



**Manufacturing processes with basic principles involved, functional properties and food applications of co-precipitates**

**Choice of manufacture of different calcium co - precipitate is influenced by consideration of yield, ease of manufacture, properties and intended use of product. Co-precipitates with different calcium content have different physico -chemical properties.**

# Proximate Composition of Granular Co-precipitates

- Calcium content of co-precipitate is determined mainly by its pH of precipitation.
- Composition of co-precipitates is also affected by extent of washing of curd.

Proximate compositional analysis of granular co-precipitates

Composition (%)	Co-precipitates		
	High calcium	Medium calcium	Low calcium
Moisture (%)	9.5	9.5	9.5
Fat (%)	0.6	0.7	0.9
Ash (%)	7.7	3.7	2.4
Protein (N x 6.38) (%)	81.7	85.6	86.7
Protein (dry basis) (%)	90.3	94.5	95.8
Lactose (%)	0.5	0.5	0.5
Calcium (%)	2.81	1.13	0.54
pH	6.5-7.2	5.6-6.2	5.4-5.8
pH of whey after separation of curd	5.8-5.9	5.1-5.3	4.9-5.1

Fat content of co-precipitates increases from 0.6%-0.9% as pH of precipitation is reduced from 5.9-4.9. High ash content of high calcium co-precipitate leads to reduction of 3-5% in protein content relative to lactic and acid caseins and low calcium co-precipitate.

# Proximate Composition of Soluble Co-precipitates

Analysis	Product				
	A	B	C	D	E
Moisture (%)	4	4	4	4	4
Fat (%)	0.6	0.6	0.7	0.7	0.9
Ash (%)	13.5	10	5	6.7	4.1
Protein (N x 6.38) (dry basis) (%)	84.5	88.0	93.0	91.5	94.0
Lactose (%)	0.5	0.5	0.5	0.5	0.5
Calcium (%)	2.9	2.9	1.2	1.2	0.5
Sodium (%)	1.9	0.6	0.6	-	1.1
pH	7.1-7.2	6.5-6.9	6.6-7.2	6.6-7.2	6.6-7.2
Solubility (%)	92	72	70-90	95-98	97-98
Farinograph water absorption (%)	278	129	193	282	292

## Proximate compositional analysis and physical properties of spray-dried soluble co-precipitates

### Product

- A. High calcium co-precipitate rendered soluble by the addition of sodium tripolyphosphate (6% w/w).
- B. High calcium co-precipitate rendered dispersible by the addition of sodium tripolyphosphate (2% w/w).
- C. Medium calcium co-precipitate, neutralized with sodium hydroxide.
- D. Product C containing additional sodium tripolyphosphate (2% w/w).
- E. Low calcium co-precipitate, neutralized with sodium hydroxide.

- Soluble high calcium co-precipitate has very high ash content (13.5%) due in part to presence of sodium tripolyphosphate and contains almost 2% sodium.
- Soluble low calcium co-precipitate has composition similar to sodium caseinate.
- In order to render medium calcium co-precipitate substantially (>90%) soluble at pH 7.5, it is necessary to use sodium hydroxide and sodium tripolyphosphate.

## Physical Properties of Co-precipitates

**General physical properties of co-precipitates may be regarded as physical properties of these products when examined alone or in water (dispersed or dissolved). These include pH solubility (in water, alkali or acid) and rate of solution, density, particle size, viscosity of solutions and colour of powder and solutions.**



## **Solubility:**

- Solubility of low-calcium co-precipitates in alkali over a range of pH values.
- Solubility is a characteristic of co-precipitates which varies under influence of pH, agitation, mixing temperature, mixing time, particle size, concentration of casein product and presence of dissolved salts.
- Solubility of co-precipitates is considered in pH range from 6-10.
- Co-precipitates can also be dissolved in phosphoric, hydrochloric and citric acid at pH 2-3.

## **pH:**

- pH of water dispersion of an insoluble co-precipitates is determined by pH of precipitation, which also affects its calcium content.
- Affected to some extent by number of washes, and by alkalinity of wash water (particularly in manufacture of low calcium co-precipitate).
- Where co-precipitates are rendered substantially or partly soluble or dispersible in water by addition of alkali and/or complex phosphates, pH of these solutions is near 7.

## **Bulk density:**

- **Packing density (bulk density) of casein products such as co-precipitates can vary depending on method of manufacture.**
- **Granular, insoluble co-precipitates have approx. density 0.6 g/ml, depending on particle size, whereas density of spray dried soluble co-precipitates can be much lower.**

## **Viscosity:**

- **Viscosity of solutions of soluble co-precipitate in water at different concentrations, temperature and shear rates can be measured.**
- **Low calcium co precipitate had a viscosity similar to that of acid casein.**
- **Viscosity of medium and high-calcium co-precipitate solutions is high when pH was above 7.**
- **Viscosity of solutions of low-calcium co-precipitate was affected by heat treatment of milk.**



## Colour:

- pH, calcium and polyphosphate content of co precipitate solutions were factors which particularly affected its whiteness.

## Flavour:

- Uses of co -precipitates in food products will depend upon satisfactory functional properties of proteins that are added in food system so that body, texture, flavour and nutritive characteristics etc. of finished product are not adversely affected and remain acceptable to consumers.

Development of “gluey” off-flavours in low calcium co-precipitates was inhibited by addition of 0.01-0.05% sodium metabisulphite.

High calcium co -precipitates being more stable than low calcium (acid) co precipitates and fresh curd soluble co -precipitates being better than those reconstituted from dry granular insoluble co-precipitates.

Co-precipitates exhibit cooked flavour due to high heat treatment.