

# Influence of process parameters during protein isolation on lupin protein structures

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## Introduction

Lupin seed proteins have shown to exhibit health-promoting effects, such as the prevention of arteriosclerosis by reduction of circulating LDL and VLDL. [1] Besides, a specific protein isolate from seeds of *Lupinus angustifolius* L., called micellar lupin protein isolate (MLP), showed fat-like properties. However, the exact cause of the fat-like behavior of MLP is unknown.

## Experimental Procedure

- Production method of the common isoelectric protein isolate (ILP): alkaline extraction and isoelectric precipitation
- Production method of MLP: NaCl-induced protein extraction and subsequent dilution in water for protein precipitation [2]
- Investigation of protein structures via cry-scanning electron microscopy (cryo-SEM)
- Rheological investigation of ILP and MLP determining storage modulus ( $G'$ ) and loss modulus ( $G''$ )
- Sensory test of a fat-reduced truffle filling supplemented with MLP

## Results

- Cryo-REM provided deeper insight into three-dimensional structures of the protein isolates (Fig. 1; C,c)
- ILP showed protein unfolding (Fig. 1; A,B,C), while MLP showed formation of ordered protein micelles (Fig. 1; a,b,c)
- In contrast to solid-like behavior of the isoelectric protein isolate, MLP offers fluid-like properties using amplitude sweep test (Fig. 2) which could explain its fat-like behavior
- Textural properties are linked to the protein conformation: Fat-like mouthfeel of MLP is caused by micellar structure arrangement (Fig. 1; b,c)
- A low-fat truffle filling (0.3 g fat, 8.5 kcal) supplemented with MLP scored equal to the full-fat reference (3.0 g fat, 37.0 kcal) in all attributes except homogeneity, in which the low-fat variant received improved rating (Fig. 3)

## Conclusion

Strong influence of process parameters on texture and protein conformation of the protein isolates, resulting in a rough texture after isoelectric protein precipitation (ILP) and a creamy texture after dilutive protein precipitation (MLP).

Because of the excellent fat-mimicry of MLP and since exclusively agents safe to use (NaCl and  $H_2O$ ) are used for preparation of MLP, its application in fat-reduced formulations as a natural fat replacer is assumed to be expanded in the near future.

\* Photo Reference: Fraunhofer IVV

[1] Duranti, M., et al. (2004) Journal of Nutrition 134, 1334–1339  
[2] El-Adawy, T. A., et al. (2001) Food Chemistry 74, 455–462

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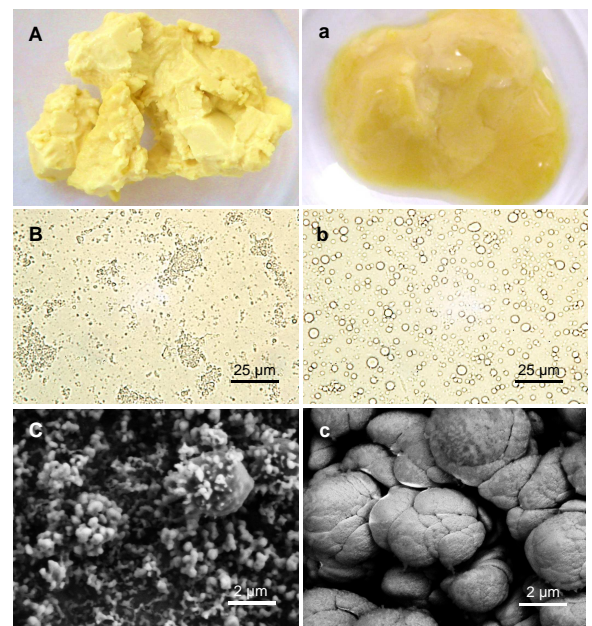


Figure 1: Influence of production parameters on protein structure of the common isoelectric (A, B and C) and the novel (a, b and c) lupin protein isolate.\*

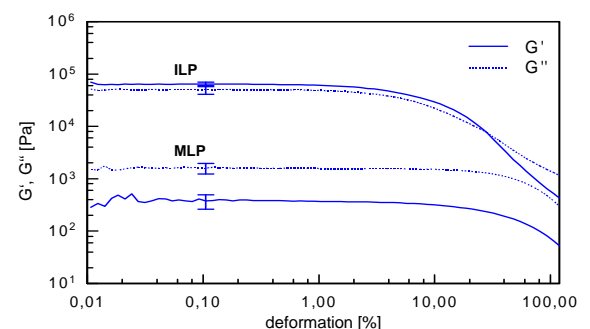


Figure 2: Rheological properties of isoelectric (ILP) and dilutive lupin protein isolate (MLP).\*

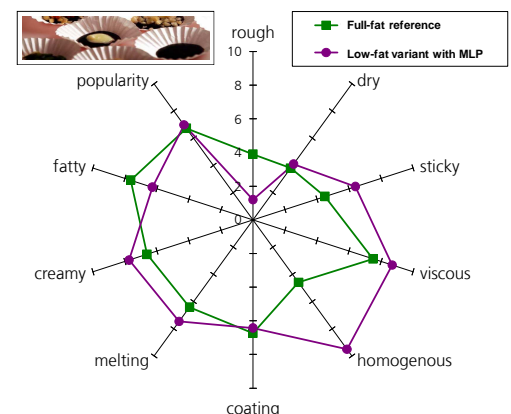


Figure 3: Sensory evaluation of a fat-reduced truffle filling supplemented with the micellar lupine protein isolate in comparison to its full-fat reference.\*