PHOSPHATES IN MEAT PRODUCTS

Niclas Holm

What are we going to talk about?

Answering the questions that just won't go away!

Why are there phosphates in most of the labels of meat products?

Is it really necessary so many phosphates like that? Aren't they all the same?

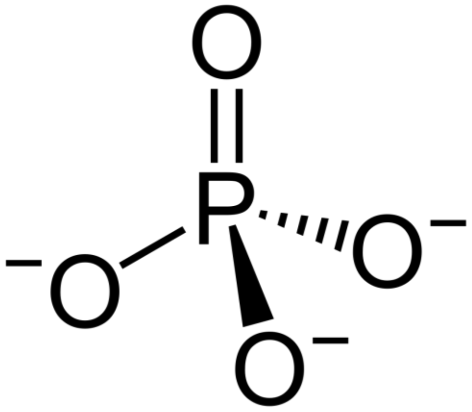
What is a phosphate?

Do I always need to apply a certain % age of phosphate in the formula?

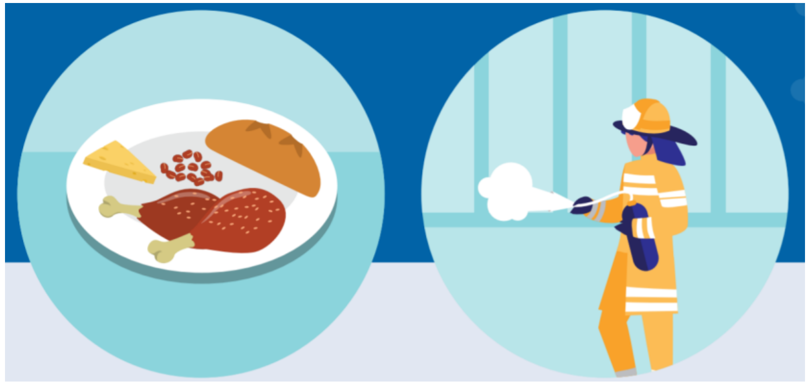
THE PHOSPHATE

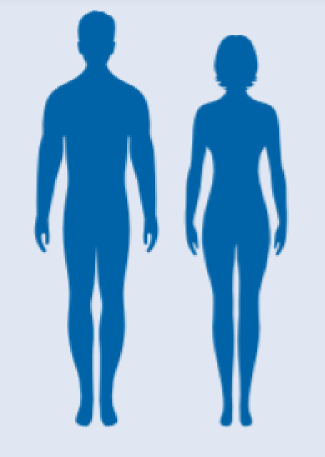
Starting from the beginning

What are phosphates?



They are organic compounds found in foods and non-food items.





It is one of the most abundant minerals in the human body, corresponding to almost 1% of the average weight of a person.

When the element phosphorus (P) is combined with oxygen, phosphates are created → form in which phosphate is found in nature.

Phosphorus is one of the most versatile and prominent elements of planet Earth, vital to the environment and human health.

Source: International Food Additives Council

Starting from the beginning

What are phosphates?

Food applications

- Growth of the bakery dough
- Increase of the the water holding capacity in meat products
- Improved fluidity in dairy products
- Mineral supplementation

Multiple applications

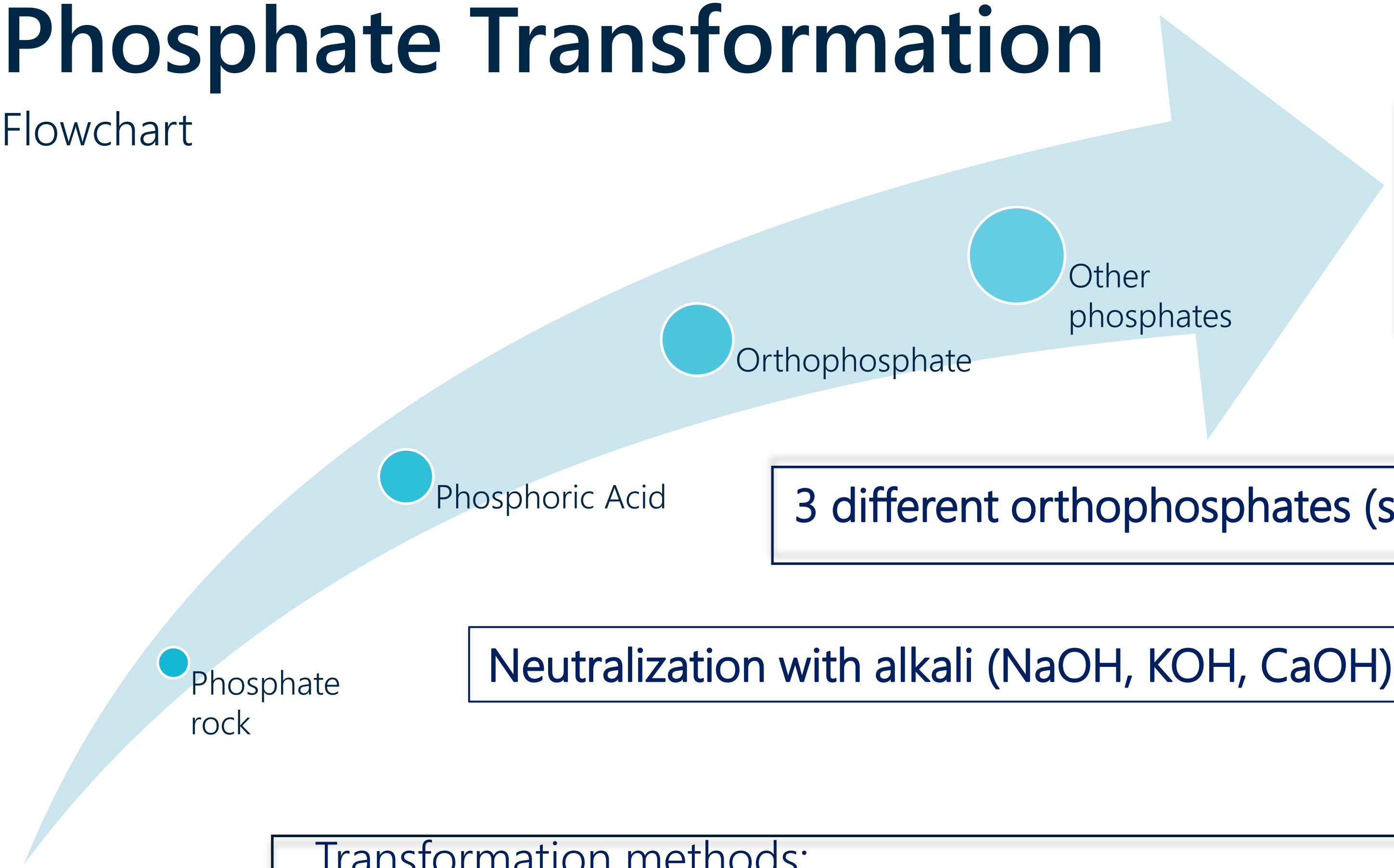
- Fertilizers
- Cleaning of electrical semiconductors
- Flame retardant
- Construction (asphalt, cement)
- Control of tarth in oral hygiene products
- Water treatment

Source: International Food Additives Council

PHOSPHATE TRANSFORMATION

Phosphate Transformation

Flowchart



Condensation of orthophosphates (time process x temperature)
Increase of the phosphates number → Di-, Tri-, Poli-

3 different orthophosphates (sodium, calcium or potassium)

Neutralization with alkali (NaOH, KOH, CaOH)

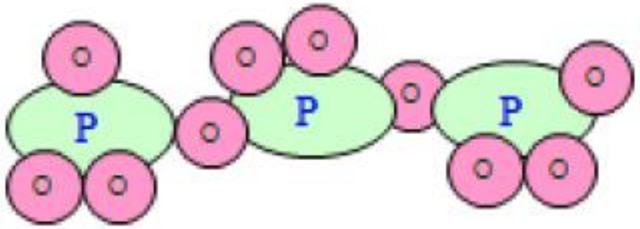
<u>Transformation methods:</u>

1) **Wet method**: gross phosphate + sulfuric acid → purified phosphoric acid + calcium sulfate
2) **Thermic**: gross phosphate + silicion dioxide and carbono (high temperature) → calcium silicate + carbono dioxide + elemental phosphorus
   Elemental phosphorus + oxygen + water → purified phosphoric acid

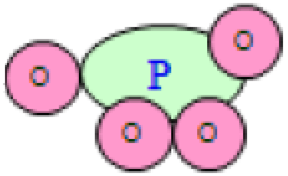
Phosphate Transformation

Different phosphates

Triphosphate (3 atoms of P)

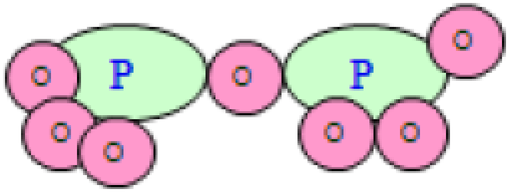


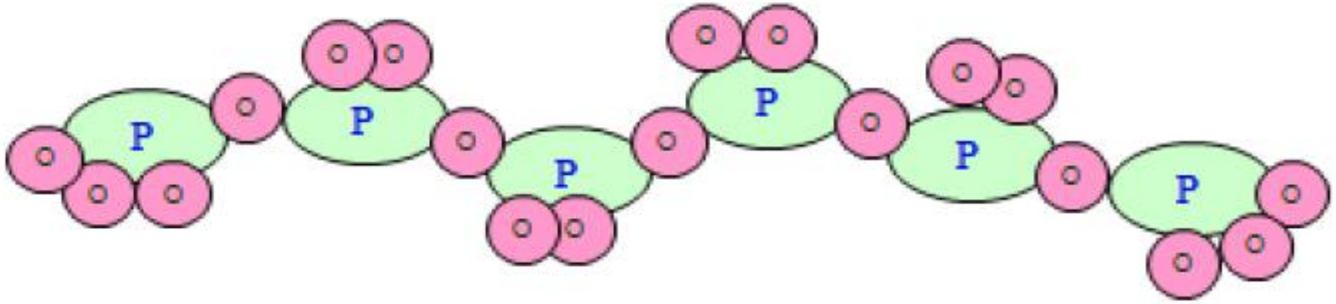
Ortho / Monophosphate (1 atoms of P)



Poliphosphate (4 atoms of P or more)

Pyro / Diphosphate (2 atoms of P)





Phosphate Transformations

Type of phosphates

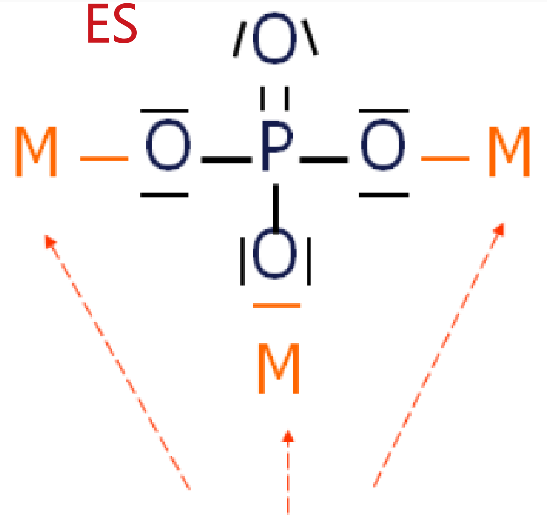
DEFINED PHOSPHATES	Trisodium monophosphate Tetrasodium pyrophosphate Potassium tripolyphosphate Tricalcium phosphate Sodium polyphosphate
ONE-STEP PHOSPHATES	Presence of unreacted diphosphates in the processing: Brifisol 500 Brifisol 505
PHOSPHATES BLENDS	Physical mixture of two or more defined phosphates: TARI K 7 Fibrisol 414 Tari K 5
AGGLOMERATED PHOSPHATES	Chemical mixture of two or more defined phosphates: Brifisol 450 Super Brifisol 750 TARI P 22

CHEMISTRY AND FUNCTION OF PHOSPHATES

Chemistry of phosphates

The different types of phosphates and ion exchanges

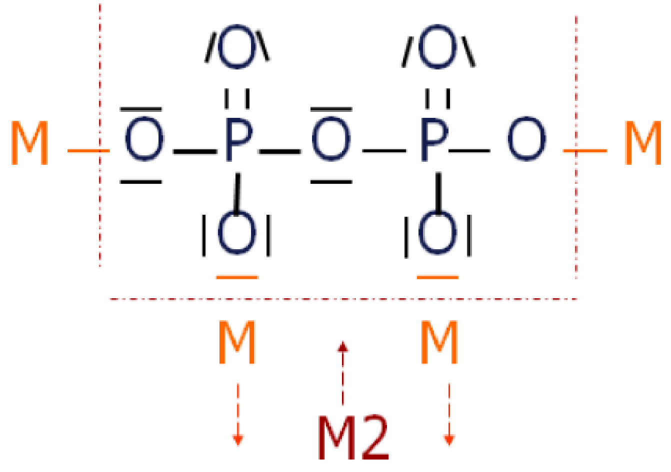
MONOPHOSPHATES



$M = H^+, Na^+, K^+$

MSP / DSP / TSP

DIPHOSPHATES



$M = H^+, Na^+, K^+$

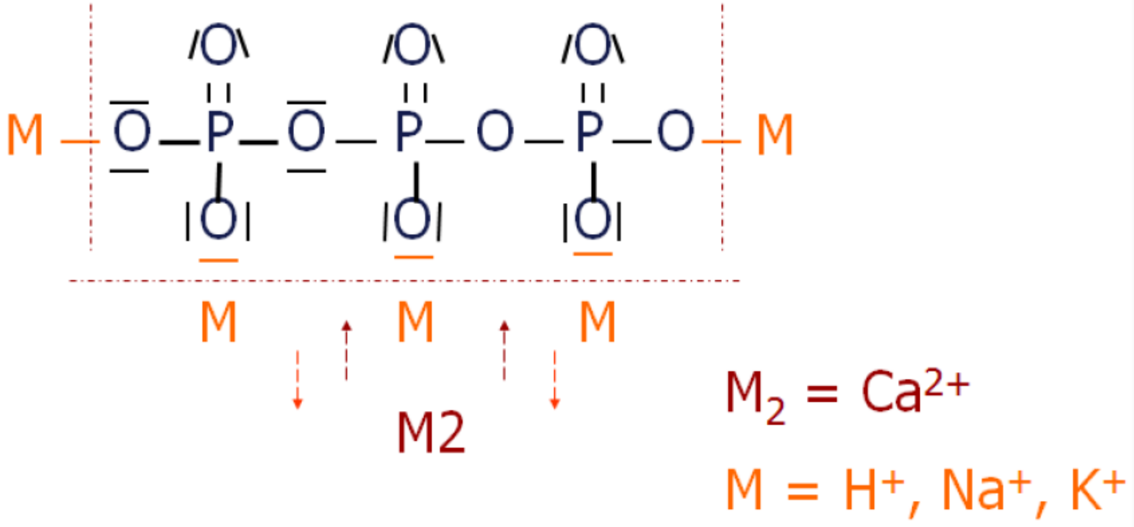
$M_2 = Ca^{2+}, Mg^{2+}$

TSPP / SAPP

Chemistry of phosphates

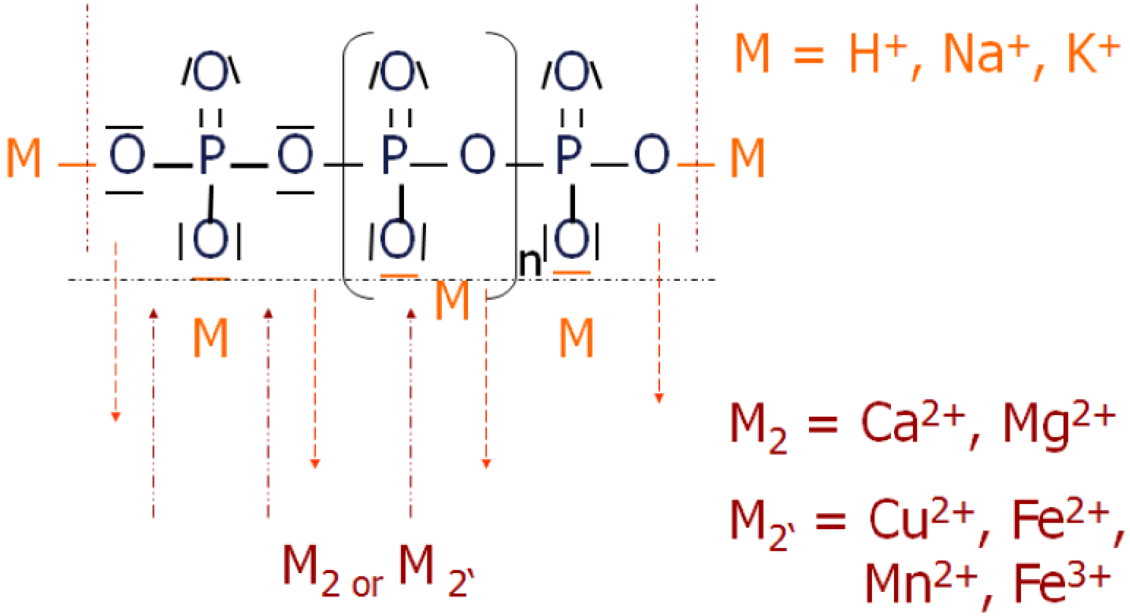
The different types of phosphates and ion exchanges

TRIPHOSPHATES



STPP

POLYPHOSPHAT

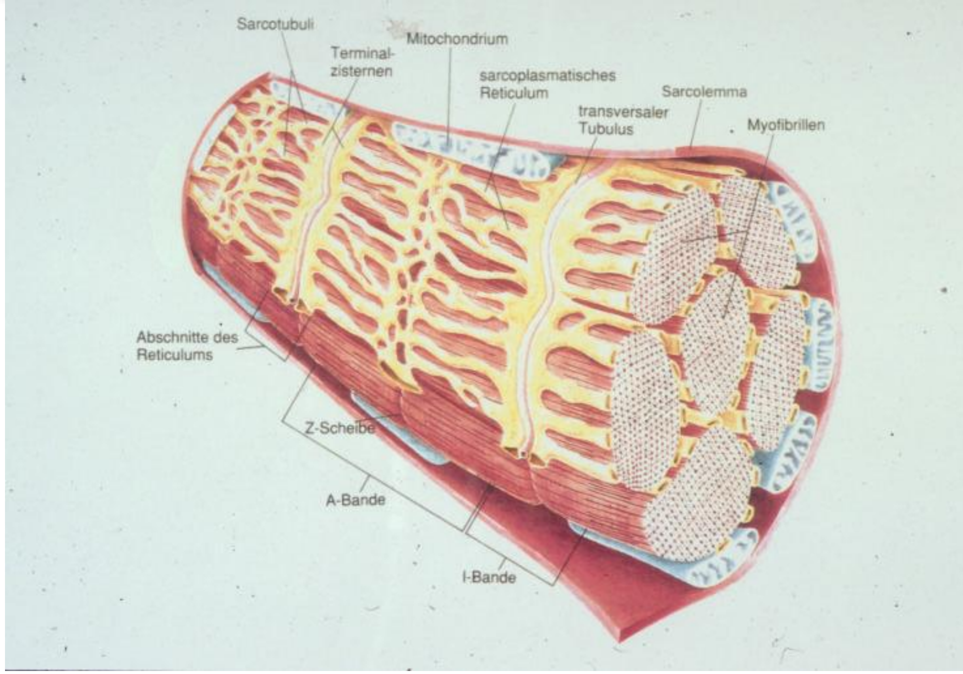


SHMP

Phosphates function

Action in the myofibrillar proteins

The amount of water connected in the muscular tissue depends entirely on **the available space** between the actin and myosin fibers.



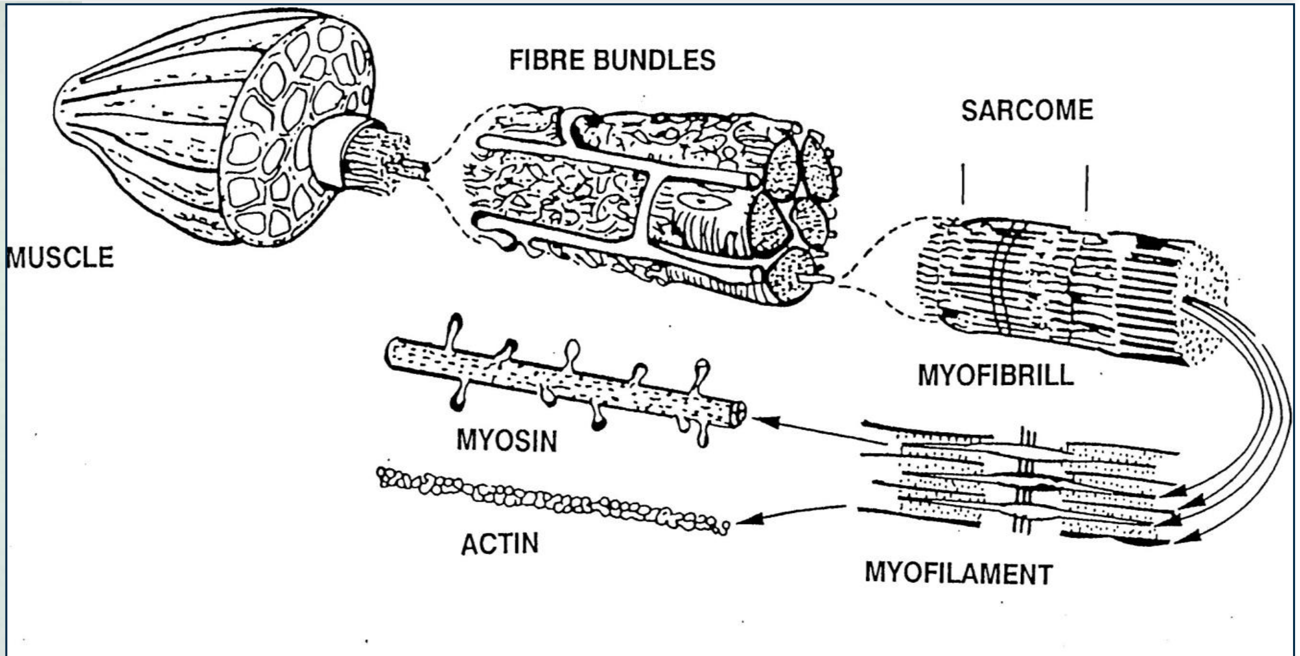
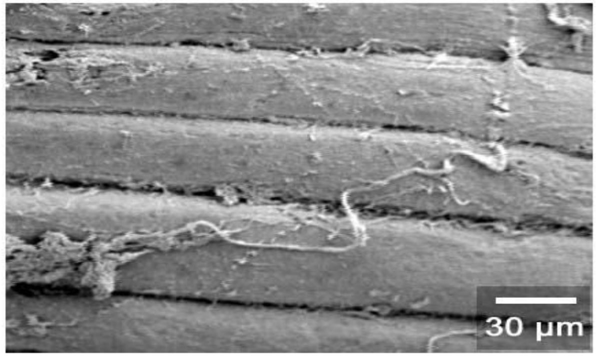


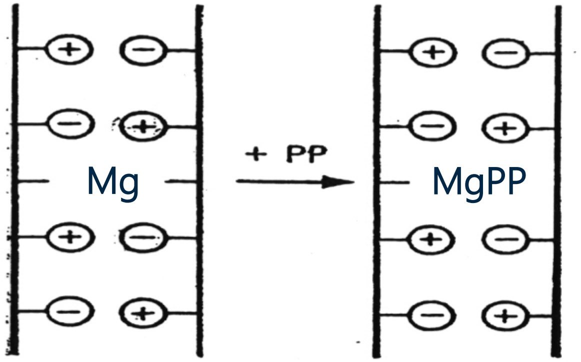
FIG. 2: STRUCTURAL ORDER OF THE MUSCLE SINGER AND HILGER, 1978

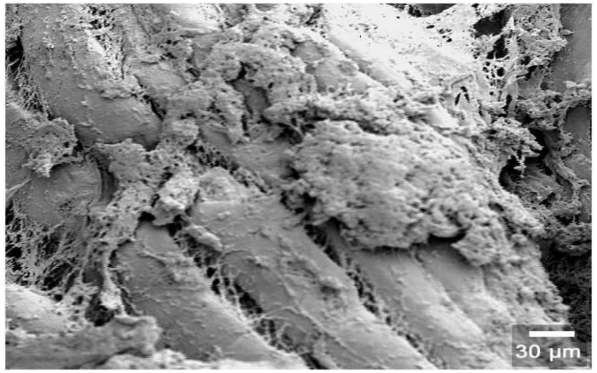
Phosphates function

Action in the myofibrillar proteins

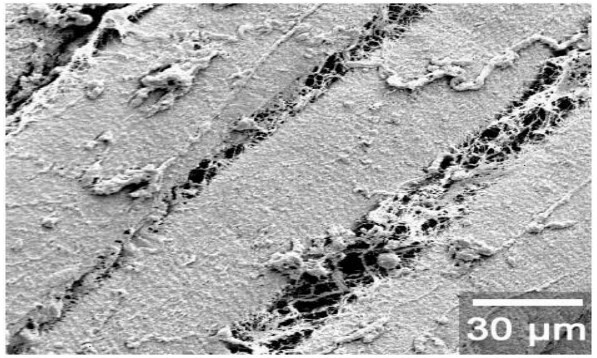


untreated

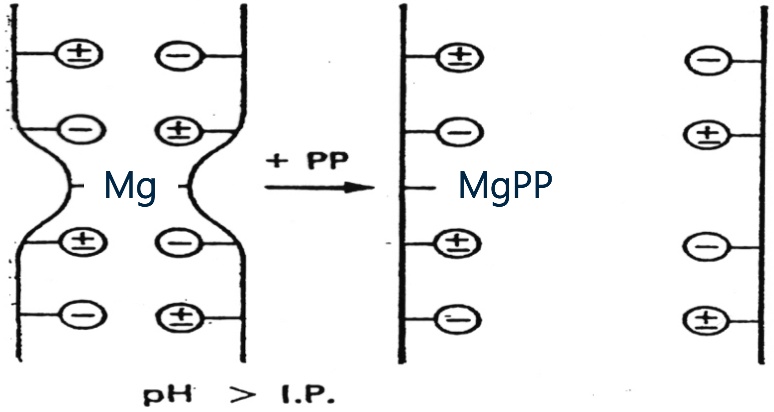


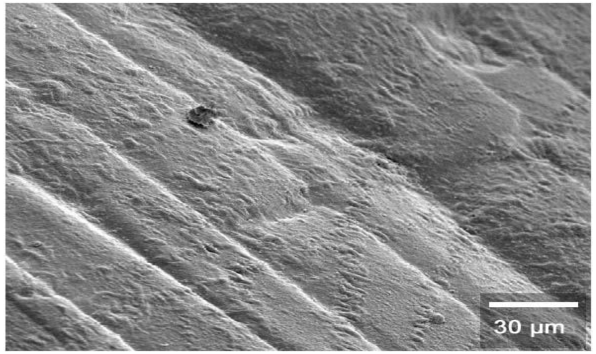


only with phosphate



with cooking salt

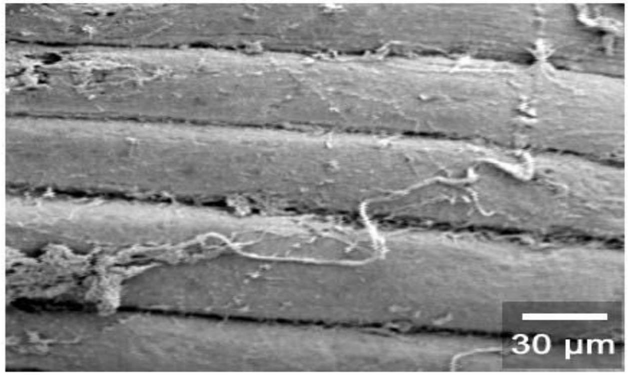




with phosphate + salt

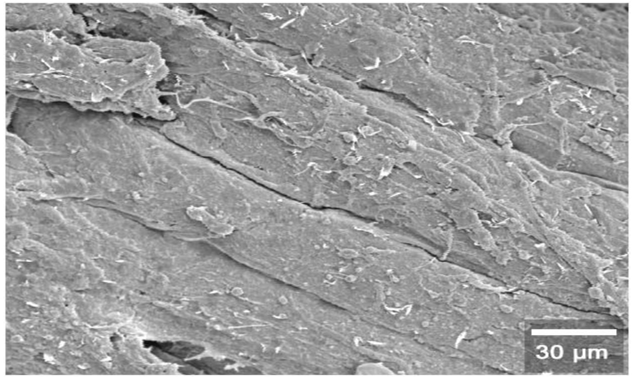
Phosphates function

Action in the myofibrillar proteins



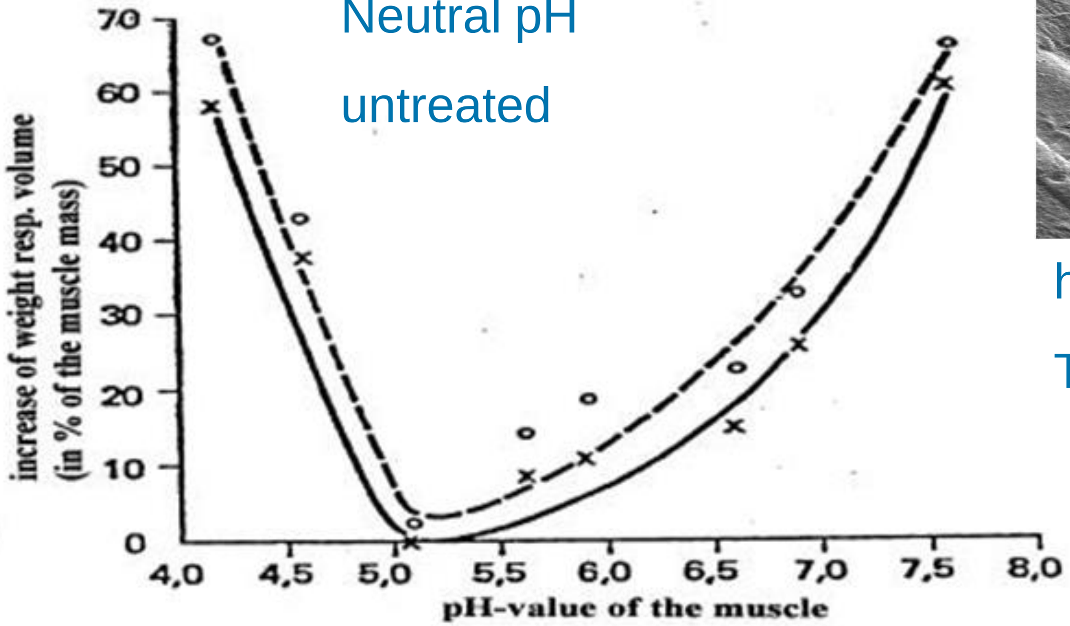
Neutral pH

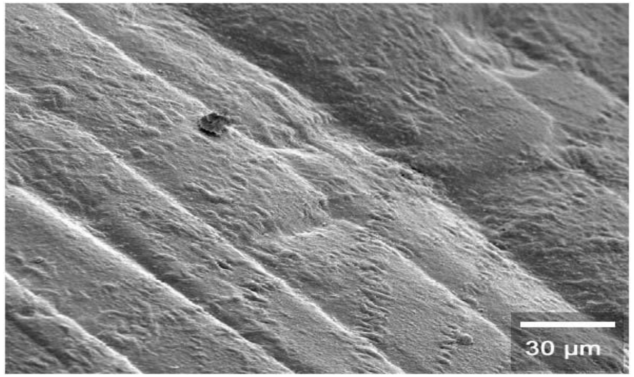
untreated



lower pH

Tari S 78





higher pH

Tari K 7

Phosphates function

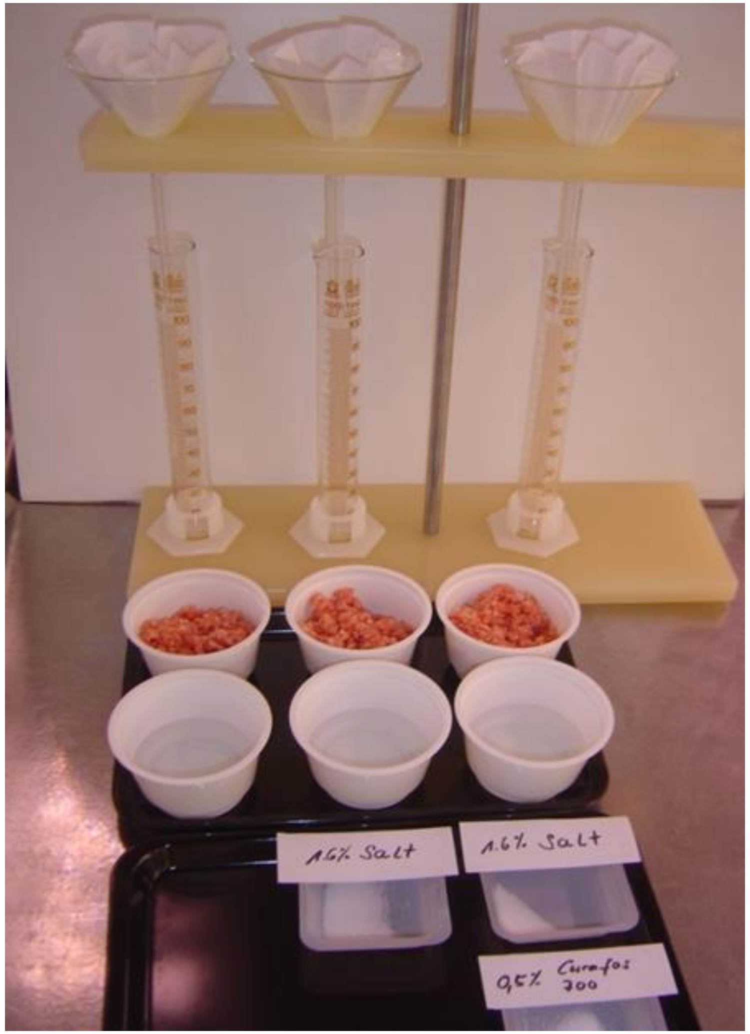
Water retention

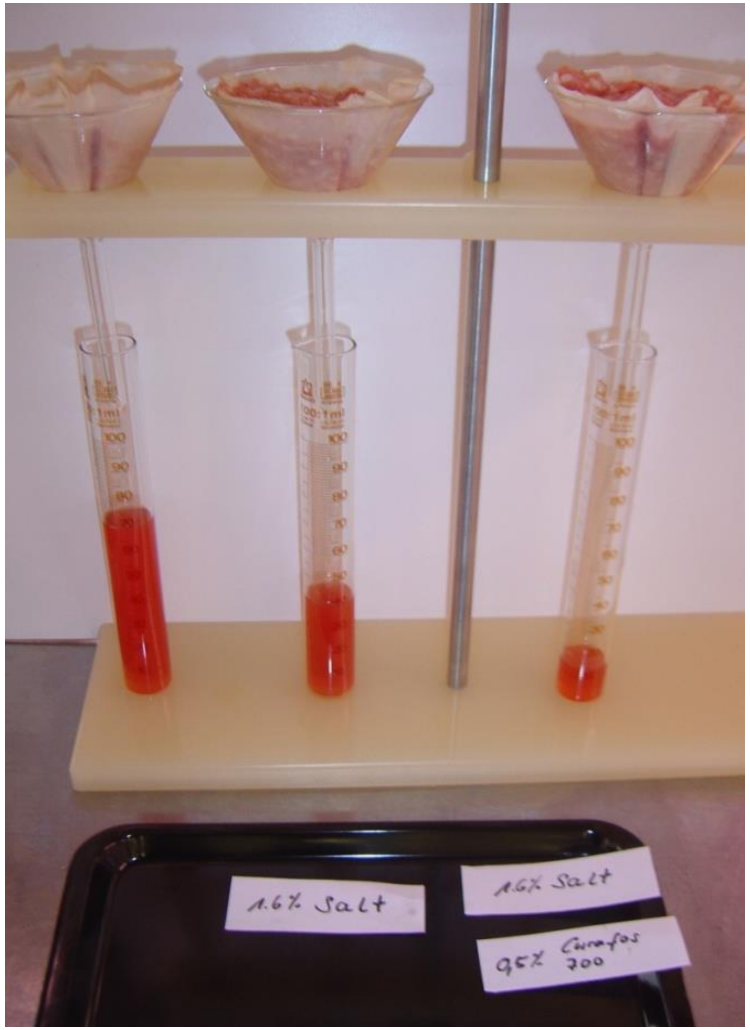
<u>Drip - test</u>

A) 100 g ground beef
+ 80 g water

B) 100 g ground beef
+ 80 g water
+ 3,6 g salt

C) 100 g ground beef
+ 80 g water
+ 3,6 g salt
+ 0,5 g Curaphos 700





Phosphates function

Differential of each phosphate

MONO/ORTHO -PHOSPHATES

- High buffering capacity
- Increase or reduction of pH
- No effect upon the meat protein

DI/PYRO -PHOSPHATE

- Medium buffering capacity
- Good calcium/ magnesium binding capacity
- Low solubility in cold water
- Applied in emulsions

TRIPOLYPHOSPHATE

- Good calcium binding capacity
- Satisfactory solubility in cold water

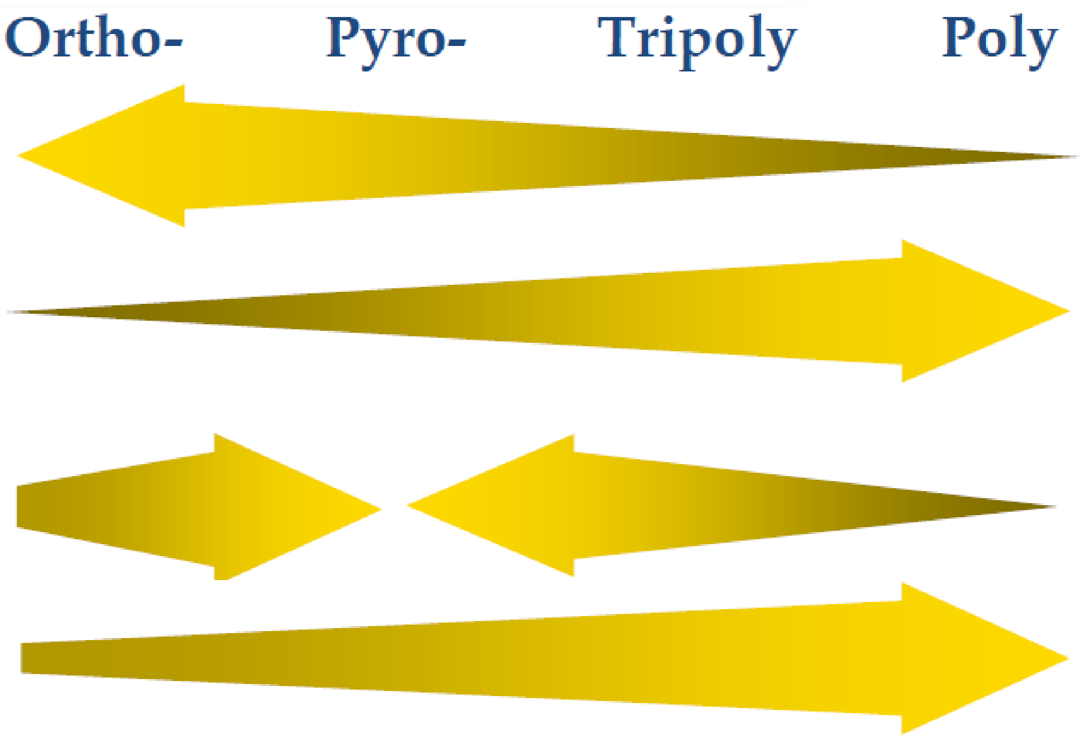
POLYPHOSPHATES

- Phosphates of long chain
- Ability to chelate metals
- Lipid oxidation delay
- Excelent solubility in cold water

Phosphates function

Summing up...

A bit of each, please!



Buffer Action

Masking, complexing multivalent cations

Hydration (specifically for meat protein and casein)

Dispersion (enhance emulsification)

APPLICATION OF PHOSPHATES IN MEAT

Application of phosphates in meat

Dosage

The average dosage of phosphates application depends on:

- Meat quantity➔ the more meat, more the phosphate is appropriate;
- Meat condition (fresh, old, frozen, thawed, origin) ➔as more protein is damaged due to storage condiditions/handling as more phosphate must be used;
- pH value➔ the lower the pH (ideal 5,8 – 6,2) the greater is the use of phosphate;
- Quality of the water ➔ the harder (Mg^{-}, Ca^{-} ions), more phosphate is necessary;
- Consider the process and characteristics of the final products.

Application of phosphates in meat

Process and characteristics of the final product

EMULSIFIED PRODUCTS

- pH control
- Quick protein activation
- Emulsification capacity
- Syneresis control

INJECTED PRODUCTS

- pH control
- Quick and good solubility in brine
- Stabilization in brine with high NaCl %
- High yield-> succulence

- pH 7,0 – 7,5 for quick curing reaction and extraction of proteins;
- Combinations of di and polyphosphates are the best;
- Low sodium phosphates: potassium.

- pH 7,0 – 9,0 for high water retention capacity;
- Combinations of tri and polyphosphates are the best;
- Concentration of solids in brine (< 30%);
- Process time is decisive for the phosphates choice.

Application of phosphates in meat

SPECIAL PHOSPHATES FOR EMULSIONS

TARI 414

Application: emulsion type fresh sausage, fast mixing processes.

TARI K7

Application: products of low meat content like vienna and polony sausage.

TARI K5

Application: fresh sausage, fast mixing processes. Reduced sodium (1,65%).

Application of phosphates in meat

SPECIAL PHOSPHATES FOR INJECTION

TARI P 22 / CURAPHOS 700

Application: cooked ham, injected whole muscle meat in general.

BRIFISOL 450 Super

Application: injection and massaging/mixing methods, poultry products like nuggets, coarse meat for sausage etc.

CURAFOS SP

Application: injected meat cuts in general. Reduced sodium (8%).

BRIFISOL 550

Application: injected meat cuts or fresh marinated, quick process; high pH.

Application of phosphates in meat

SPECIAL PHOSPHATES FOR DIVERSE APPLICATIONS

BRIFISOL 500

Application: product “one-step”, with residual of diphosphate that doesn’t need to be labeled. Used in restructured products such as burgers and nuggets.

BRIFISOL 960

Application: injected meat cuts or cooked marinated products, or processes involving direct addition of the phosphate. High cooking performance due to the presence of diphosphate.

TAYLOR MADE PRODUCTS!

If none of the phosphates mentioned meets your needs, we can develop the perfect solution together!

Questions

Niclas Holm
Niclas.Holm@icl-group.com
+449 6203777819

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