Outline

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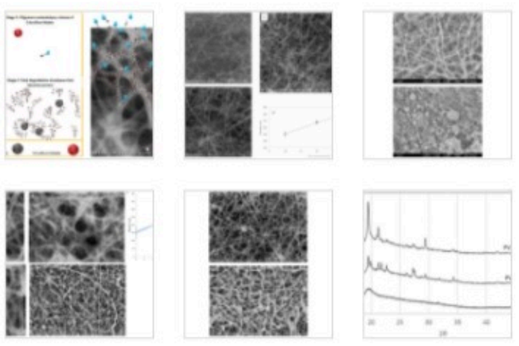
Figures (15)



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Journal of Drug Delivery Science and Technology

Volume 64, August 2021, 102630

Research paper

Citrulline malate transdermal delivery through integrating into polyvinyl alcohol (PVA) nanofibers

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Received 14 December 2020, Revised 9 April 2021, Accepted 26 May 2021, Available online 8 June 2021.

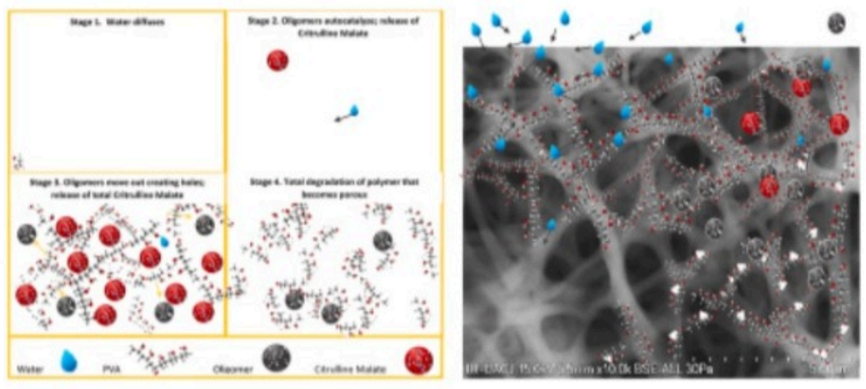
https://doi.org/10.1016/j.jddst.2021.102630

Abstract

Citrulline Malate (CM) is a pre-workout energy supplement, frequently used to reduce fatigue in sports that require high levels of energy. Typically, oral intake should occur at least 2 h before undertaking sport, in order for effects to take place. In this study, we have developed a method for immediate dermal release, which would considerably increase the amount of supplement delivered, in a continuous manner. The method was based on polyvinyl alcohol (PVA)-CM integrated fibers, which were fabricated using an electrospinning technique and which ranged between 168 and 396 nm in diameter. The PVA fibers hosted and released the energetic supplement of up to 5 g of CM, equivalent to 5 doses of 1 gr/day. FTIR and Raman measurements indicated a physical rather than a chemical interaction. PVA-CM systems were of relatively low crystallinity and patched fibers became more flexible when CM was increased. Total experimental time of up to 20 h was proportional to the amount of CM released and followed transport mechanism type II, where the first order Korsmeyer-Peppas model correlated the release results. Hydrolytic degradation took place over 4 steps and was proportional to hydrolytic degradation of polymeric fibers. Theoretical calculations at the level of density functional theory (DFT), using the functional B3LYP with the set of bases 6–311 ++ G (d, p), made it possible to determine the nature of the intermolecular interactions between PVA and CM. Electronic and spectroscopic properties were also determined in order to contribute to and complement molecular characterization.

Graphical abstract

Integration of Citrulline Malate in poly (vinyl alcohol) (PVA) sport enhancement supplement, for transdermal release patches using fiber spinning.



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Keywords

Sports; Supplements; Electrosppining; Modeling; Patches; Polyvinyl alcohol