Unraveling Structure Formation in Tailor-Made Buriti Oil Emulsion during Simulated Digestion

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The formation of lyotropic liquid crystalline (LLC) structures during lipid digestion can be explored to add functionality to food, boosting bioaccessibility of nutrients or influencing digestion kinetics.[1] In particular, lipolysis products from monounsaturated triglycerides present interesting colloidal properties such as the self-assembly of pH-responsive structures, including LLC phases.[2] The oil from the Amazonian buriti fruit (*Mauritia flexuosa*) is rich in carotenoids, vitamin E and has a large amount of unsaturated fatty acids, known for their benefits on cardiometabolic health.

In this work, we design buriti oil-based emulsions and report its dynamic colloidal transformations during in vitro digestion using an innovative combination of multistep digestion model (oral, gastric, and intestinal steps) with *in situ* synchrotron Small angle X-ray scattering (SAXS). Additionally, cryogenic electron microscopy and dynamic light scattering are used to complement the investigation. The whey protein-stabilized buriti oil-in-water emulsion remains structured as emulsion droplets during oral and gastric digestion, and eventually transforms into LLC structures under compromised bile salt concentrations in the simulated intestinal digestion phase. The structure formation is found to be strongly pH- and bile salt-dependent and can be tailored with vitamin E supplementation in the oil. The colloidal digestion structures could maintain and even improve bioaccessibility of the hydrophobic nutrients.

These results can further guide the design of innovative food materials with a controlled rate of lipid digestion and absorption, with applications in newly designed delivery systems for bioactives and nutrients with improved bioaccessibility.

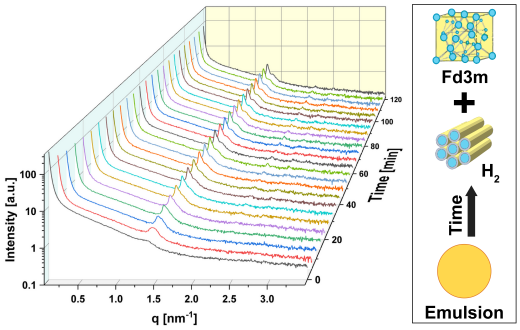

Figure 1. Time-resolved in situ SAXS curves of simulated intestinal digestion of buriti oil emulsion and artistic representations of the observed structures.

[1] Stefan Salentinig, *Current Opinion in Colloid & Interface Science*, **2019**, 39, 190-201.
[2] Rafael V.M. Freire, Eliane Haenni, Lind Hong, Mark Gontsarik, Stefan Salentinig, *Advanced Materials Interfaces,* **2022**, 9 (23).