

International Conference on

Food Chemistry & Hydrocolloids

August 11-12, 2016 Toronto, Canada

Evolutions of structural properties of Native Phospho Casein (NPC) powder during storage

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Background: Spray dried powders containing some caseins are commonly produced in dairy industry. It is widely admitted that the structure of casein evolves during powder storage, inducing a loss of solubility. However, few studies evaluated accurately the destabilization mechanisms at molecular and mesoscopic level, in particular for Native Phospho Casein powder (NPC). Consequently, at the state of the art, it is very difficult to assess which secondary structure change or crosslinks initiate insolubility during storage. To address this issue, controlled ageing conditions have been applied to a NPC powder (which was obtained by spray drying a concentrate containing a higher content of casein (90%), whey protein (8%) and lactose (few %)). Evolution of structure and loss of solubility, with the effects of temperature and time of storage were systematically reported.

Methods: FTIR spectroscopy, Raman and Circular Dichroism were used to monitor changes of secondary structure in dry powder and in solution after rehydration. Besides, proteomic tools and electrophoresis have been performed after varying storage conditions for evaluating aggregation and post translational modifications, like lactosylation or phosphorylation. Finally, Tof Sims and MEB were used to follow in parallel evolution of structure in surface and skin formation due to storage.

Results & Conclusion: These results highlight the important role of storage temperature in the stability of NPC. It is shown that the rise of post translational modifications, disulphide bridges and physical cross link seems to contribute to the destabilisation of structure and aggregation of casein. A relative quantification of each kind of cross link, source of aggregates, is proposed. In addition, it has been proved that migration of lipids and formation of skin in surface during the ageing also explains the evolution of structure casein and thus the alterations of functional properties of NPC powder.

Biography

Sarah Nasser is an Agro Food Engineer and started her 3-years of thesis. The thesis is supported by CNIEL (The French Dairy Industry Inter-Professional Organization) and is integrated within a wider program about the storage of milk powder (involving several thesis and post doctorate). The objective of her thesis is to understand and quantify the evolution of function and structure of Native Phospho Casein powder during ageing and linking with initial state. A part of her thesis purpose is to quantify evolutions of different functional properties of NPC. She has presented her results at IDF World Dairy Summit in 2015 and won the second best poster award.

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