# FUNCTIONAL PROPERTIES OF Lupinus luteus PROTEINS

I. M.N. SOUSA*, M. L. BEIRÃO da COSTA*, S. E. HILL**, J. R. MITCHELL** and S.E. HARDING**

*S.A.C.T.A./ Instituto Superior de Agronomia, Technical University of Lisbon Tapada da Ajuda, 1399 Lisboa Codex. Portugal

** A.B.F.S. Faculty of Agricultural and Food Sciences, University of Nottingham Sutton Bonington. Loughborough. LE12 5RD U.K.

## ABSTRACT

The thickening potential and the gelation ability of lupin protein isolates were studied using soy isolates as a comparison. Lupin major globulin fractions were characterised by ultracentrifugation. Three globulins (2.5S, 7.7S and 12.2S) were present and these were associated with the three peaks seen in the differential scanning calorimetry (D.S.C.) thermograms. The molecular masses of the two main globulins were found to be 390 kD and 90 kD. The lupin and soy isolates showed similar solubilities. The intrinsic viscosity of the soy isolates was higher (12 $cm^3 \cdot g^{-1}$) than the lupin (7 $cm^3 \cdot g^{-1}$). The soy viscosity was consistently higher (1.2 Pa.s against 0.2 Pa.s at 50 $s^{-1}$, 23% isolate concentration). The D.S.C. denaturation temperature of the lupin globulins was higher than the soy globulins. The gelling behaviour of lupin protein was very poor when compared to soy protein even when slightly improved by promoting the Maillard reaction. It was concluded that lupin globulins have a stronger hydrophobic nature which explains the higher thermal stability, poor thickening and gelling properties.

## INTRODUCTION

Lupin, specially Lupinus luteus, is a legume that can be produced in marginal soils and is part of an environmentally friendly agricultural system traditional in Portugal. The presence of alkaloids, in bitter varieties, prevents the direct use of the unmodified seeds in human foods. The isolated protein is alkaloid free and has potential in human food applications currently employing soy isolates. The success of this concept will depend on how the functional properties of lupin and soy proteins compare.

In this paper we describe the characterisation of lupin proteins and compare their solubility, thickening and gelation properties with soy.

## MATERIALS AND METHODS

Lupin (from L. luteus) and soy isolates and the major lupin globulins were produced as previously described (1, 2).

The proteins were characterised by ultracentrifugation (Beckman XL-A analytical ultracentrifuge pH 7, $\mu$ = 0.01), D.S.C. (Perkin Elmer D.S.C.-2, water, heating rate of 5°C/min.) and by intrinsic viscosity (pH 7, $\mu$ = 0.01). Gelation properties were determined by heating proteins in Universal bottles at a range of times and temperatures. In some cases xylose was incorporated to promote the Maillard reaction (3). Solubility was measured as previously described (4) and flow behaviour was determined using a Bohlin CS rheometer equipped with concentric cylinders geometry.

## RESULTS AND DISCUSSION

### Protein characterisation

The sedimentation velocity studies for the major lupin globulin fractions gave ($S_{w,20}$) values of 12.2S, 7.7S and 2.5S and molecular masses obtained by sedimentation equilibrium of 390 kD and 90 kD for the first two globulins.

DSC lupin isolate thermograms revealed three peaks (peak maxima 372 K, 381 K and 387 K) which we assign to the denaturation of the three globulins. The soy isolate thermograms revealed only two peaks (at 368 K and 384 K). The denaturation temperature of the soy 2S is close to the soy 7S and peak is thus hidden. The lupin peaks were broader (less cooperative) suggesting that there is aggregation between 7S and 11S globulins following denaturation.

### Functional properties

The solubility of lupin is similar to that of the soy (fig. 1). A high solubility indicates the absence of denatured protein and is a requirement for thickening and gelation.

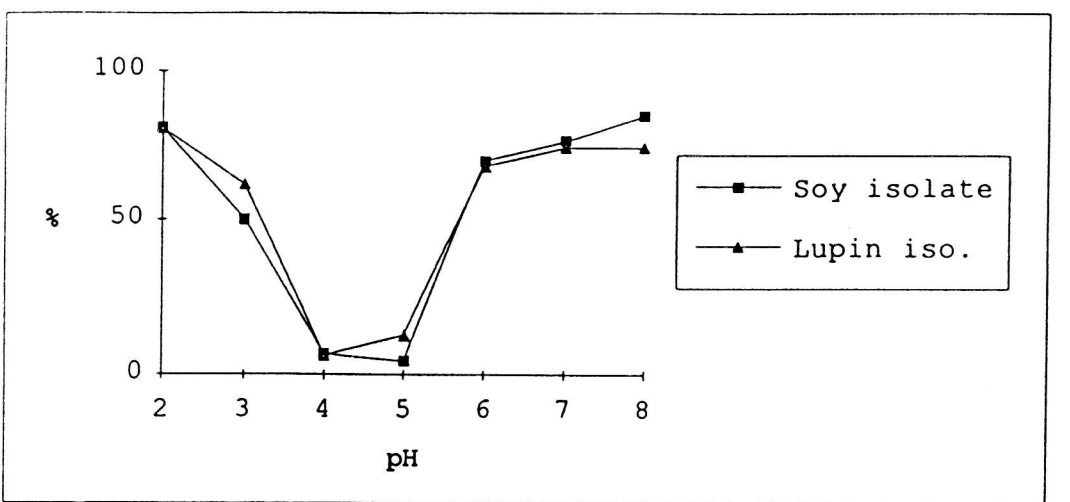


Figure 1. Percentage of soluble protein/initial protein at different pH values of lupin and soy isolates

The shear viscosity of 23% isolate cold suspension at $50s^{-1}$ was 0.2 Pa.s for lupin and 1.2 Pa.s for soy. This is consistent with the intrinsic viscosity which was 6.7 $cm^3 \cdot g^{-1}$ for lupin isolate and 12.3 $cm^3 \cdot g^{-1}$ for soy.

The heat gelation properties of lupin isolate were very poor compar ed with soy over the whole isolate concentration (20 - 30%), pH (5.00 - 9.00) and salt additi on range (0 - 0.5M) studied (5). Even at the upper concentration limit it was not possible to form a coherent gel from lupin and in contrast to soy (6) the addition of xylose did not re sult in a significant improvement.

## CONCLUSIONS

We suggest that the poor gelation properties reflect the greater h ydrophobic nature of the lupin protein system. This causes aggregation rather than gelation. Supporting evidence for this high hydrophobicity comes from the high thermal stability and low hydrodynamic volume.

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