Production of mineral delivery system with thermal mineral water for dermatological application

Maximiano P. Ribeiro, André R.T.S. Araujo and P. Coutinho
Superior Health School of Institute Polytechnic of Guarda / Unit for the Development of Portugal's Inland (UDI/IPG), Guarda, Portugal.

Keywords: Mineral delivery system; Thermal mineral water; Skin hydration;

Abstract

Nowadays, many cosmetics formulation have thermal water in their composition in order to prevent and treat skin dehydration. Although, the hydrophilic character of water turn very difficult to incorporate it in the major dermocosmetics formulation which have hydrophobic properties. In this way, the development of mineral systems with thermal water can be an interesting approach to overcome this limitation. In this preliminary study were produced chitosan microparticles with thermal water in order to evaluate the release profile of mineral composition using as model Cl^- ions. The preliminary results suggested that this system can be use in near future to incorporated thermal water in hydrophobic dermocosmetics.

Introduction

The skin is the largest organ in mammals and acts as a barrier between the human body and the surrounding environment. One of the main functions of the skin is to prevent the water loss (Yildirimer, L. et al. 2012). Preserve the skin hydration is crucial since its dehydration affects the skin's appearance, mechanical properties, and cell signaling processes (Kilpatrick-Liverman L. et al. 2009). In order to overcome this problem dermocosmetic industries have been introducing in market many products for skin hydration. With the aim of improve its products many companies have been incorporating thermal mineral water at the dermocosmetic formulations such as Avène, La Roche Posay and Vichy. The action of thermal mineral water on skin is based into its physical-chemical properties namely sulphur, silica, sodium, calcium and potassium composition (Araujo ARTS et al. 2015). Although the existence of some dermocosmetic formutations with thermal mineral water it is very difficult to incorporate it, due to its hydrophilic properties and the hydrophobic characteristics of the majority of dermocosmetic. In order to overcome these effect polymers particles seems to be an interesting choice.

Aims and methods

In this study chitosan microparticles containing Portuguese thermal mineral water with therapeutic indications for dermatological use (Termas do Cró) were produced in order to be incorporated as a system in dermatologic products in the near future.

The microparticles were prepared by inotropic gelation between the positively charged chitosan and the negatively charged tripolyphosphate ions (Ribeiro. et al. 2013). The microparticles were prepared with different times of gelatination (2,5; 10 min), and placed into distilled water. The test tubes with microparticles were immersed in a shaking bath at 37 ^oC to determinate the release profile over time. The Cl- was used as a model to determined the release profile of minerals from minero-medicinal water in this preliminary study.

Results and discussion

The microparticles produced presented spherical shape with a diameter below 2 mm (Figure 1).

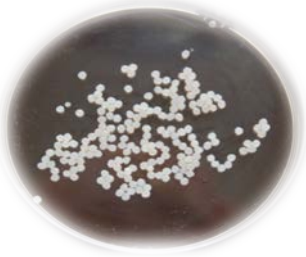

Figure 1: Microparticles of chitosan produced with thermal water.

The release profile study showed that the time of gelation of chitosan microparticles in tripolyphophate influences the release over time, once the microparticles with less time of gelatination release

faster the mineral than the microparticles with high time of gelatination, as represented in Figure 2. In aqueous ultrapure environment the process of release was mainly controlled by the diffusion process.

In this way the difference of release profile can be explained by interaction of tripolyphosphate with chitosan. Those particles which have less time of gelation (2,5 min) only interact with superficial

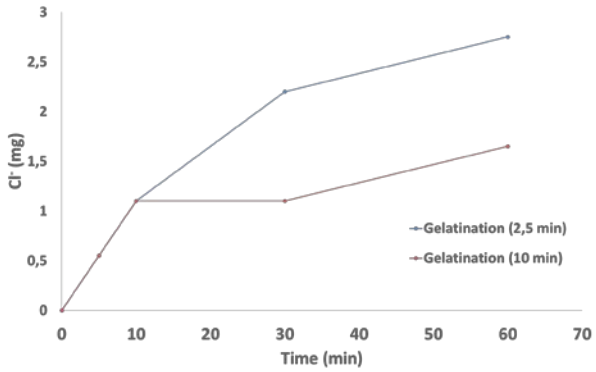

Figure 2: Release profile of Cl^- ions.

chitosan that allows a faster degradation of the microparticle and consequently improves the release of Cl^- ions. In microparticles synthetized after 10 min of gelatination the microparticle was not degradated, forcing Cl^- ions draw out through the porous, and then increasing the time necessary for the release.

Conclusions

In the present work, chitosan microparticles were produced with thermal mineral water and characterized in terms of size and capability as mineral delivery systems. These preliminary results suggests that in the near future these systems can be an interesting vehicle for incorporate thermal water in a hydrophobic dermocosmetic formulations.

References

Araujo, A. R., Paiva, T., Ribeiro, M. P., & Coutinho, P. (2015). Innovation in Thermalism: An Example in Beira Interior Region of Portugal. In Health and Wellness Tourism (pp. 165-180): Springer.

Kilpatrick-Liverman, L., Mattai, J., Tinsley, R., & Wu, J. (2009). Mechanisms of Skin Hydration. Handbook of Cosmetic Science and Technology, 91.

Ribeiro, M., Morgado, P., Miguel, S., Coutinho, P., & Correia, I. (2013). Dextran based-hydrogel containing chitosan microparticles loaded with growth factors to be used in wound healing. Materials Science and Engineering: C, 33(5), 2958-2966, doi:10.1016/j.msec.2013.03.025.[3]

Yildirimer, L., Thanh, N. T., & Seifalian, A. M. (2012). Skin regeneration scaffolds: a multimodal bottom-up approach. Trends in biotechnology, 30(12), 638-648

Acknowledgments

The authors would like to acknowledge the financial support provided by the Portuguese Foundation for Science and Technology (FCT) (PEst-OE/EGE/UI4056/2014), Mais Centro "UDI/Transferência de IDT e Desenvolvimento do Produto" da UDI-IPG (CENTRO-07-CT62-FEDER-005026).