Synthesis of Uniform-Sized Silver-Cysteine-Functionalized Superparamagnetic Iron(II, III) Oxide Nanoparticles (SPIONs) Under Aerobic Condition and Its Potential Application in Chiral Separation

Tam, Man Shun (School: King's College)
Chan, Pak Hang (School: King's College)
Cheung, Marcus Hok Yin (School: King's College)

In this project, uniform Sized SPIONs of various sizes were synthesized in a reverse micelles system under aerial conditions. The variation in size was achieved by varying the loading of iron ions and NaDBS. SPIONs with PDI as low as 0.035 and Z-averages ranging from 13.28 and 65.58 nm were synthesized. The successful synthesis of uniform-sized SPIONs under mild temperature under aerial conditions is first to be reported in this project. Furthermore, a novel method of dispersing SPIONs in aqueous solutions via the usage of polarizing cations was developed. It was found that ions with high polarizing power such as iron(III) and chromium(III) ions were able to redisperse SPIONs, reverting them to nano-sized after addition then decantation. This effectively raises the surface area for functionalizing and chiral separation, significantly improving our yield. The effect of such cations on SPIONs is the first to be reported in this project. Moreover, our team is also first to report that a high degree of chiral separation across a variety of analytes has been achieved by using silver-cysteine functionalized uniform-sized superparamagnetic iron(II, III) oxide nanoparticles as chiral selectors. Notably, research was conducted on simple monofunctional chiral compounds such as butan-2-ol and butan-2-amine while also investigating the effect on bifunctional analytes such as alaninol and valine. The following optical purities were achieved: 14.9% for valine, 22.8% for butan-2-ol, 59.1% for butan-2-amine and 7.1% for alaninol.

Awards Won:
Third Award of $1,200