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Development of magnetic nanoparticles for targeted drug delivery

Črt Dragar[1], Tanja Potrč[1], Sebastjan Nemec[1,2], Robert Roškar[1], Stane Pajk[1], Slavko Kralj[1,2], Mirjana Gašperlin[1], Petra Kocbek[1]

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

Among several types of nanoparticles, iron-oxide-based magnetic nanoparticles (MNPs) have shown great potential for their use as targeted drug delivery systems [1]. Despite numerous advantages, some limitations of MNPs need to be overcome before their application in clinical practice, including ineffective spatial guidance, poor colloidal stability, usually low drug loading, and inadequate drug release [1,2].

The aim of our work was to prepare MNPs based on the controlled assembly of superparamagnetic iron oxide (γ-Fe_2O_3) nanocrystals. Thus, we had developed a one-pot method for the preparation of MNPs composed of several nanocrystals, tetradecan-1-ol, model drug, and surfactant (Brij®L4 or our own surfactant N^1,N^1-dimethyl-N^2-(tricosan-12-yl)ethane-1,2-diamine (SP11)). The method is based on hot homogenization of the hydrophobic phase containing a nonpolar surfactant into the aqueous phase, using ultrasonication. The resulting MNPs showed good colloidal stability and relatively high drug loading capacity (up to 7.6 wt. %). The surfactant selection influenced the MNPs morphology, drug release profile, and MNPs surface charge, whereas the MNP size, iron oxide content, and drug loading were comparable among investigated formulations.

To sum up, the specific composition gives these MNPs promising characteristics for application in nuclear magnetic resonance imaging and magneto-thermally-triggered targeted drug delivery [3,4]. They are therefore attractive candidates as novel nanotheranostics.

References

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Supervisor: Petra Kocbek