MICROSTRUCTURE OF INFANT FORMULA RELATED TO ITS FUNCTION

Zuzana Burdiková[1]*, Vladislav Krzyžánek[2], Kamila Hrubánová[2], Peter Hohoth[1], Martin Schätz[1], Zdeněk Švindrych[2], Ondřej Šebesta[1]
[1] Faculty of Sciences, Charles University in Prague, Czechia
[2]Institute of Scientific Instruments of the CAS, v.v.i., Brno, Czechia
[3]Geisel School of Medicine, Dartmouth College, NH, USA
***E-mail: burdika@natur.cuni.cz**

KEYWORDS: Emulsions, STORM-Imaging, CRYO-SEM, Infant Formula Organization,

Dairy powders are an important product stream in the food industry. Among dairy powders, infant formula powder stands out for its nutritional offering and economic value. Formulation, processing condition, and storage condition can all affect the microstructure and compositional (lipid and protein) distribution of infant formula emulsions. Subsequently, the microstructure can affect several powder attributes, such as agglomeration, dissolution behavior etc. Advancing the tools to characterize both macro-and microstructures, as well as the distribution of lipid and protein, can help the industry to better understand the influence of formulation, processing condition, and storage condition on infant formula powders [1].

Zeiss Axio Scan.Z1 fluorescent imaging system was first used to characterize the compositional heterogeneity in the size of infant formula emulsions. Super-resolution microscope Zeiss Elyra PS.1 was applied to characterize the microstucture. Further imaging processing including noise reduction was introduced to describe the distribution of fluorescent signals on the microstructure of infant formula and human milk emulsions.

To understand the influence of pH on the microstructure. The buffer pH was changed from 2 to 9. A comprehensive toolset was used to characterize the infant formula emulsions and powders and compared with human milk. Particle size, surface morphology, compositional distribution, and pH dependent behavior were measured and compared across different formulations as well with Cryo-SEM technology [Fig.1]. The pH differences were found to influence the distribution of proteins and lipids in emulsions. In summary, our study can be useful in the design of dairy powders formulation and processing condition, as well as the evaluation of emulsions microstructure under different pH and other quality attributes.

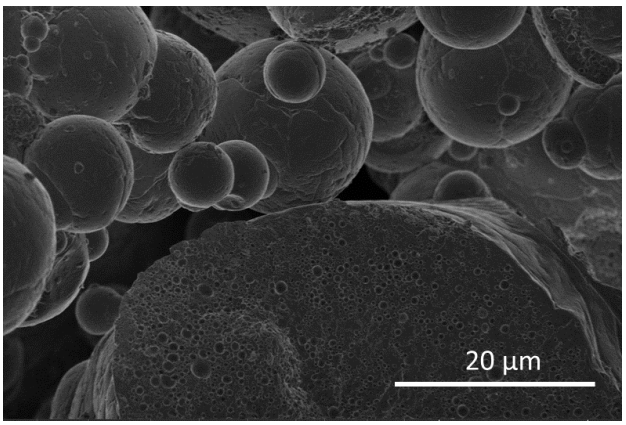

Fig. 1: Cryo-SEM image of infant formula.

Acknowledgments: Runjing Li., NIGMS COBRE award P20-GM113132.

[1] S. Huang, S. Strobel, R. Rai, T. Jeoh and N. Nitin, "Multiscale imaging approaches for simultaneously mapping distribution of multiple components in infant formula powders", *Journal of Food Engineering,* **281,** 109999 (2020).

[2] V. Krzyzanek, K. Hrubanova, J. Nebesarova and F. Ruzicka, "Cryo-SEM of Perpendicular Cross Freeze-Fractures Through a High-Pressure-frozen Biofilm", *Microscopy and Microanalysis*, **20 (S3)**, 1232-1233 (2014)