ABSTRACT

Jehan Bastamy Ali Farag: Functional Properties of Modified Buffalo Milk Casein by Glycosylation . Unpublished, PH.D. Thesis, Department of Food Science, Faculty of Agriculture, Ain Shams University, 2011.

Casein, the major milk protein component and its caseinate derivatives have physicochemical, functional and nutritive properties which make them useful worldwide. Functionality of casein is defined as any physicochemical property that affects the processing and behavior of protein in a food system, as judged by the quality attributes of the final product. Thus, the aim of the present research was to modify of the physico-chemical and functional properties of buffalo's casein through glycosylation with food – additives, i.e. ribose, glucose, galactose and lactose. The glycation of Rib-Glu-Gal- and Lac-casein was generated at 60 C°. pH 6.5 for 72 h and then dialysed for 36 h. The samples were analysed for amino acid, ethanol stability, Ca sensitivity, pH sensitivity, foam properties, emulsion properties, buffer capacity, viscosity, surface tension. Lysine side chain in control casein was 8.5 mg and decreased to 1.99, 3.4, 4.6 and 3.49 mg for glycated casein with ribose, glucose, galactose and lactose, respectivity. Histidine side chain in control casein was 2.98 mg and decreased to 0.001, 1.49, 1.15 and 1.7 mg for glycated casein with ribose, glucose, galactose and lactose, respectivity.

Ethanol stability was improved as a result of carbohydrate binding. The precipitations of alcohol test were detected only by using both 75 % and 95% alcohol concentrations and at pH 4.0 only (around isoelectric point of casein).

The casein solubility in calcium solutions for modified and unmodified casein was determined at different calcium concentrations ranging from 0 to 100 mM of $CaCl_2$ at pH value of 7.0. The results of glucose and lactose showed the higher solubility when compared to

unmodified casein whereas galactose showed less solubility, but ribose showed more similar solubility as control sample.

Glycated casein with glucose and lactose showed the higher foam stability and glycated with ribose and galactose presented the lowest values upto the end of the experiment. A significant difference between type of carbohydrate and emulsion properties shows glucoglycation the highest significantly value of casein then lactose, ribose and galactose. Control casein shows the least value.

Casein glycated with galactose showed the highest buffer index, followed by glucose, then ribose and the lowest was with lactose. Glycated buffalo's casein under the same experimental conditions, i.e., pH, temperature, and shear rate, can be graded in order of increasing apparent viscosity and shear stress as a result of changing both of kind of carbohydrate and concentration of protein solution: galactoglycated; lactoglycated; riboglycated; glucoglycated; unmodified control casein. Increasing shear rates resulted in decreasing apparent viscosity. It can be seen from the results reported that increasing the pH value resulted in decreased values of apparent viscosity.

Regarding the surface tension of 0.1% solutions of control buffalo casein as well as various glycated caseins, it was noticed that increasing the pH value resulted in significantly increase in the surface tension except at pH 4.0 which showed significant decrease. Glycosylation with lactose gave the least value of surface tension whereas the glycosylation with galactose showed the highest value.

Key Words:

Buffalo casein, Ribose, Glucose, Galactose, Lactose, Glycosylation, Functional properties.

CONTENTS

ABBREVIATIONS

AGEs : Advanced glycosylation end products
AOAC : Association of Official Analytical Chemists
a_w : Water activity
BSA : Bovine serum albumin
α-CN : Alpha casein
β-CN : Beta casein
κ -CN : Kappa casein
CCP : Colloidal calcium phosphate
DM : Dry matter
FE : Foaming expansion
FS : Foam stability
FVC : Foam volume capacity
NPN : Non-protein nitrogen
M : Molar
ES : Ethanol stability
U/g : Unit per gram
EAI : Emulsion activity index
RV : Relative viscosity
V : Viscosity
σ : Surface tension
K : Consistency coefficient
kJ : Kilo Jull
DV : Dynamic viscosity
mM : Milli mole
min : Minute
nm : Nano meter
mPa*s : Millipascal * per second
cP : CentiPoise
pI : Isoelectric point
α-La : α- lactolbumin
β-Lg : β-lactoglobulin

Da **:** Dalton
SDS **:** Sodium dodecylsulfate
SE **:** Standard error