



TECHNICAL APPLICATION
INFORMATION



**Influence of Calcium Concentration
on Texture and Bake Stability
of Bake Stable Fruit Preparations**

INTRODUCTION

The bake stability of a fruit preparation depends on its melting temperature which can be specifically influenced by the calcium concentration in the fruit preparation.

Low-methoxyl pectins do not only gel according to the sugar-acid-mechanism but also to the eggbox-model by building calcium bridges. The calcium bridges give the network of pectin molecules an additional firmness (see fig. 1).

Calcium ions also influence the setting temperature of pectin, defined as the temperature, at which the building of junction zones between the pectin molecules starts. Directly correlated to the setting temperature is the melting temperature of the gel, the temperature melting the gel under thermal stress.

The setting temperature and the melting temperature increase with the addition of calcium ions to the recipe. Simultaneously the breaking strength and calcium dosage is connected to each other which can be seen when measuring the firmness of pectin. The following application of a bake stable fruit preparation shows this connection:

By adding a small amount of calcium to a fruit preparation with a fixed pH-value and soluble solids content an elastically gelled, thermo-reversible gel forms.

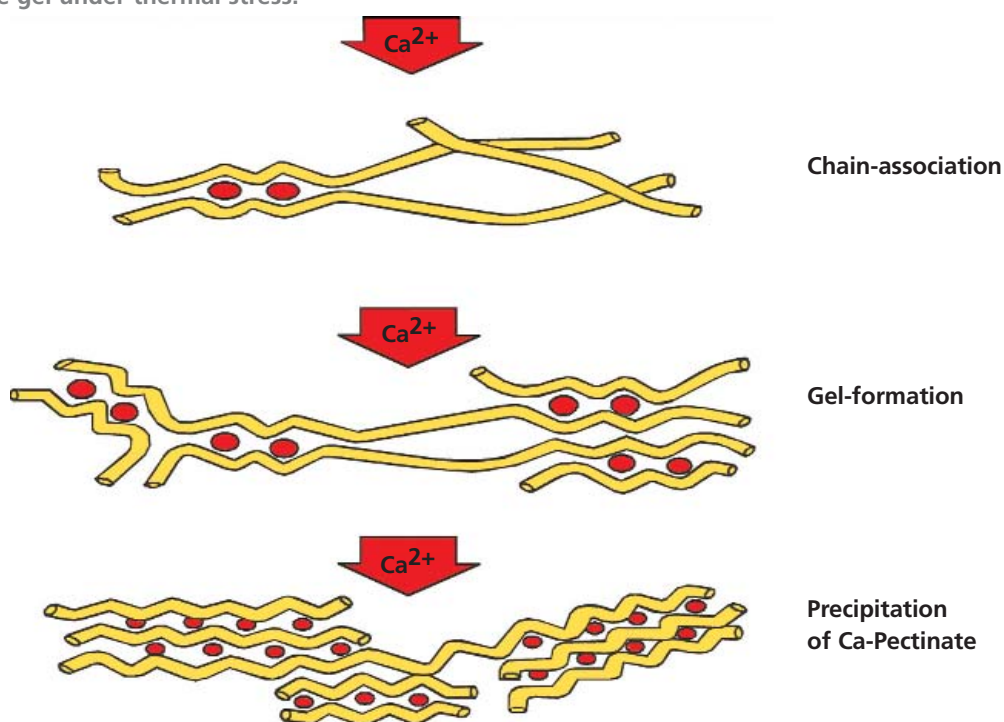


Fig. 1: Gelling Mechanism of Low-Methoxyl Pectins

Because of the too low setting temperature such a fruit preparation is not bake stable. The heat during the baking process melts the fruit preparation and it starts to boil which will lead to a low-quality product.

A fruit preparation is bake stable when the melting temperature of this fruit preparation is in the range of the oven temperature.

This can be achieved by increasing the calcium dosage of the recipe. By increasing the calcium dosage the setting temperature of the fruit preparation will increase to above the cooking temperature so that a pre-gelling of the product occurs.

In contrast to jams or marmalades the controlled pre-gelation of bake stable fruit pre-parations is required.

With the pre-gelation a creamy, structure-viscous texture of the fruit preparation without any tendency towards syneresis will be achieved.

The exact calcium dosage can adjust the melting temperature of a bake stable fruit preparation (see fig. 2). If the melting temperature is slightly below the temperature of the oven, the fruit preparation will start to melt during the baking process. After finishing of the product, the fruit preparation will gel elastically with a shiny surface, typical for fruit preparations made with pectin.

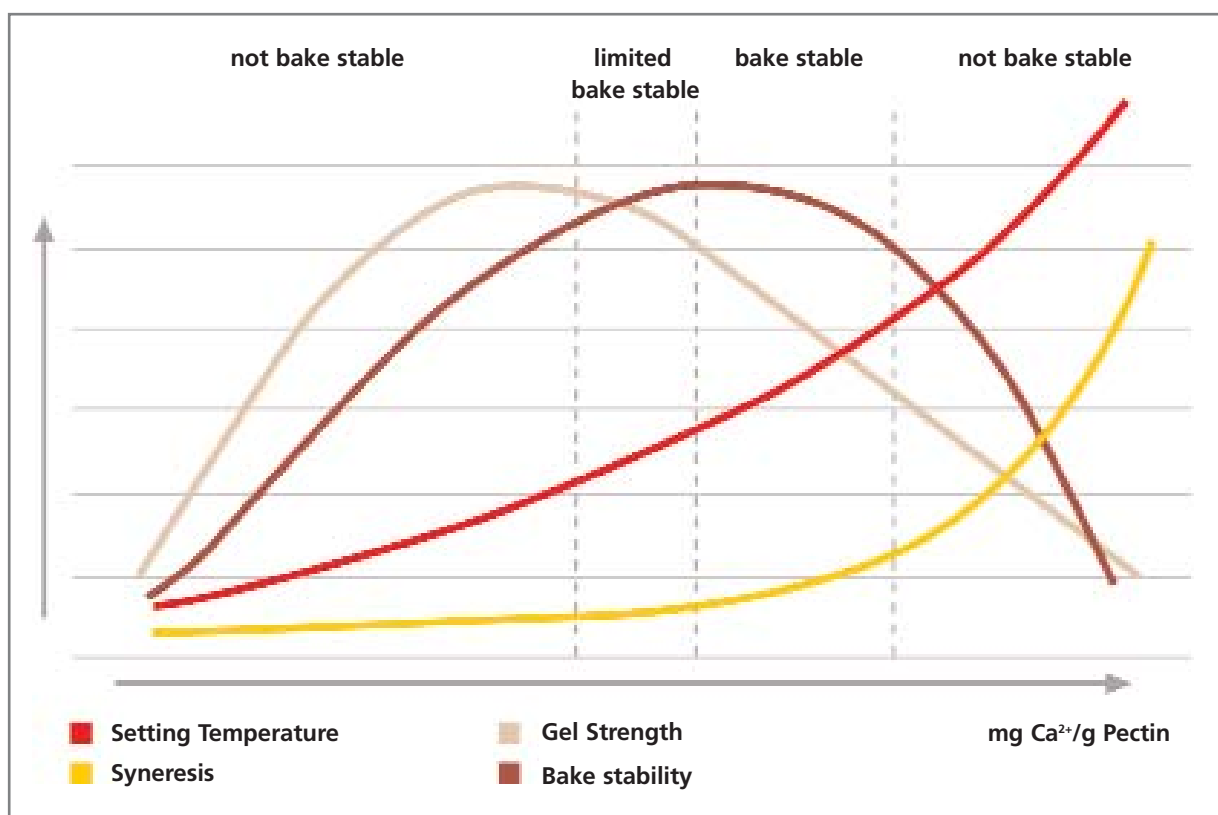


Fig. 2: Schematic presentation of the influence of calcium concentration on setting temperature, gel strength, tendency to syneresis and bake stability of a fruit preparation made with low-methoxyl pectin.

The further increase of the calcium dosage will lead to an increase of the temperature stability of the fruit preparation, though the temperature stability may not be increased unlimited. An overdose of calcium ions will cause the development of calcium pectate, an insoluble salt which is not able to gel.

Thus the water binding gets worse, which can be noted by the developing of a low gel firmness and increased tendency to syneresis.

During the baking process the syneresis water will start to boil which will result in a poorer bake stability of the fruit preparation.

Therefore it may be advisable to reduce the calcium dosage in order to increase the baking stability of the fruit preparation.

Because of this connection, the functional properties of a bake stable fruit preparation, next to the pectin dosage, can be adjusted by the addition of calcium citrate.

In general the calcium citrate dosage should amount to 8 - 10% of the pectin dosage, so that in this pectin-calcium-relation the melting temperature of the gel structure is sufficiently high. If during the baking process syneresis occurs, the calcium citrate dosage should be slightly reduced if the bake stability corresponds to the requirements.

If the bake stability is not sufficient, the baking stability of the fruit preparation can be increased by adding sodium citrate at the same calcium citrate dosage. Here these citrate ions will buffer the excessive calcium ions, so that the reaction of the pectin molecules with the calcium ions will slow down. This will lead to a stronger network with a higher heat stability, so that in an application with low-methoxyl pectin in bake stable fruit preparation the separate addition of calcium citrate and a corresponding sodium citrate dosage will allow an exact adjustment of the temperature stability.