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Different processing technologies applied to formulated food systems containing soy proteins: effects on protein structure

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Abstract

Different food systems were formulated with soy protein concentrate, lactose or maltodextrin and folic acid. The effect of thermal treatment, microfluidization, and microwave on the structure of soy protein into the formulated food systems was investigated through the quantification of surface free sulfhydryl groups and extrinsic fluorescence measures. The results revealed that the temperature is the core parameter to induce changes in protein structure.

Key words: soy protein, thermal treatment, microfluidization, free sulfhydryl groups

INTRODUCTION

The number of formulated food products where proteins from traditional sources have been replaced by plant ones is increasing. Several factors are behind this trend such as the increasing number of people adopting climate friendly diets, but also the development of products for restrictive diets as in the case of plant-based infant formulas. There are several plant protein sources available for these applications, among them, soy protein has been highlighted as a viable alternative to animal proteins in formulated food products due to their high nutritional quality and competitive cost. In complement, several alternative processing technologies, such as microfluidization (HPH) and microwave (MW), has been applied by food industries as an alternative to traditional thermal treatment (TT), although the effect of these technologies in formulated food systems containing plant-proteins, different carbohydrates and vitamins is still less studied.

RESULTS AND DISCUSSION

Samples were formulated with soy protein concentrate and lactose (L) or maltodextrin (M) (2 g/100 g protein), and folic acid (0,1 g/ 100 g protein). Samples at 50 g/L were subjected to TT (63 °C/30 min. - TT63 - or 88 °C/10 min. - TT88), HPH (140 MPa/ 5 cycles/ 25 °C) or MW (45 W/ 40°C/ 75 s). Figure 1 displays the results of extrinsic fluorescence intensity (Ho) for treated and non-treated samples (CNT). Both thermal treatments led to an increase in Ho.

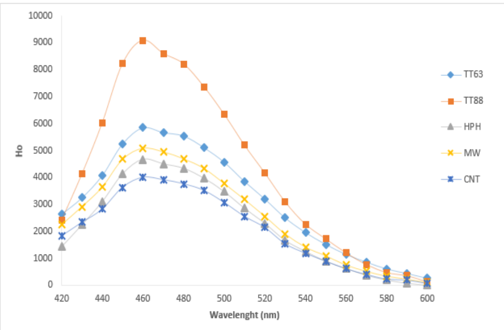

Figure 1 – Extrinsic fluorescence (samples containing L.)

TT88 allowed a higher level of protein denaturation, but with limited protein aggregation. HPH and MW promoted minor effects on protein structure probably because of the moderate temperatures achieved. The observed behavior was very similar independently of the carbohydrates used. In terms of the surface free SH content, it was observed that HPH induced a significant ($p<0.05$) decrease of it, probably due to a spatial rearrangement or by the interchange of SH to disulfide bonds (Figure 2).

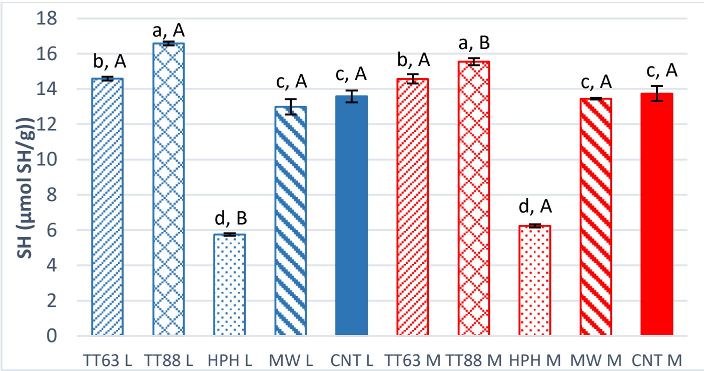

Figure 2 – Surface free SH content of samples.

CONCLUSION

To summarize, the processing technologies induced distinct changes on the structure of soy protein, which were mainly related to thermos induced ones. The technological properties of protein can be greatly affected considering these technologies. The results in the current study are relevant because they help to elucidate the behavior of a promising plant protein useful to the development of innovative food products presenting high complexity, such as plant based infant formulas.

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