

# Digital sugar reduction tool

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For bakery product reformulation



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Wageningen University & Research (WUR) innovative reformulation tool helps the bakery industry to achieve a substantial reduction in added sugars without compromising on texture and taste. This unique digital tool allows companies to efficiently find tailor-made solutions depending on their specific bakery product formulation.

#### Reformulation as growth opportunity

Naturalness, clean label, sugar and fibre content, nutritional profile and energy intake, sustainability are all trendy topics among consumers. This provides bakery product manufacturers and ingredient suppliers an opportunity for growth within these consumer trends. As a result of this, many product developers are in the process of redesigning the formulation of their product portfolio.

Whilst this is a clear commercial opportunity, reformulation also comes with a number of technical, regulatory and societal challenges. Substantial reduction in sugar content adversely affects the product characteristics. At the same time, the reformulation must meet food labelling requirements and consumers' expectations for natural, clean label ingredients. Finally, improvement of the nutritional profile may be of interest, for example by replacing sugars with prebiotic fibers. Such a reformulation is

generally a challenging multi-criteria task that requires substantial investments and technical expertise.

#### Digitalization of knowledge for reformulation purposes

Experts at Wageningen University & Research have performed a great deal of research over recent years regarding the behaviour of sugar in food. Taking into account the complexity of the food matrix application, sugar functionalities have been studied from a chemical-physical perspective. By doing so, a number of physical relations have been developed between the sugar functionalities in food products such as bakery, dairy and confectionary and the sugar (and sugar replacers) properties.

The advances in understanding the functionality of ingredients, i.e. starches, proteins, sugars, fibres have provided us with new avenues for

more sophisticated and tailored reformulation approaches. For instance, describing and quantifying the physicochemical interactions between ingredients during the main processing stages in bakery manufacturing, e.g. mixing, fermenting, baking and cooling, allows us to set up quantitative formulation guidelines to reformulate products and can be directly used in a development process. Additionally, a physics-guided reformulation approach enables us to make a direct link between ingredient properties and their effect on end product quality, facilitating the development of new functional ingredients.

The knowledge developed on the influence of sugar on texture, rheology, water activity and sweetness has now been implemented in a digital reformulation tool using the combination of ingredients data and unique algorithms. This allows Wageningen experts to quickly assess novel product formulations that have a high chance of meeting the product requirements in a time-efficient way.

The tool can be used to:

- 1 Support end-product-manufacturers to efficiently identify the optimal sugar replacement according to the specific formulation and specific requirements (e.g. nutritional and labelling aspects)
- 2 Support ingredient suppliers in effectively identify how to best use their sugar replacing ingredients in specific formulations
- 3 Support ingredient suppliers in the development of new sugar replacers

### Beyond sugar reduction: improving the overall nutritional value

The WUR digital reformulation tool serves not just the purpose of technical reformulation, i.e. texture and taste. By integrating nutritional and labelling requirements into knowledge rules and algorithms, the tool can support multi-criteria formulation choices based on consumers' preferences and dietary requirements. Hence,

optimal sugar reduction can be combined with additional aims, such as fibre enrichment, calorie reduction, NutriScore and minimal use of additives. Additionally, the tool also calculates the effect of sugars and sugar replacement on water activity. In such way, aspects of safety and shelf-life can be taken into account in the reformulation strategy.



### *Our tailor-made offer*

At Wageningen University & Research the key for successful and time-effective reformulation lies in the here presented reverse engineering approach. In a standardized project we start by discussing the reformulation aims and the current bakery product formulation. This information is used by our experts to compute optimal formulations using the tool based on the agreed requirements. In discussion with the industrial partner, we will then make a selection of formulations to be experimentally tested both instrumentally and with a sensory panel. Based on the findings, further optimizations can be explored using the tool or by integrating aroma and fermentation strategies. Overall, we provide a comprehensive, tailor-made approach to develop reformulation strategies tuned to your needs. This all-inclusive approach includes:

- 1 Consultancy on sugar reduction requirements and computations using the digital tool on your specific product
- 2 Evaluation of reformulated product by instrumental and sensory tests
- 3 Further optimization, including integrated aroma and fermentation strategies (when desired)

## Integrated solutions for flavour modulation

Sugar reduction often results in changes in flavour perception. While these effects can be minimized in the digital reformulation tool by accounting for sweetness, additional strategies can be integrated in our approach.

Congruent aromas which enhance sweetness perception can be added to the specific formulation designed with our digital reformulation tool. WUR's broad flavour expertise enables evaluation of these integrated strategies with an Olfactoscan approach (GC-olfactometry/gustometry and PTRMS) whilst trained panellists consume and evaluate the sensory attributes.

Sweetness enhancing aromas can be also generated via in situ fermentation. This natural process to produce desired sweetness enhancing aroma components is utilized by the microbial experts of WUR to overcome the challenges

of sugar reduction. Production of flavor volatiles by microbial and yeast strains can be screened with WUR high-throughput tool. The flavor volatiles formed are grouped into functional groups to efficiently assess which ferments should be selected for potential applications. This allows the identification of clean label strategies for optimal sugar reduction.

### *The benefits of the digital Sugar reduction tool for Bakery Product Reformulation*

- Efficient selection of tailor-made reformulation solutions based on a multi-criteria method
- A fast-track comprehensive approach to product development
- Demonstrated success in several product applications
- Methodology for maximal de-risking of your R&D project

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## Contact

Are you interested to find out how you could fast track your reformulation needs? Please contact Joost Blankestijn to discuss this in detail.

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**[www.wur.eu/reformulation-tool](http://www.wur.eu/reformulation-tool)**