Ref: 4365

Nanoencapsulation of quercetin into bio-based nanostructures obtained from assembling of α-lactalbumin and lysozyme

Monteiro, Adenilson A.[1,2,3]***; Monteiro, Marcia R.***[3,4]***; Ramos, Óscar L.***[3,5]***; Pereira, Ricardo N.***[3]***; Malcata, F. Xavier***[5,6]***; Teixeira, José A.***[3]***; Teixeira, Álvaro V.***[1]***; Oliveira, Eduardo B.***[1]***; Coimbra, Jane S.***[1]***; Vicente, António A.***[3]

[1]Department of Food Technology, Universidade Federal de Viçosa, Viçosa, Minas Gerais, Brasil; [2]COLUNI – Colégio de Aplicação da Universidade Federal de Viçosa, Viçosa, Brasil;
[3]CEB - Centre of Biological Engineering, University of Minho, Braga, Portugal;
[4]Department of Nutrition, School of Nursing, Universidade Federal de Minas Gerais, Belo Horizonte, Brasil;
[5]LEPABE – Laboratpry for Process Engineering, Environment, Biotechnology and Energy University of Porto, Porto, Portugal;
[6]Department of Chemical Engineering, University of Porto, Porto, Portugal

E-mail: os.silva.ramos@gmail.com

Keywords: Nanoencapsulation, bio-based materials, quercetin, functional foods, health benefits

Abstract

Nanotechnology possesses an intrinsic potential to produce new food ingredients and innovative products, with considerable benefits to human health. This can be attained via development of innovative structures for application in functional foods. In recent years, consumption of foods providing health benefits has risen chiefly as a result of significant investments from the food industry and widening consumer awareness in this field. Polyphenols constitute one such functional ingredient: it entails a large group of plant metabolites with a large spectrum of recognized biological activities in humans. Quercetin is, in particular, one of the most representative compounds of the flavonoid family; it has been assigned a wide range of health benefits, including anti-inflammatory agent, cancer prevention, DNA protection agent, antioxidant and cardio-protective agent. However, its bioavailability is low, so limited biological effects may be noticed arising from its poor solubility, gastrointestinal instability and low uptake rate through the gastrointestinal tract. A possible solution to overcome such limitations is nanoencapsulation of quercetin. Therefore, our study was aimed at encapsulating quercetin into bio-based nanostructures obtained from assembling of α-lactalbumin (α-La) and lysozyme (Lys), as promoted by heating at 75 ^{o}C for 15 min, at pH 11; evaluation of their association efficiency was performed. Such nanostructures were prepared via solubilization of 2 mg mL^{-1} of Lys and α-La powders in water, at a molar ratio of 1:0.54, and were extensively characterized by dynamic light scattering (for particle size, polydispersity and zeta potential) and transmission electron microscopy (for microstructure and morphology).

Quercetin has been successfully encapsulated into protein nanostructures above 50% efficiency. These nanostructures exhibited spherical morphology, with average size below 100 nm and zeta potential around -35 mV. Our results suggest that quercetin encapsulated in such proteinaceous nanostructures may be used for manufacture of functional foods.

Acknowledgements: A.A.M and M.R.M gratefully acknowledge their grants to CNPqz and CAPES (Brazil), and their support to FAPEMIG and CNPEM-LNBio, both from Brazil. O.L.R and R.N.P gratefully acknowledge their Post-Doctoral grants (SFRH/BPD/80766/2011 and SFRH/BPD/81887/2011, respectively) to Fundação para a Ciência e Tecnologia (FCT, Portugal). The authors thank FCT Strategic Project PEst-OE/EQB/LA0023/2013 and project “BioInd - Biotechnology and Bioengineering for improved Industrial and Agro-Food processes", REF. NORTE-07-0124-FEDER-000028, co-funded by the Programa Operacional Regional do Norte (ON.2 – O Novo Norte), QREN, FEDER.