



6th WORKSHOP

Green Chemistry and Nanotechnologies
in Polymer Chemistry



July 15-17, 2015

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Eds. - M. F. Barreiro, O. Ferreira, A.I. Pereira



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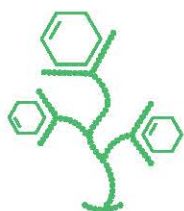
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Introduction

Nowadays, there is an increasing concern among consumers to choose “natural foods” or foods in which synthetic additives were replaced by natural ingredients. Some of these ingredients possess antioxidant and antimicrobial properties making them suitable to be used as natural preservers, bringing also health benefits in the prevention of several diseases [1].

Foeniculum vulgare Mill. (Fennel) and *Matricaria recutita* L. (Chamomile) are examples of plants that showed both antioxidant and antimicrobial activity. Furthermore, their aqueous extracts proved to be suitable for incorporation in cottage cheese, maintaining the nutritional properties and improving the antioxidant potential of cottage cheese samples, up to 7 days [2, 3]. Nevertheless, a decrease in the bioactive properties of the studied samples was observed after 14 days of storage.

In fact, problems linked with the incorporation of natural extracts into food matrices, mainly related to their stability and bioavailability, are often referred in literature, being well known that several agents (light, moisture, heat and pH) can induce changes in those extracts. In this context, microencapsulation emerges as a solution to provide protection and controlled release of natural extracts, being increasingly used in several fields including in pharmaceutical and food industries [4]. Therefore, the aim of this study was to prepare microcapsules with the aqueous extracts of fennel and chamomile for incorporation in cottage cheese samples, in order to solve the previously mentioned decrease in bioactivity observed after 14 days of storage.

Experimental

The aqueous extracts of *Foeniculum vulgare* Mill. and *Matricaria recutita* L. were obtained by decoction and their lyophilized form further used as the core material. Microspheres were prepared by using an atomization/coagulation technique with alginate as the wall material. For monitor the process and access microcapsules consolidation and morphological evolution during the synthesis process, optical microscopy (OM) and Scanning Electron Microscopy (SEM) analysis were applied (this last technique only with final lyophilized samples). FTIR was used to check the effective incorporation of the extract in the alginate matrix and HPLC-DAD to determine the encapsulation efficiency (EE). Free and microencapsulated extracts were incorporated in cottage cheese samples that were thereafter characterized in terms of nutritional properties and antioxidant potential immediately after incorporation, after 7 and 14 days under storage at 4°C.

Results and discussion

After the atomization process, the OM analysis showed an efficient incorporation of the extracts with a homogeneous distribution within the microspheres, recognized as brown droplets well distributed in the alginate matrix. It was observed that the microspheres had different shapes and sizes; the larger showed round shape while the smaller had a pear-like shape. The EE, determined by quantification of quercetin-3-O-glucoside (microspheres with fennel) and 5-O-caffeoylquinic acid (microspheres with chamomile), was estimated as approaching 100% for both samples. Only traces of these compounds were detected in the coagulation and washing solutions. These compounds were the major molecules identified and quantified in the extracts [2, 3] thus representing suitable compounds to monitor EE as demonstrated in previous works of the group [4, 5]. The presence of the decoction extracts inside the microspheres was confirmed by FTIR analysis. Fig. 1 shows the microcapsules morphology at different preparation stages.

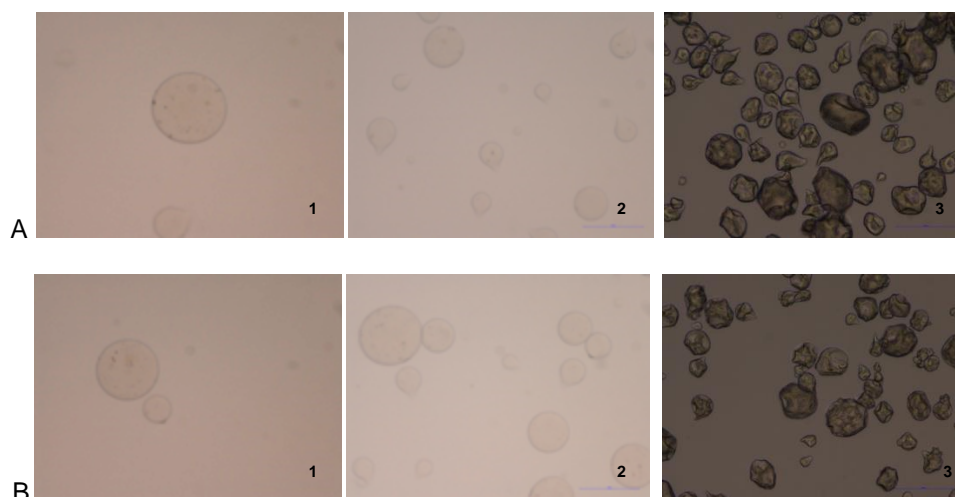


Fig. 1. Morphology of fennel (A) and chamomile (B) microspheres by OM analysis under magnifications of 100X of the microspheres immediately after atomization (1) and after 4 hours coagulation period (2) and lyophilized microspheres (3).

Conclusions

In this study, aqueous extracts of *F. vulgare* (fennel) and *M. recutita* (chamomile) were successfully encapsulated by an atomization technique, and then incorporated in cottage cheese samples. Further studies are ongoing in order to compare the bioactive and preserver effects of the microencapsulated extracts with their corresponding free forms.

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