From a universal sugar replacement strategy towards valorising untapped sources of fibre-rich sugar replacers from side-streams

RENZETTI S. (1), VAN DER SMAN R. (1)
1 Wageningen Food & Biobased Research, Wageningen, Netherlands

Recently, we have formulated a universal sugar replacement strategy based on physical chemical principles [1]. The strategy is centred on the hypothesis that two physical characteristics, the volumetric hydrogen bond density and volume-averaged affinity for water, has to be mimicked to obtain similar texture in sugar replaced foods. This strategy has been validated for biscuits [1] and cakes [2], using measurements of both physical and sensorial attributes. For potential sugar replacers like polyols or dietary fibers the two physical characteristics number are straightforwardly determined from values of the glass transition of the dry ingredients (or via viscosity), and the moisture sorption isotherm.

Via the physical principles underlying the sugar replacement strategy one can easily reason that hydrolysis product of cell wall materials can be healthy and sustainable alternatives to commercially available solutions like polyols and inulins. Sustainable sources of cell wall materials are readily available via side-streams from plant-based food (ingredient) processing. Hence, the physical principles underlying the sugar replacement strategy could be used to derive functional ingredients from cell wall rich side-streams by applying physical and enzymatic treatments.

In this contribution, we first discuss the physical-chemical principles behind the sugar replacement strategy, and its validation for biscuits and cakes by demonstrating the relations with rheology, phase transitions, structure and sensory. Subsequently, we show the extension of these physical-chemical principles to cell wall materials such as arabinoxylans and xylo-oligosaccharides. Relatively simple measuring techniques are used to demonstrate the applicability of the principles to these cell wall derived materials, which can allow for 1) fast screening of potential cell wall based ingredients, and 2) process control to optimize treatment conditions. Overall, the approach here presented shows potential for valorising untapped source of fibres as highly functional sugar alternatives.

References

1. van der Sman, R.G.M.; Jurgens, A.; Smith, A.; Renzetti, S. Universal Strategy for Sugar Replacement in Foods? Food Hydrocoll. 2022, 133, 107966, doi:10.1016/j.foodhyd.2022.107966.
2. Renzetti, S.; van der Sman, R.G.M. Food Texture Design in Sugar Reduced Cakes: Predicting Batters Rheology and Physical Properties of Cakes from Physicochemical Principles. Food Hydrocoll. 2022, 131, 107795, doi:10.1016/j.foodhyd.2022.107795.