Survival of *C. botulinum*

	Group I, Proteolytic *C. botulinum*	Group II, Nonproteolytic *C. botulinum*
Minimum temperature for growth	10°C	3.0°C
Minimum pH for growth	4.6	5.0
Minimum water activity for growth		
i) NaCl	0.94	0.97
ii) Glycerol	0.91	0.94
NaCl conc. preventing growth	10%	5%

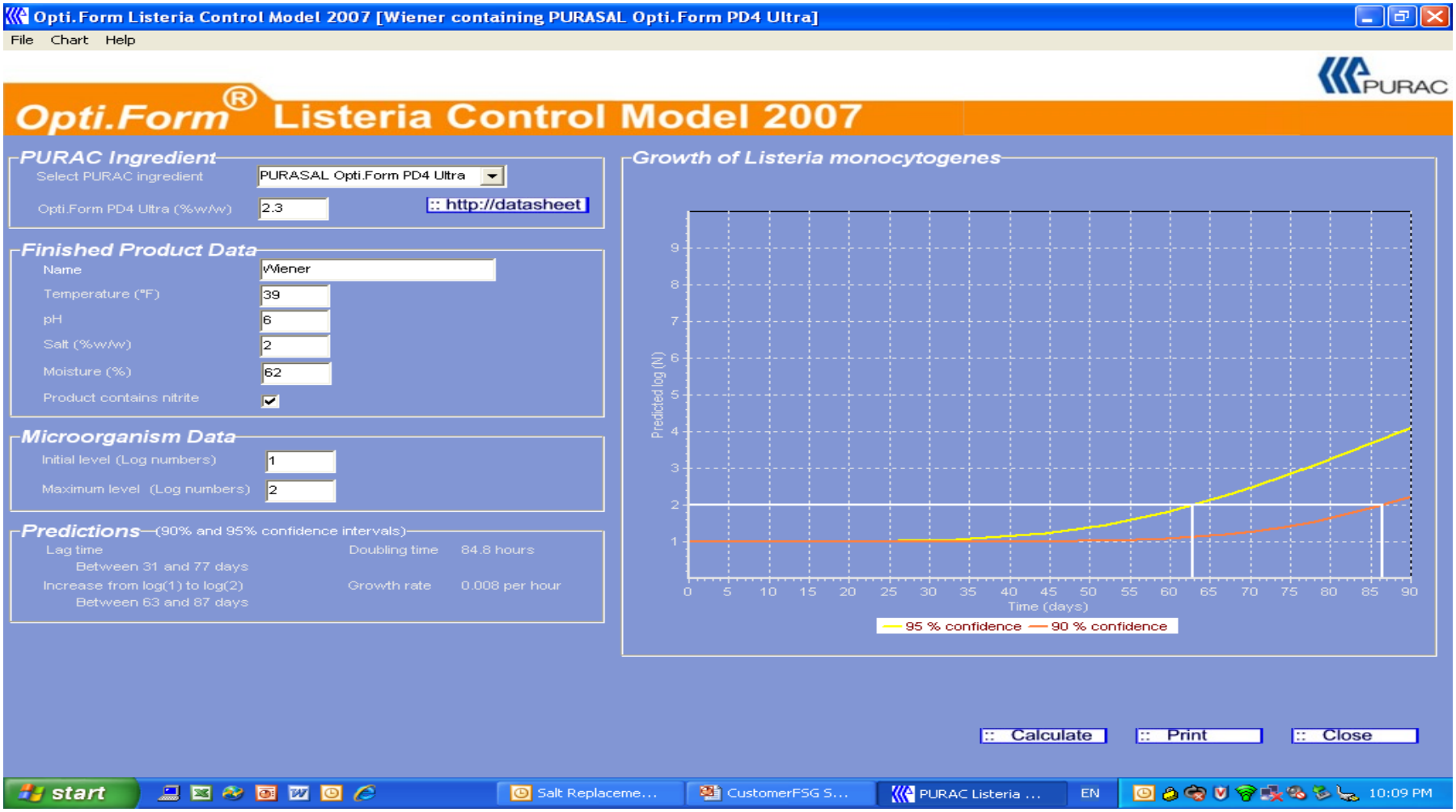
Effect of Reducing Salt on Pathogen Growth



The effect of reducing salt on pathogen growth in a hypothetical food with the same pH and moisture contents as typical ham.

*From:**Microbial risks associated with salt reduction in certain foods and alternative options for preservation, Institute of Food Research, Norwich, England. 2005***

Listeria monocytogenes

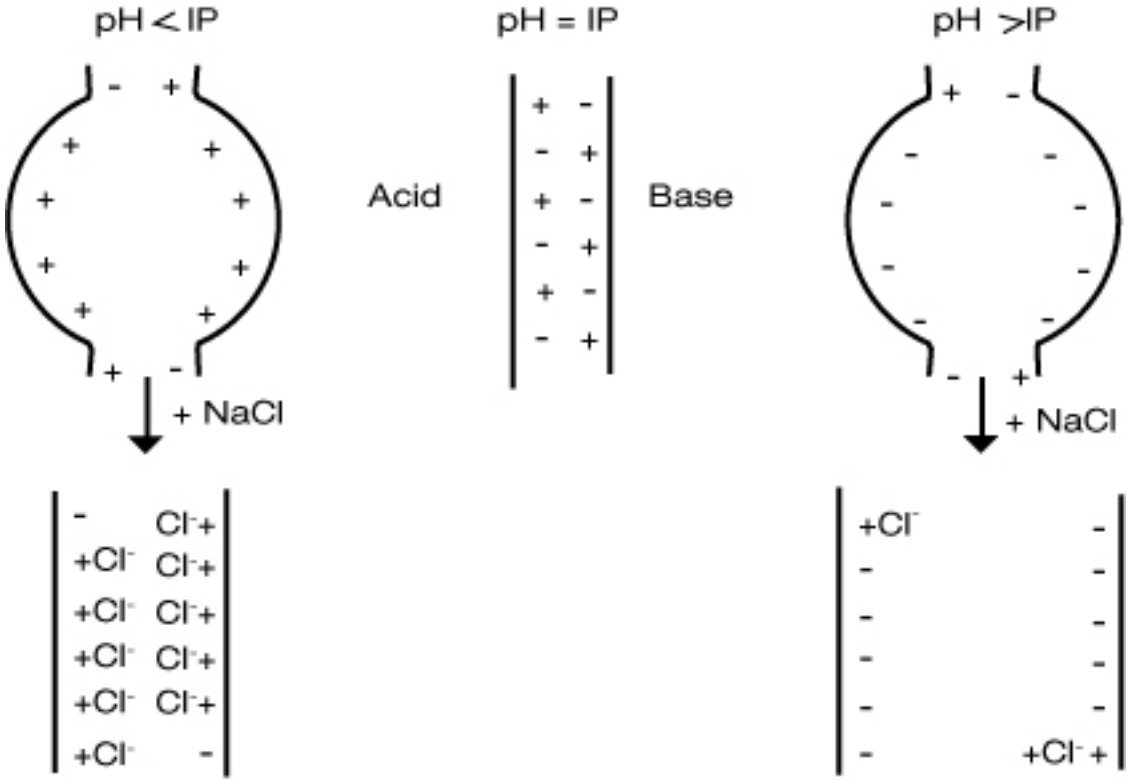


Listeria monocytogenes

Succulence and Juiciness

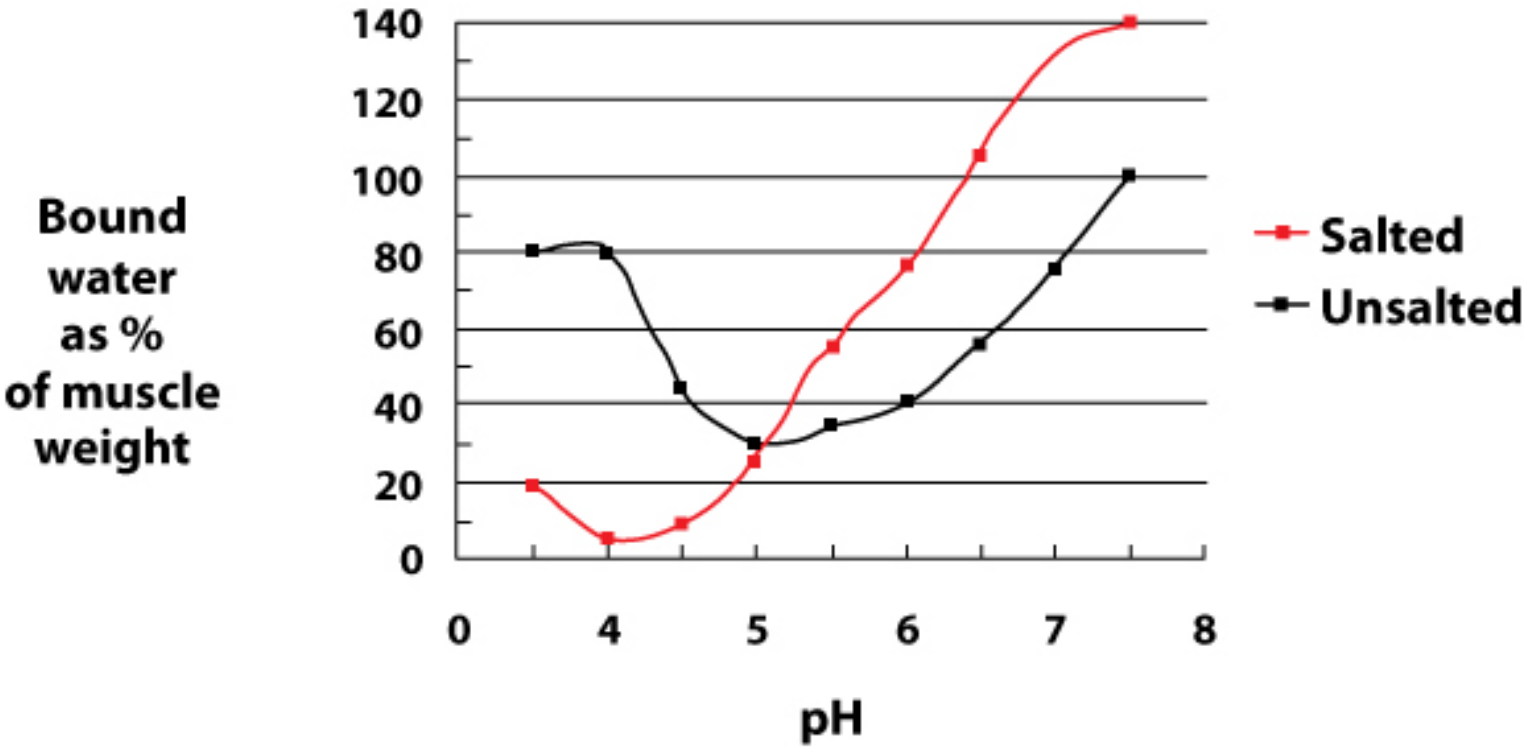
- Below the isoelectric point of the muscle the positive charge of the proteins is neutralized by the negative chloride ions, the repulsive forces are reduced and the matrix shrinks. The net effect is a reduction in the water holding capacity i.e a reduction in juiciness
- Above the isoelectric point of the muscle, the negative chloride ions neutralize the few positive charges, the net negative charge increases and opens up the matrix allowing moisture to be held. The net effect is an increase in water holding capacity and an increase in juiciness

The Influence of Salt on Muscle Water Holding Capacity



Pictorial representation for the effect of sodium chloride on Muscle Water Holding

Influence of salt on water holding



From J. Sebranek, University of Iowa

Effect of Salt on Myofibrillar Extraction

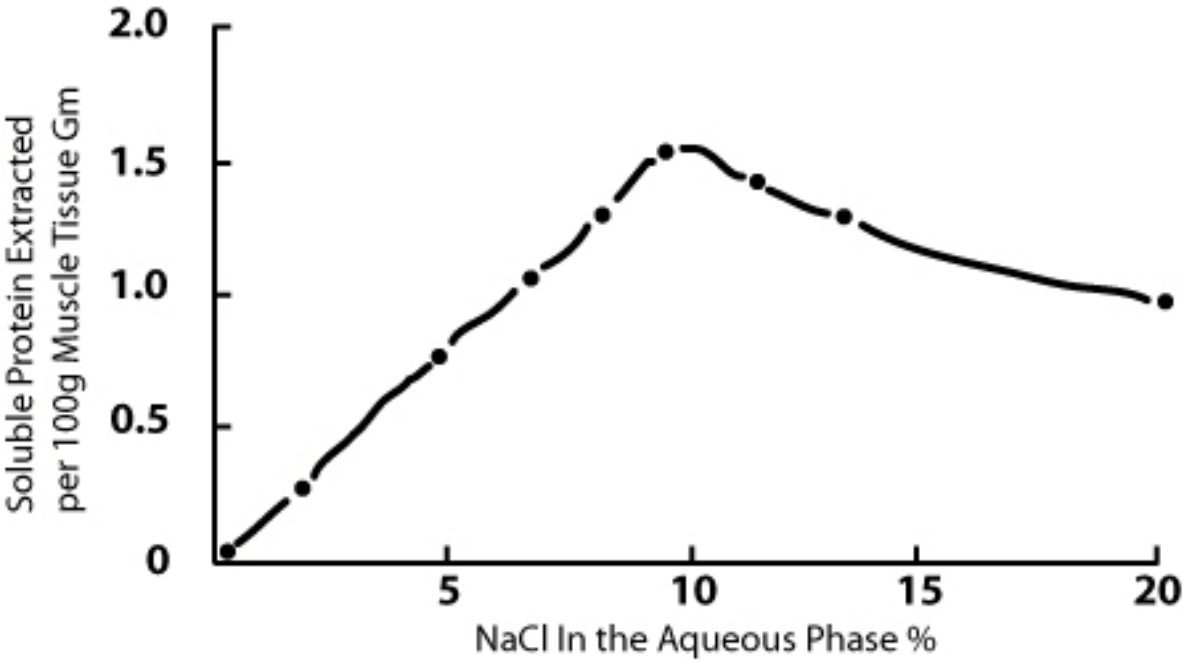
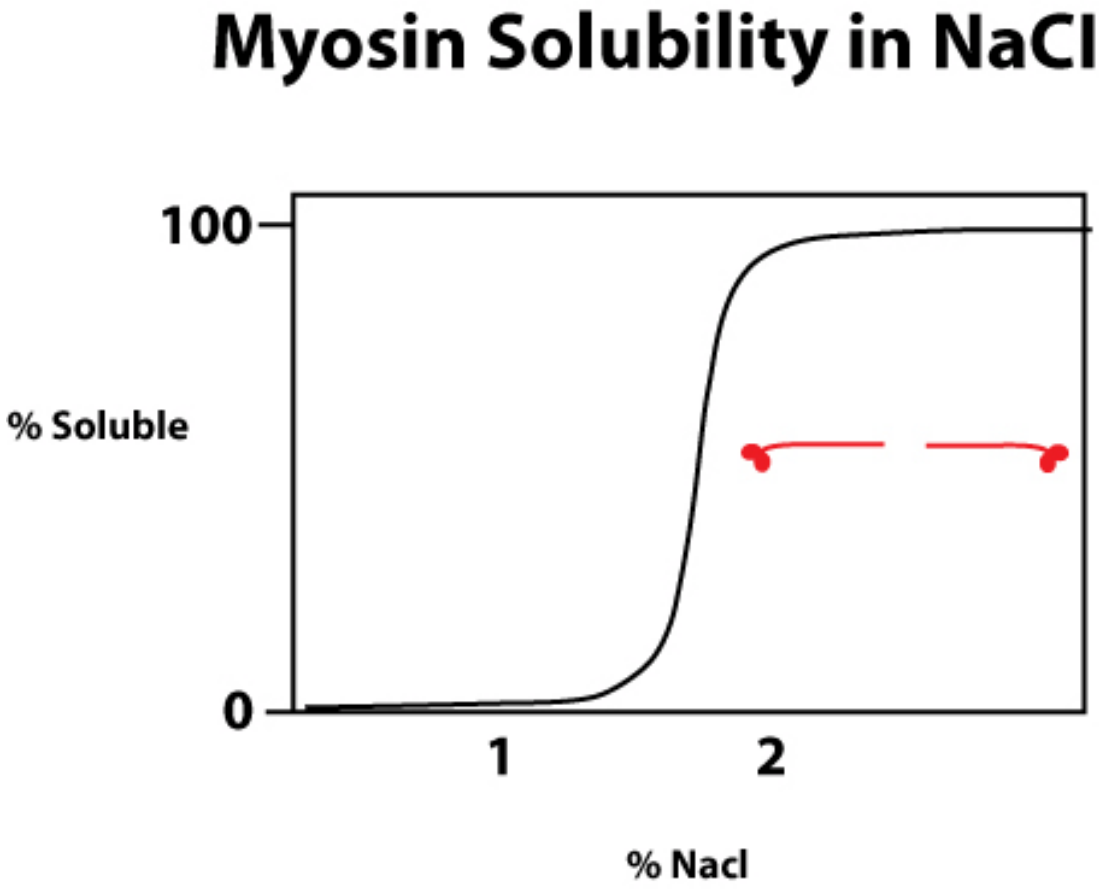


Figure 1. Effect of Sodium Chloride concentration on Solubilizing Salt-Soluble Proteins of Post-Pigor Pork

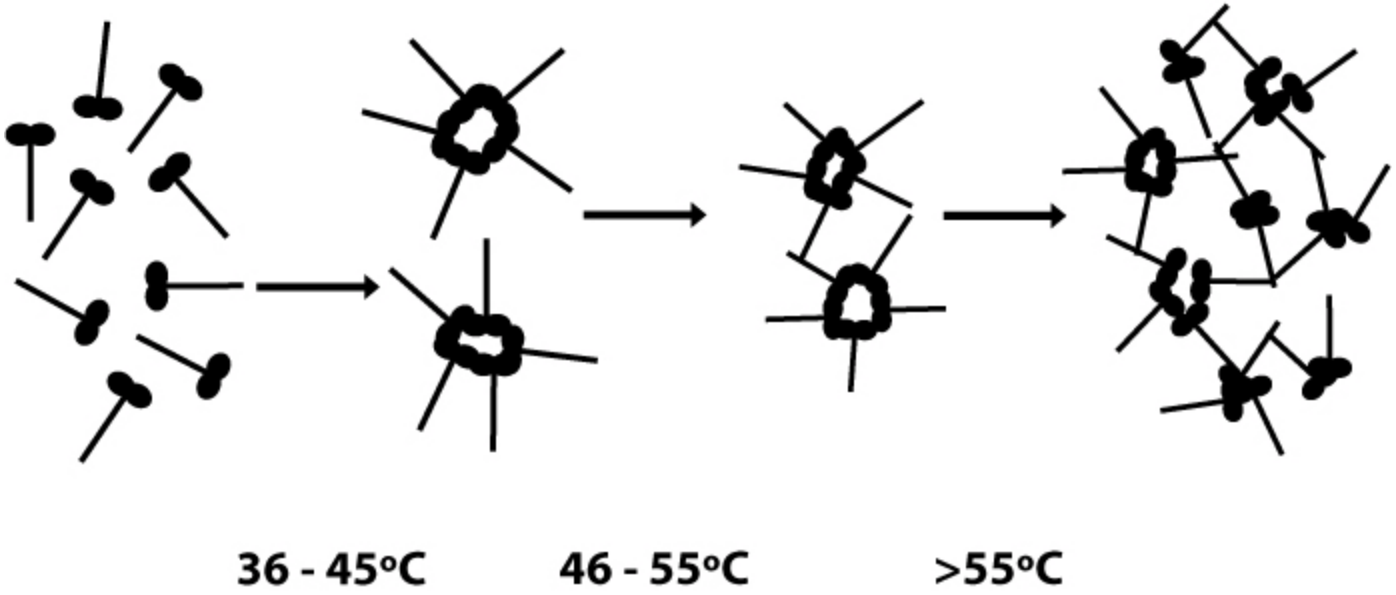
From J.Bard 1964

Impact of NaCl on Myosin Solubility



From A. Milkowski, University of Wisconsin

Thermal Gelation of Myosin



Source Y, Xiong, University of Kentucky

Functional Role of Sodium in Bakery Goods

Dough Structure

- **Flour protein (gluten) upon hydration and energy input (mixing) forms a viscoelastic matrix (dough) which entraps carbon dioxide formed by yeast fermentation.**

- **As salt dissociates it forms protein-protein and protein-sodium ionic bonds, to strengthen or tighten the gluten matrix.**

Functional Role of Sodium in Bakery Goods

Fermentation

- **Salt / sodium levels impact the rate of yeast fermentation (too little increases fermentation, too much retards fermentation)**

- **Fermentation affects dough rheology which impacts overall bread quality attributes like crumb texture, crust colour , loaf volume, and overall bread flavour.**

Functional Role of Sodium in Bakery Goods

Microbial Spoilage / Shelf-life

- **The high water activity of white bread (>0.97) or free water, supports the growth of moulds, wild yeast and bacteria.**

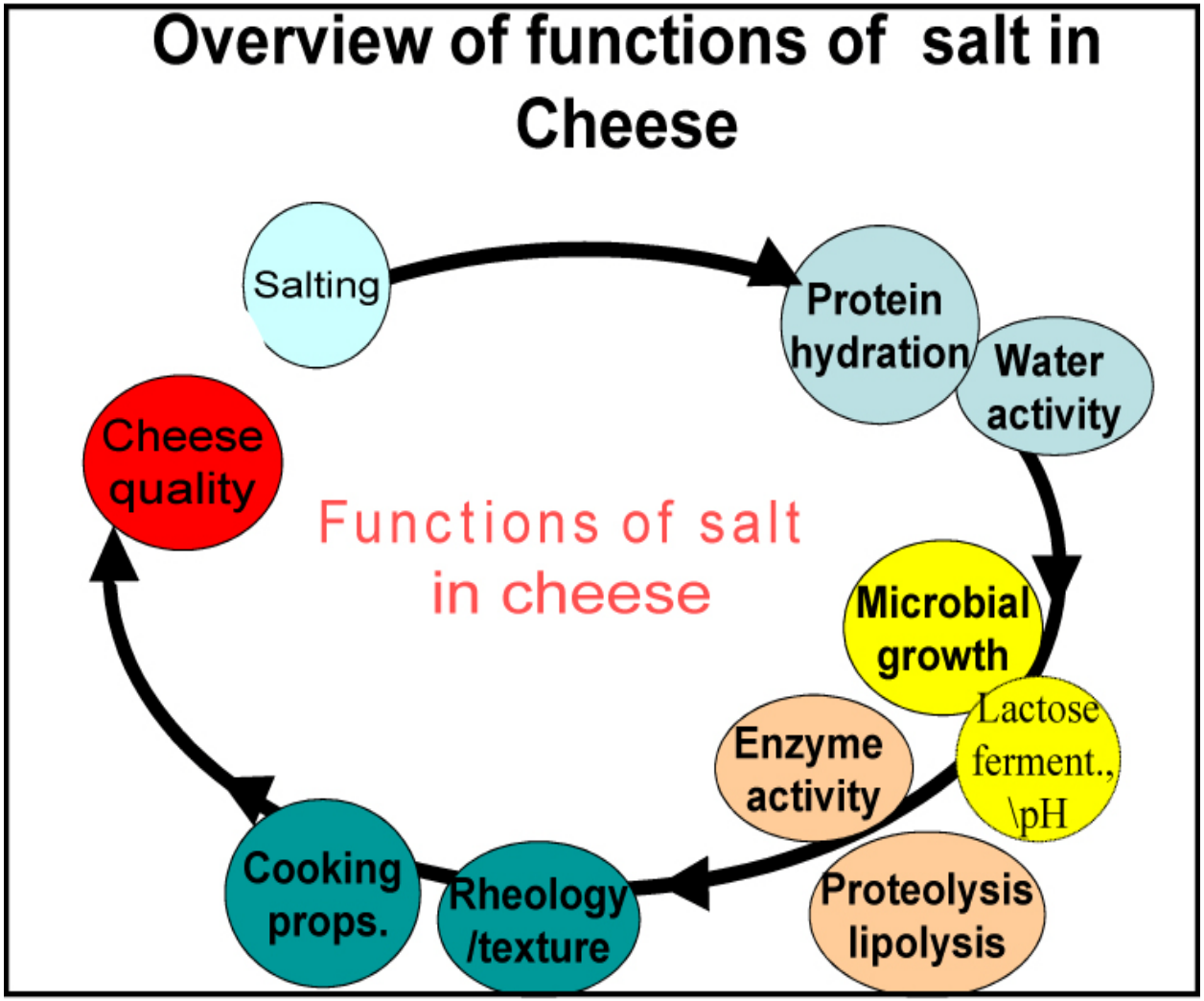
- **Salt reduces water activity and aids in controlling mold-free shelf-life. No salt bread molds faster than bread with a standard level of 2% salt based on flour.**

Technological Challenges in Bakery

Processing

- **low salt levels produce “sticky” doughs that are difficult to mechanically process through high-speed bakery production lines. This is due to a decrease in mixing stability which can create “over-mixed” doughs that stick to processing equipment and conveyor belts. Sticky doughs cause major delays that create product loss, disruption of a continuous make-up process which impacts product quality, and higher costs due to down time to clean equipment.**

How Sodium Chloride Impacts Cheese



Issues with Salt Reduction in Cheese

- Safety of lower salt cheeses
- Control of spoilage organisms
- Issues of flavor development
- Issues with grading
- Poor texture quality

THANKS

ANY ?