DOI: 10.14232/syrptbrs.2022.19

Electrospinning as a novel method for drying iron-oxide-based magnetic nanoparticle dispersions

Črt Dragar[1], Nives Belcar[1], Sebastjan Nemec[1,2], Slavko Kralj[1,2], Mirjana Gašperlin[1], Petra Kocbek[1]

[1] University of Ljubljana, Faculty of Pharmacy, Ljubljana, Slovenia
[2] Jožef Stefan Institute, Department for Materials Synthesis, Ljubljana, Slovenia

Iron-oxide-based magnetic nanoparticles (MNPs) have shown numerous advantages for application in biomedicine, especially as novel drug delivery systems [1]. However, their long-term physical stability in dispersions still represents a big technological challenge. Several methods for the transformation of MNP dispersions into dry products have been thus developed in the last two decades aiming to improve their stability [2]. The methods currently available for drying of MNP dispersions usually require relatively high amounts of excipients to preserve MNP size and result in powdered products, which can provoke adverse health effects in humans, if unintentionally inhaled [3].

The aim of our work was therefore to establish a new method for drying of MNP dispersions, which will give a non-powdered product. Electrospinning was thus employed for drying of MNP dispersions and enabled the preparation of dry product, namely hydrophilic nanofibers loaded with up to 50 % (w/w) of MNPs. The obtained dried electrospun product was rapidly and easily reconstituted in 0.9 % (w/v) NaCl solution without the use of sonication. The polymers used improved also the MNP stability in presence of salts, thus, average hydrodynamic particle size was preserved in a dispersion. The results proved the applicability of the electrospinning method in the formulation of dry non-powdered MNP products, which could be transformed into stable MNP dispersions just before administration.

References

1. Dragar et al. Int.J.Pharm. 597, 120348 (2021)
2. Ataide et al. J.Drug.Deliv.Sci. Technol. 61, 102225 (2021)
3. Valdiglesias et al. J.Trace.Elem. Med. Biol. 38, 52-63 (2016)

Acknowledgments

The authors gratefully acknowledge the financial support provided by Slovenian Research Agency (Programs P1-0189 and P2-0089, Projects J1-7302, J2-3043, J2-3040, J3-3079, and bilateral project BI-HU/21-22-011).