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Overcoming challenges in plant-based food reformulation

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Abstract

Reformulating dairy alternatives is a key pathway toward more sustainable food systems, as it expands the availability of lower-impact food choices for consumers. Many studies have demonstrated that plant-based products generally offer sustainability advantages over their animal-derived counterparts[1]. Nonetheless, delivering acceptable taste, mouthfeel, texture, and functionality remain a major technical challenge[2]. Using plant-based cheese and yogurt analogues as examples, this presentation discusses the practical challenges associated with reformulation of plant-based food from their dairy counterparts. For instance, due to the differences in the macromolecular structure between dairy and plant proteins, the resulting network formed can vary, which subsequently affect the texture and mouthfeel. Conventionally, casein is the key structural protein that contributes to the texture and melting behavior in cheese. In contrast, protein content in plant-based cheese analogues are typically low, and consequently, they do not taste like conventional cheese. While individual plant proteins contributed distinct functional roles, from emulsification, smoothness, to gelation, single-protein addition was insufficient to replicate dairy-like behavior. Successful reformulation depended on combining protein functionalities with a tailored starch system to build the desired structure, stability, and sensory characteristics. In plant-based yogurts, chickpea and fava bean proteins produced a yogurt structure with lower G' values compared to dairy proteins. This exemplifies key differences in molecular interactions between dairy and plant matrices, which might explain the difficulty of achieving the same sensory qualities in plant-based food. These findings demonstrate that the sustainability potential of plant-based foods can be advanced through rational reformulation guided by structure-function understanding of proteins, starches, hydrocolloids, and fibers, enabling products that better meet consumer expectations while supporting more sustainable dietary transitions.

References

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