Supplementary Information on:

Malaria pigment crystals as magnetic micro-rotors: key for high-sensitivity diagnosis

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Characterization of the crystals. The quality of the synthetic malaria pigment was checked using infrared absorption and Raman spectroscopy. The spectra shown in Fig. S1 are in good agreement with data previously reported in the literature for crystals prepared from hemin by the same aqueous acid-catalyzed reaction as used in the present study.

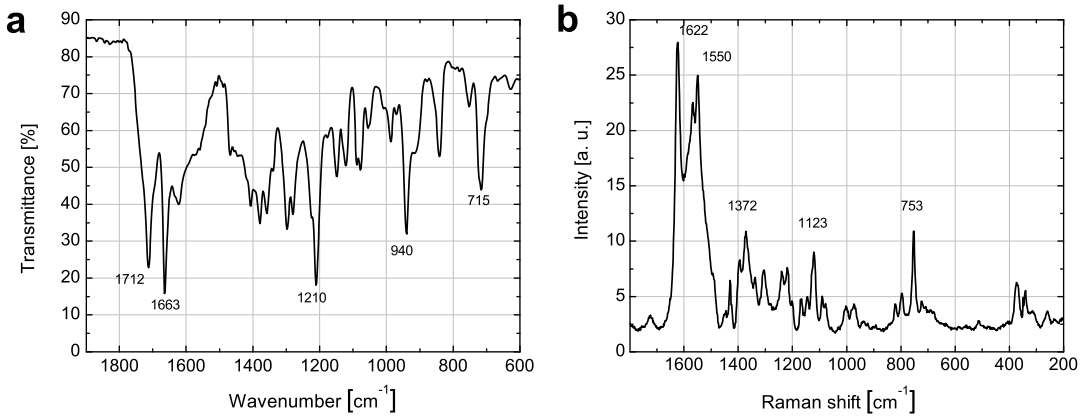

FIG. S1: | **Vibrational properties of synthetic hemozoin crystals.** (**a**) Transmittance spectrum and (**b**) Raman spectrum of crystals used in the present study. Raman scattering was performed with excitation at $\lambda = 633\,\mathrm{nm}$.

Morphology and crystallographic axes. Although there is no apparent difference in sense of orientation between the ensemble of magnetically aligned and randomly distributed crystals (for comparison of the former and latter cases see Fig. S2 and Fig. 1c, respectively), for the magnetically aligned samples we found macroscopic linear dichroism in contrast to the unordered ones. The lack of morphological alignment of the crystals reflecting their magnetic co-alignment is a consequence of the nearly isotropic distribution of the hard axes in the ordered state within the plane perpendicular to the magnetic field and the angle of $\delta \approx 60^o$ spanned by the hard axes and the fore-axes of the crystals. The latter introduces another degree of freedom in their alignment, namely arbitrary rotation around their hard axis, which costs no magnetic energy.

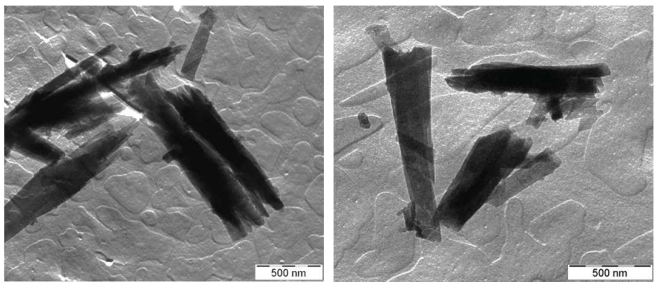

FIG. S2: | **Typical transmission electron micrographs on magnetically aligned ensembles of crystals.** After a field-cooling process the images were recorded using a freeze-fracture method. The magnetic co-alignment of the crystals is not reflected by the seemingly random orientation of their fore-axes.

Magnetization of powder samples and suspensions. Besides magnetization data presented in the main text, we also investigated the field dependence of the magnetization on powder samples at 5 K (see Fig. S3).

The glycerol-water mixture used for the fixation of suspended hemozoin crystal freezes at $T_{fr} \approx 230\,\mathrm{K}$. This is also discernable in the temperature-dependent magnetization data of field cooled (magnetically aligned) and zero-field

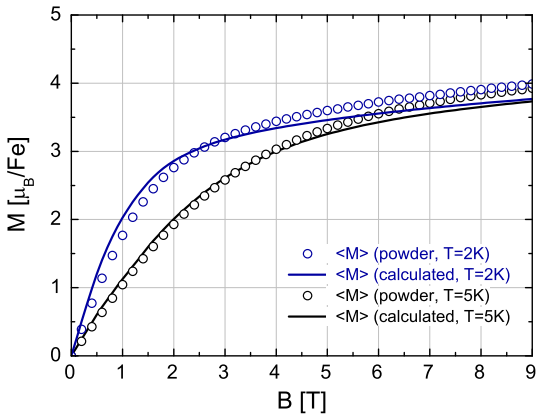

FIG. S3: | **Field dependence of the magnetization of hemozoin.** Blue and black open circles represent data measured on hemozoin powder at 2 K and 5 K, respectively. Lines are the corresponding theoretical curves with $D = 13.4$.

cooled (randomly oriented) hemozoin suspensions shown in Fig. S4. When warming up the suspensions in B=0.5 T, the two curves shows decreasing but clear difference up to 220 K, where the mixture is melted. Above this point the magnetization curve of the randomly oriented sample approaches that of the aligned one as the crystals become oriented in both cases by the applied magnetic field of B=0.5 T.

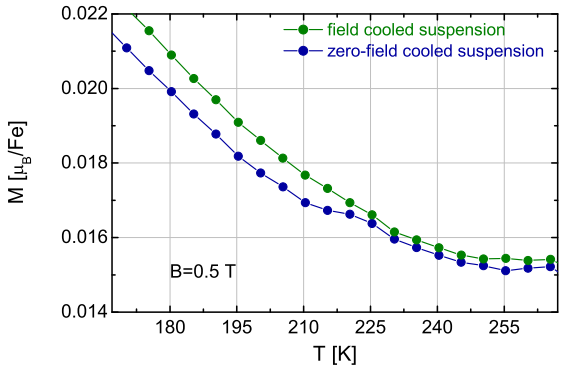

FIG. S4: | **Temperature dependence of the magnetization for hemozoin suspensions.** Green and blue dots represent data measured on suspensions with increasing temperature following a field-cooling and a zero-field-cooling process.