Effect of ultrasound on glucose-lysine complexes obtained via Maillard reaction

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It is well-known that Maillard reaction (MR), that occurs between the ε-amino group of lysine of aminoacids, peptides or proteins with the carbonyl group of reducing carbohydrates, is one of the most important and complex reactions that may spontaneously occur in living organisms or during food processing. In addition, during the last years, there has been an increased interest in deliberately promoted MR under controlled conditions to obtain glycoconjugates with improved functionalities in relation to the initial proteins. In this case, the reaction can be carried out in solution or in dry-state, the later being more time consuming than the former. However, in general, it has been stated that when the reaction is done in solution more structural changes can be produced in the initial proteins. Therefore, the application of other procedures that could improve the manufacture of glycated proteins via MR, as well as reducing the reaction time, is of interest.

On the other hand, the application of ultrasound (US) technology in various fields including bioprocess, biotechnology and food processing has increased tremendously in recent years and, it is known that this emergent technology can accelerate different chemical reactions. Thus, effects of US on intermediate products of MR, browning intensity, antioxidative activities and chemical structure of bovine serum albumin glycated with glucose has been previously investigated. However, no evidence of the effect of US on the initial steps of MR has been done and in order to improve a number of functional properties of proteins is necessary to keep MR in the initial steps under very well controlled conditions. In this sense, 2-furoyl-methyl-lysine (furosine) is one of the most important indicators of the initial steps of MR. Thus, in this work, we have evaluated the effect of US (with a probe of 13 mm diameter, maximum wave amplitude of 145 μm, 20 kHz frequency, and 400 W full power) on the formation of furosine in a liquid model system of glucose and lysine at pH 7 (buffered solution), temperatures lower than 35°C, wave amplitude of 50% and sonication time of 10 min. Similar heat treatments were also carried out in a conventional bath. In the obtained HPLC profiles, two peaks, corresponding to the glycation of the α- and ε-amino groups of lysine, were observed, the amount of furosine being higher in the case of samples subjected to US treatment. These preliminary results can indicate the usefulness of US as a MR promoting system to obtain glycated proteins with improved functionalities.

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