Functional Properties of Proteins from Lima Bean (*Phaseolus lunatus* L.) Seeds

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Functional properties were identified for the total globulin (TG), 7S and 11S fractions of Lima bean (*Phaseolus lunatus* L.) seeds. The 11S component accounted for 58.3% of TGs and the 7S for 41.7%. Solubility was higher in the 7S fraction, especially at alkaline pHs. Water-holding capacity was similar (3 g water/g sample) in both globulin fractions. Oil-holding capacity was higher in the 11S fraction, which also exhibited better foaming capacity and foam stability than the 7S and TG fractions at alkaline pHs. The TG and 7S fractions exhibited low emulsifying capacity and emulsion stability at different pHs (5, 7 and 9), but the 11S fraction had relatively higher values. In suspension at low concentrations, all fractions exhibited shear-thinning (pseudoplastic) behavior. The studied Lima bean globulin fractions exhibit functional properties which make them potentially apt for use in some industrial food systems.

Key Words: Lima bean, proteins, globulins, functional properties, texture

INTRODUCTION

Demand is increasing for promising vegetal sources of functional ingredients to improve food nutritional quality and control costs (Sánchez-Vioque et al., 1999). Legumes are a significant food source worldwide and particularly so in the developing world, where they function as an accessible protein source in the absence of animal protein (Siddhuraju et al., 2002). Like cereals and oil seeds, legumes are an excellent source of low-cost protein (20.4%) and carbohydrates (50–60%) and also provide thiamin, niacin, calcium and iron (El-Adawy et al., 2000). Indeed, millions of people in the tropics depend on several legume species as their principal source of dietary protein (Okafor et al., 2002). In addition, certain legume species, such as soybean and common bean, are widely used in the food industry for their many functional properties (foaming, emulsion and gelling capacities, viscosity) which impart texture and sensory characteristics.

A protein's composition and the conditions under which it is processed, e.g., temperature, time, concentration, pH and ionic strength, influence its functional properties, e.g., solubility, water-holding capacity (WHC), oil-holding capacity (OHC), gelling, foaming and emulsifying capacities, etc. (Kinsella, 1976). These properties can be observed normally in natural proteins and are often used to determine degree of denaturation since they are linked to physicochemical and structural properties (Damodaran, 1997). The rheological methods used to evaluate finished gel properties are also critical to analyzing and characterizing legume protein functionality.

Based on solubility, legume proteins are generally divided into four groups (Osborne, 1924). The largest proportion (approx. 70–80%) of these proteins is usually the globulins, or reserve proteins, which are classified as 7S or 11S according to their sedimentation coefficient. Soy bean contains mostly 11S proteins, the properties of which have been extensively researched, leading to its broad use as a food ingredient. Many other legumes and non-legumes very likely also contain

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