Bacterial cellulose as a novel stabilizer and texturizer for cosmetic and food applications

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Bacterial nanocellulose (BNC) is a sophisticated material produced biotechnologically by different microorganisms, but most efficiently by acetic acid bacteria from the genera *Gluconacetobacter*. While chemically identical to plant cellulose, BNC is chemically pure. Each BNC nanofiber is a bundle of cellulose nanofibrils. Due to their nano-size, these aggregates of extended cellulose chains have a rather large surface area. The unique properties of BNC account for an extraordinary physico-chemical and mechanical behaviour.

For industrial applications, hydrocolloidal microcrystalline cellulose from vegetable sources is widely used to regulate the texture, rheology, stability and organoleptic properties of the formulations [1]. Several studies are being carried out to investigate the technological role of BNC. Preliminary results already showed that BNC is technically superior to these vegetable celluloses, and can outperform plant celluloses in several applications within the food industry. As a novel hydrocolloid, BNC presents important features such as the stabilization of heterogeneous systems (air-liquid, solid-liquid and liquid-liquid): it is able to stabilize aerogels, increasing the incorporation of air in the liquid matrix (overrun), so it can be used as an additive in ice cream, smoothies and whipped cream; it can stabilize solid particles in a liquid matrix (e.g. cocoa particles in chocolate milk); BNC also stabilizes of oil-in-water emulsions, in spoonable and pourable dressings, without the need to add any other emulsifying agents.

Likewise, the stabilizing/thickening properties of BNC offer a similarly huge potential for application in the field of cosmetics. Regarding these exceptional functional properties, the effect of BNC was also assessed in a generic cosmetic cream (oil in water emulsion with other basic cosmetic ingredients), and compared to the effect of other commonly used additives in cosmetic formulations [2]. BNC can be used to stabilize active compound particles and oil droplets, as well as improving texture and other sensorial properties. Moreover, it may allow to reformulate the percentage of surfactants used on a liquid matrix without changing the rheological properties.

The incorporation of BNC in replacement of other polymers in food and cosmetics may bring environmental and economic advantages and reduce the use of plant cellulose and their (synthetic) derivatives in the above-mentioned applications.

References

[1] Wüstenberg, T., 4. Microcrystalline Cellulose, in Cellulose and Cellulose Derivatives in the Food Industry - Fundamentals and Applications. 2014, Wiley VCH Verlag GmbH: Germany. p. 143-184.

[2] Gilbert, L., et al., Rheological and textural characterization of cosmetic emulsions containing natural and synthetic polymers: relationships between both data. Colloids and Surfaces A: Physicochemical and Engineering Aspects, 2013. 421: p. 150-163.