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Non-thermal electromagnetic fields to trigger On-Demand drug release from High-Tm Magnetoliposomes

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Abstract

Magnetic nanoparticles with superparamagnetic properties have attracted increased attention for applications in biomedicine, as they exhibit a strong magnetization only when an external magnetic field is applied. Magnetoliposomes (MLs) are the combination of liposomes with encapsulated magnetic nanoparticles. These hybrid nanocarriers have been showing significant biomedical application possibilities. However, it is essential that nanoparticles exhibit superparamagnetism, this causes nanoparticles to become susceptible to strong magnetization. When the magnetic field is applied, they orient toward this field, but do not retain permanent magnetization in the absence of magnetic field. The magnetic properties of super paramagnetic iron oxide nanoparticles (SPIONs)-based magnetoliposomes allow for alternative therapies through magnetically controlled drug delivery and hyperthermia. In this way they can be viewed as trigger-responsive carriers as they have the potential to act as "remote switch" that can turn on or off the effects of the therapeutics, based on the presence or absence of the stimulus. Recently, a pilot study has demonstrated the feasibility of smart controlled delivery through a magnetic field with intensity significantly lower than the ones usually reported in literature. In this way, a controlled release has been obtained through a magneto-nanomechanical approach without any macroscopic temperature increase. Specifically, signals generated by non-thermal alternating magnetic fields (AMFs) or non-thermal pulsed electromagnetic fields (PEMFs) were applied to high-transition temperature magnetoliposomes (high-Tm MLs) entrapping hydrophilic SPIONs, proving to be interesting and promising stimuli-controlled drug delivery systems.

Biography:

Stefania Petralito the Ph.D. degree in Pharmaceutical Science and a Postgraduate Diploma in Hospital Pharmacy from the Sapienza University of Rome. Her current research interests include preparation and characterization of vesicular systems as drug delivery systems. She is a member of the Controlled Release Society Italian Chapter (C.R.S.), of the Società Chimica Italiana (SCI)-Division of Pharmaceutic Technology, of the Association of Italian Doctors, and Researchers of Pharmaceutical Technology and Legislation (A.D.R.I.T.E.L.F.).

Speaker Publications:

1. Garzoli, S; Petralito, S; Ovidi, E; Turchetti, G; Laghezza Masci, V; Tiezzi, A; Trilli, J; Cesa, S; Casadei, MA; Giacomello, P; Paolicelli, P. 2020 Lavandula x Intermedia Essential Oil and Hydrolate: Evaluation of Chemical Composition and Antibacterial Activity Before and After Formulation in Nanoemulsion. Journal of Industrial Crops and Products, 145, 112068
2. Adrover, A; Paolicelli, P; Petralito, S; Di Muzio, L; Trilli, J; Cesa, S; Tho, I; Casadei MA 2019. Gellan Gum/Laponite Beads for the Modified Release of Drugs: Experimental and Modeling Study of Gastrointestinal Release. Pharmaceutics, , 11 (4), e187
3. Nardoni, M; Della Valle, E; Liberti, M; Relucenti, M; Casadei, MA; Paolicelli, P; Apollonio, F; Petralito, S. 2018 Can pulsed electromagnetic fields trigger on-demand drug release from high-tm magnetoliposomes? Nanomaterials, , 8(4), e196
4. Di Sotto, A; Paolicelli, P; Nardoni, M; Abete, L; Garzoli, S; Di Giacomo, S; Mazzanti, G; Casadei, MA; Petralito, S. 2018 SPC liposomes as possible delivery systems for improving bioavailability of the natural sesquiterpene β-caryophyllene: Lamellarity and drug-loading as key features for a rational drug delivery design. Pharmaceutics, 10(4), e274
5. Spera R., Apollonio F., Liberti M., Paffi A., Merla C., Pinto R., Petralito S. 2015 Controllable release from high-transition temperature magnetoliposomes by low-level magnetic stimulation. Colloids surf B Biointerface 131(1) 136-140

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