

## RHEOMETRY AND SCANNING ELECTRON MICROSCOPY STUDY OF CASEIN CURDS ADDED WITH MESQUITE SEED GUM AND SOY PROTEINS

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**Abstract** — The rheological and micro-structural characteristics of curds added with mesquite seed gum (MESG) and soy protein (SP) were studied. Two types of curds were prepared either with 100% raw commercial milk or with a 50% low-fat milk and the effect of the addition of 0.15% (w/w) and 0.45% (w/w) of MESG and/or 0.3% (w/w) and 0.6% (w/w) soy protein content was analyzed. The addition of MESG and SP results in moisture of up to 64.0% compared to 43.2% in the control sample. The rheometric functions  $G'$  (storage modulus) and  $G''$  (loss modulus), measured in the frequency sweep from 6.28 to 62.8 rad/s tend to decrease for curds prepared with 100% raw milk and the addition of MESG and/or SP. In the case of low-fat milk curds the opposite behavior was observed. The micro-morphology of the samples added with MESG-SP present a cavernous appearance that was not present in the control curd.

**Keywords** — Rheometry, microscopy, casein curds, mesquite seed gum, soy protein.

### I. INTRODUCTION

The addition of carbohydrates and proteins to cheeses has been amply studied (Anonymous, 1989; Brummel and Lee, 1990; Messina and Messina, 1992; Kucukoner and Haque, 1995) regarding their rheology, textural and microstructural behavior, in order to improve the characteristics of low-fat cheeses. However, not enough information about fat replacer ingredients is available, and our understanding of the behavior of this material needs to be expanded (Bagley and Christianson, 1987). Fat replacers are additive compounds used to fully or partially replace fat in reduced foods (Ma *et al.*, 1997). Some carbohydrates have been developed for low-fat cheeses, such as Novagel (cellulose microcrystalline-guar), Stellar (starch), Salatrim, Dairy Lo and Simplese (Kucukoner and Haque, 1995; Kosmark, 1996). Also, natural proteins with

excellent nutritional and physical properties such as soy protein (SP) have been tested, but are used less frequently (Messina and Messina, 1992) although soy protein isolates could be incorporated into dairy products (Hokes, 1992).

Some natural hydrocolloids could be considered as fat replacers, such as mesquite seed gum (MESG) from *Prosopis sp.* Mesquite is a leguminous plant that grows naturally along the Mexican territory (Rzedowski, 1988); MESG has been shown to possess great potential applications in a variety of food products (Meyer *et al.*, 1986; Vázquez *et al.*, 1988; Romeo *et al.*, 1989; Figuereido, 1990; Bravo *et al.*, 1994; Hernández-Tinoco, 1998).

The sensory attributes of foods are closely related to their chemical composition, rheological behavior and microstructure (Tunick, 1989; Kaláb, 1993), and all affect customer appearance appreciation of the product. The combination of MESG and SP is thought to confer good physical properties to casein curd. The rheological behavior and microstructure of these added products provide information about the possible changes induced by the addition of these materials to the physical properties of the curd. Many materials in food industry are viscoelastic (Bagley and Christianson, 1987). These materials can be described by their rheological behavior in terms of a general constitutive equation which relates the stress state to the strain history it has experienced, rather than relying on simple relationships which are material-specific and applicable only over a limited range of conditions (Ferry, 1980). The aim of this work was study the effects of the addition of MESG and SP at different concentrations to casein curds to determine its rheological and microscopic characteristics.

### II. MATERIALS AND METHODS

#### A. Experimental details

Two series of curds were prepared, one series (A) was prepared using pasteurized homogenized raw milk and another series (B) using 50% low-fat milk prepared with raw milk and powdered low-fat milk. The rennet was

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