PHYSICO-CHEMICAL PROPERTIES OF MILK PROTEINS MODIFIED BY TRANSGLUTAMINASE

By

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B.Sc. Agric. Sc. (Dairy Technology), Ain Shams University, 2005

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5- SUMMARY

The utilization of dairy protein products as a food ingredients is dependent on their physico-chemical and functional properties. Casein, in particular, serve as food supplementation due to its high nutritive value and ease of preparation with good qualities as well as serving as functional additives contributing adhesive, emulsion, coagulation or viscoelastic properties to foods.

However, modification of casein to enhance or alter their functional properties may increase the area of their food application.

Transglutaminase is an enzyme that forms crosslinks between protein molecules. This cross linkage has unique effects on protein properties. Transglutaminase is now widely used in many food products as well as dairy products. Casein has been shown to be a very good substrate for transglutaminase. These days, it seems that the most advanced area of dairy product processing using transglutaminase is yoghurt manufacturing

There is very little published information on the effect of transglutaminase on the casein of buffalo's milk. So, the objective of the present study was to gain better understanding regard the effect of transglutaminase on acid casein physico-chemical properties and then trying to adapt the results obtained in the manufacture of yoghurt from buffalo's milk.

Buffalo's casein was separated from skimmilk by HCl at pH 4.6 and used for preparing casein solutions at different pH and different concentration. The samples of casein solutions were treated by microbial transglutaminase in the concentration of 0.5 unit/g protein at 40 ºC for 60 min, then transglutaminase was inhibited by heating the samples at 80 ºC, and after that samples were cooled to room temperature and used for the experimental studies. The obtained results could be summarized in the following:

1. The electrophoresis of casein and TGase treated casein showed an increase in the molecular weight of the bands of casein fractions on the gel.
2. The coagulation time of milk using acid or rennet showed an increase as a result of transglutaminase treatment.
3. The acid clotting time > rennet clotting time for TGase treated milk.
4. The water holding capacity of casein treated by TGase was higher at temperatures of 5, 25, and 40 °c.
5. The oil binding capacity of casein treated by TGase showed a higher value compared with untreated casein at 5, 25, and 40 °c.
6. Ethanol stability of casein treated samples were better than the control casein.
7. Foaming capacity and stability were lower with casein treated samples than the control casein solution.
8. The emulsifier capacity and stability properties was improved in the case of casein treated samples.
9. The solubility of casein treated samples by TGase showed better values than the control casein solution.
10. The buffering capacity of casein solution treated with enzyme showed better quality than the control casein samples.
11. The rheological properties was improved as a result of treated casein by TGase.

For the manufacture of yoghurt, fresh buffaloes milk standardized to 5.5 % fat was divided to three batches. Buffaloes` milk was treated with the enzyme (0.5 unit/g milk proteins for 1 h at 40 ºC) followed by heat treatment (80 ºC / 1 min) for inactivation of the enzyme (Treatment 1). Another batch of milk was heated to 90 ºC /10 min to inactivate the TGase inhibitor located in the milk serum, then cooled to 40 ºC (Treatment 2). Milk was treated with the enzyme and followed by heat

treatment (80 ºC / 1 min) for inactivation of the enzyme, and then the fermentation process was carried out with the addition of 1.5% starter culture and control treatment was prepared without enzyme.

The results obtained were summarized in the following:

1. Transglutaminase improved the viscosity of yoghurt which being Treatment 1 > Treatment 2 > Control.
2. Syneresis defects was reduced by using transglutaminase.
3. The curd strength was increased by using TGase enzyme.
4. The curd structure was improved and became compact with good distribution of protein and fat as seen with the electron microscope examination.
5. Using transglutaminase was a good processing step for manufacture high quality yoghurt.

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