COMPARISON BETWEEN THE ISOTHERMS OF TWO COMMERCIAL TYPES OF TEXTURED SOY PROTEIN

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***Abstract*— Textured soy proteins (TSP) are functional ingredients used in food applications. This study aims to compare the sorption isotherms of two commercial types of TSP at 10, 20, 30 and 40 °C; the best fit to the experimental data was selected from eight classical models. The curves obtained for TSP type I showed that the equilibrium moisture content decreases as temperature increases for water activities up to 90%. At higher water activities, the moisture content showed an inverse behavior. This inversion did not occur for TSP type II due to the absence of sugars in this type of TSP. The Chirife, GAB and Peleg equations presented the best fit for the curves.**

***Keywords*— Textured soy protein, sorption isotherms, water activity, heat of sorption.**

I. INTRODUCTION

Around 1950, the production of a deffated soybean flour designated to human feed were developed by the food industries due to the nutritional importance of protein and the high protein content present in the soybean (soybean contains about 40% of vegetable protein).This production increases everyday and, nowadays, more than 1.5 million ton of this defatted meal is produced worldwide. As a consequence of their great applicability in the food industry, the deffated soybean flour gave origin to three other products: textured (TSP), concentrated (CSP) and isolated (ISP) soy protein. The main difference between these three products is their protein contents: about 50%, 70% and 90% protein, respectively. The CSP and ISP are commercialized in powder, while TSP passes through an extrusion process, being commercialized under different sizes and formats.

Textured soy protein is the most widely used vegetable protein for human food processing. Generalized use of TSP in food products is due to a number of reasons, namely: increase in water and protein contents, cost reduction, texture and hardness enhancement as well as replacement of meat content while keeping the original protein content. Clearly, these advantages have been gradually augmenting the range of food products by using soy protein as a functional ingredient in their processing.

In the TSP processing, one of the main steps is the drying process, which is necessary to decrease the product moisture content to acceptable levels. The objective of dehydration in foods is to reduce the degradation caused by thriving bacteria, yeasts and molds. Moreover, undesirable chemical and biochemical reactions responsible for product degradation and shelf lifetime reduction are also heavily influenced by the moisture content. The TSP sorption isotherms are regarded as important tools in drying process operations since they describe the relationship between the relative humidity and the equilibrium moisture content of each type of TSP at constant temperatures. In general, the food industry has great interest in determining the sorption isotherms because they represent the best way to obtain data about the shelf-life and stability of its products (McLaughlin and Magee, 1998). In addition, the isotherms give relevant information concerning further steps in the process, such as packaging and storage.

Several researchers have reported sorption data for many different food products using the gravimetric static methods. McLaughlin and Magee (1998) determined the sorption isotherms for potatoes at 30, 45 and 6O°C; Prachayawarakorn *et al.* (2002) determined the desorption isotherms for shrimp at 50, 60, 70 and 80°C; Sandoval and Barreiro (2002) determined the water sorption isotherms of non-fermented coca beans at 25, 30 and 35°C, covering a range of a_w from 0.08 to 0.94; Mcminn *et al.* (2003) determined the moisture sorption isotherms of potato starch, starch-sugar and starch-salt gels at 30, 45 and 60°C, over a range of relative humidities from 0.10 to 0.84; Pahlevanzadeh and Yazdani (2005) determined the equilibrium moisture contents of powder almond at 15, 30, 55 and 75°C and of nut almond at 15, 55 and 75°C, for water activity ranging from 0.11 to 0.87; Talla *et al.* (2005) determined and compared the sorption isotherms of banana, mango, and pineapple at 40, 50, and 60°C for a range of water activities from 0.056 to 0.85; Wani *et al.* (2006) determined the moisture adsorption isotherms of watermelon seeds and kernels (two different cultivars) over a range of water activities from 0.113 to 0.92 at 20–60°C; and Furmaniak *et al.* (2007) adapted the Generalized D'Arcy and Watt model to the description of water vapor sorption on foodstuffs (pineapple, macaroni, sardine and pistachio nut paste) between 20 and 50°C.

Works dealing with the determination of the sorption data for soy products are, however, a little scarcer in the literature. Pan (2003) studied the adsorption characteristics of three commercial functional soy protein isolates and concentrates at different temperatures (10 – 40 °C).

The author found that the temperature is a very important factor affecting the equilibrium moisture content