Supporting Information

Bacterial Magnetosomes – Nature's powerful contribution to MPI tracer research

A. Kraupner,[a] D. Eberbeck,[b]* D. Heinke,[a] R. Uebe,[c] D. Schüler,[c] and A. Briel [a]*

a. nanoPET Pharma GmbH, Robert-Koch-Platz 4, 10115 Berlin, Germany

b. Physikalisch-Technische Bundesanstalt Braunschweig und Berlin, Abbestraße 2–12, 10587 Berlin, Germany

c. University of Bayreuth, Department of Microbiology, Universitätssstraße 30, 95447, Bayreuth, Germany

** These authors contributed equally to this work.*

Characterization methods

TEM images and SAED patterns were obtained using a Zeiss EM 912 Ω operating at an acceleration voltage of 120 kV. Dynamic light scattering was performed using a Submicron Particle Sizer Model 370 (Nicomp Particle Sizing Systems; USA). The magnetic particle spectra were measured applying a drive field with an amplitude of 10 mT and a frequency of f_0 = 25.25 kHz with a commercial MPS system (Bruker BioSpin GmbH, Germany). Static M(H)-curves were measured with a commercial MPMS XL system (Quantum Design Inc., USA). MRX measurements were performed using a homebuilt device. MRX is a measurement technique which probes the dynamics of the magnetisation of MNPs[1] equivalent to ac-susceptibility measurements.[2,3] In short, the magnetic moments of the MNP in the sample are aligned by an external magnetic field of about 2 kA/m. After switching off the field within 420 µs, the decay of the magnetisation is measured by a low-Tc SQUID system at T = 295 K for 0.5 s.[4]

Table SI1. Standard deviation σ_c, σ_h and σ_m of crystal diameter, intensity-weighted hydrodynamic diameter and magnetic diameter (from M(H) data), respectively.

Sample	σ_c nm	σ_h nm	σ_m nm
LMU1	5.4	51.4	0.181 ± 0.002
LMU2	8.1	45.5	0.200 ± 0.007
LMU3	6.6	40.3	0.326 ± 0.02

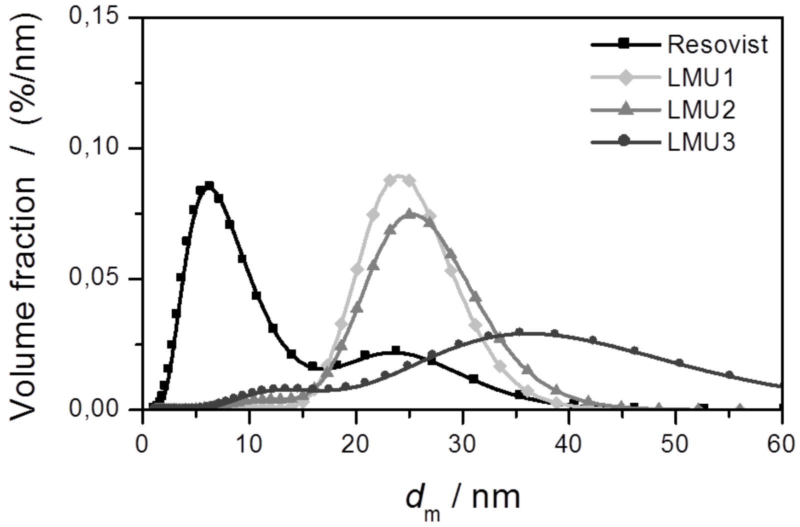

Figure SI1. Distributions of the effective magnetic diameters of all magnetosome samples and Resovist® calculated from their static magnetization curves normalized to the volume fraction of magnetite using the Moment Superposition Model assuming a bimodal size distribution.

Table SI2. $d_{spacing}$ values obtained from the SAED pattern of magnetosomes on TEM grid (corresponding to figure 1d in the manuscript). The calculated $d_{spacing}$ values (ref) for Fe_3O_4 are reported for comparison.

hkl	d (ref)[a]	d (measured)
111	4.85	4.84
220	2.97	2.97
311	2.53	2.53
400	2.10	2.09
422	1.71	1.70
511	1.61	1.61
440	1.48	1.47

[a] ref. ICDD-PDF4+ 04-001-7822

References

1 Kötitz, R.; Fannin, P. C.; Trahms, L. Time Domain Study of Brownian and Néel Relaxation in Ferrofluids. *J. Magn. Magn. Mat.* **1995**, *149*, 42–46.

2 Astalan, A. P.; Ahrentorp, F.; Johansson, C.; Larsson, K.; Krozer, A. Biomolecular Reactions Studied Using Changes in Brownian Rotation Dynamics of Magnetic Particles. *Biosens. Bioelectron.* **2004**, *19*, 945–951.

3 Horng, H. E.; Yang, S. Y.; Hong, C.-Y.; Kiu, C. M.; Tsai, P. S.; Yang, H. C.; Wu, C. C. Biofunctionalized Magnetic Nanoparticles for High-Sensitivity Immunomagnetic Detection of Human C-Reactive Protein. *Appl. Phys. Lett.* **2006**, *88*, 252506.

4 Matz, H.; D.Drung; Hartwig, S.; Gross, H.; Kötitz, R.; Müller, W.; Vass, A.; Weitschies, W.; Trahms, L. A SQUID Measurement System for Immunoassays. *Appl. Supercond.* **1998**, *6*, 577–583.