

## Supplementary Information

### **Riboflavin-citric conjugate multicore SPIONs with enhanced magnetic responses and cellular uptake in breast cancer cells**

Wid Mekseriwattana,<sup>ab</sup> Pablo Guardia,<sup>b</sup> Beatriz Torres Herrero,<sup>c</sup> Jesus M. de la Fuente,<sup>c</sup> Chutima Kuhakarn,<sup>d</sup> Anna Roig,<sup>b</sup> Kanlaya Prapainop Katewongsa<sup>\*ae</sup>

<sup>a</sup> School of Materials Science and Innovation, Faculty of Science, Mahidol University, Bangkok 10400, Thailand.

<sup>b</sup> Institut de Ciència de Materials de Barcelona (ICMAB-CSIC), Campus UAB, Bellaterra 08193, Spain

<sup>c</sup> Instituto de Nanociencia y Materiales de Aragón (INMA) CSIC-Universidad de Zaragoza & Centro de Investigación Biomédica en Red de Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN), 50018 Zaragoza, Spain

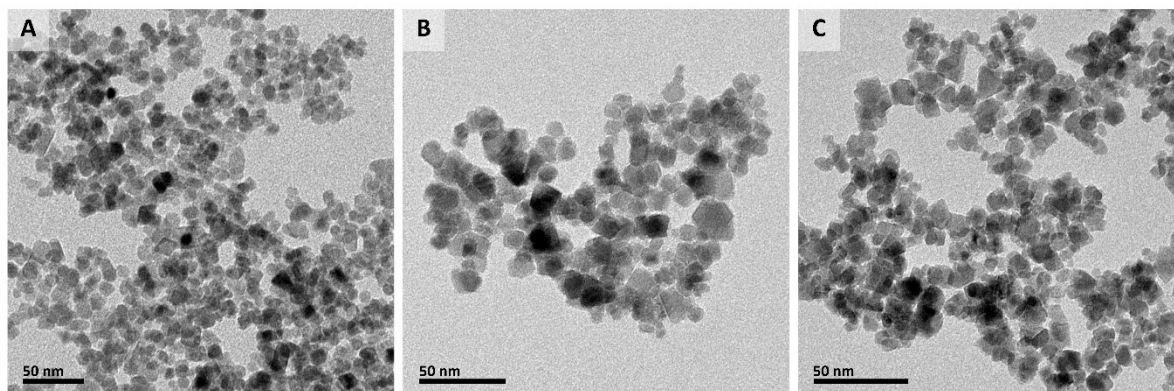
<sup>d</sup> Department of Chemistry and Center of Excellence for Innovation in Chemistry (PERCH-CIC), Faculty of Science, Mahidol University, Bangkok 10400, Thailand

<sup>e</sup> Department of Biochemistry, Faculty of Science, Mahidol University, Bangkok 10400, Thailand.

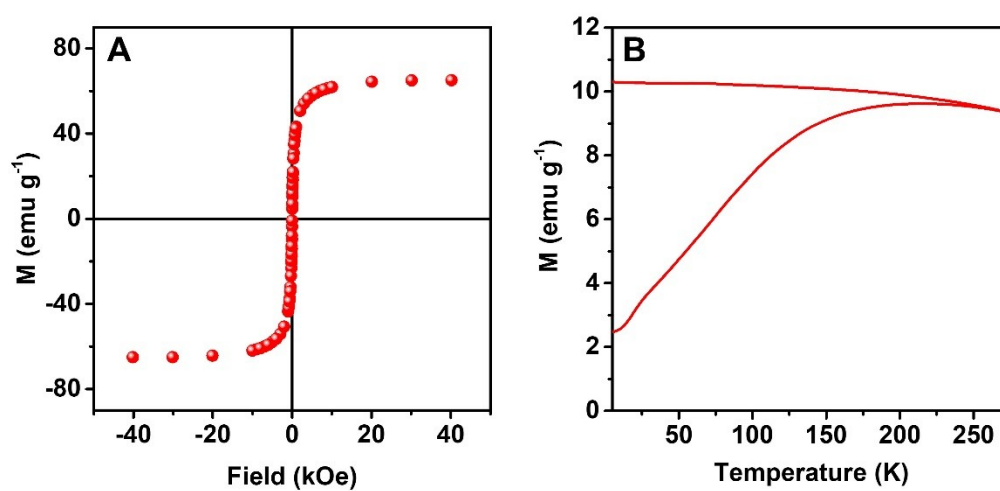
E-mail: kanlaya.pra@mahidol.edu

## Supplementary figures

**Figure S1.** TEM images of (A) SPIONs, (B) Rf-SPIONs and (C) C-SPIONs.

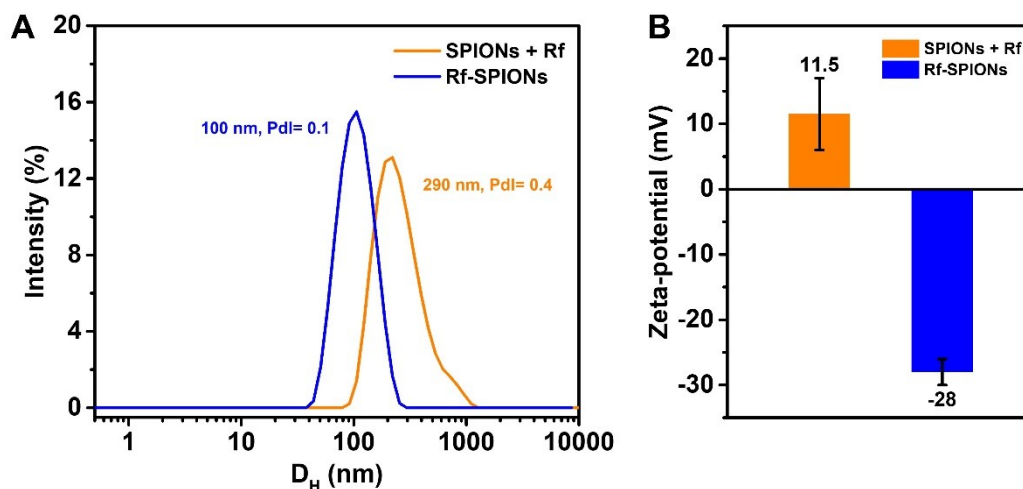


**Figure S2.** C-SPIONs: (A) Field-dependent magnetization measured at 300 K, and (B) Zero-field and field cooled magnetization (ZFC/FC) versus temperature curves recorded with an applied field of 50 Oe.

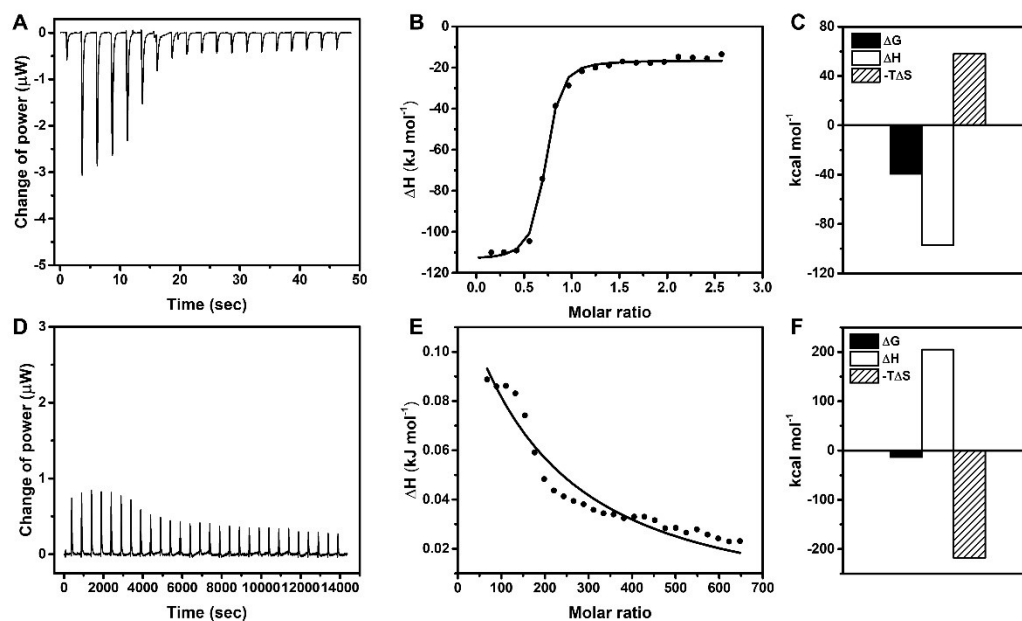


*Supplementary figures*

**Figure S3.** (A) Hydrodynamic diameter distribution, and (B) Zeta-potential of Rf-SPIONs and mixture of uncoated SPIONs and Rf.

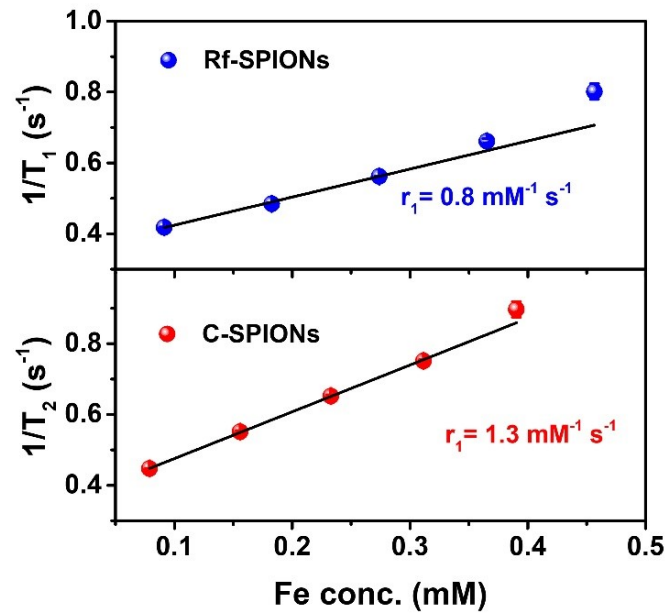


**Figure S4.** Raw ITC data, integrated heat plot, and thermodynamic parameters of the binding between RCP with free Rf (A-C) and HSA with Rf-SPIONs (D-F).

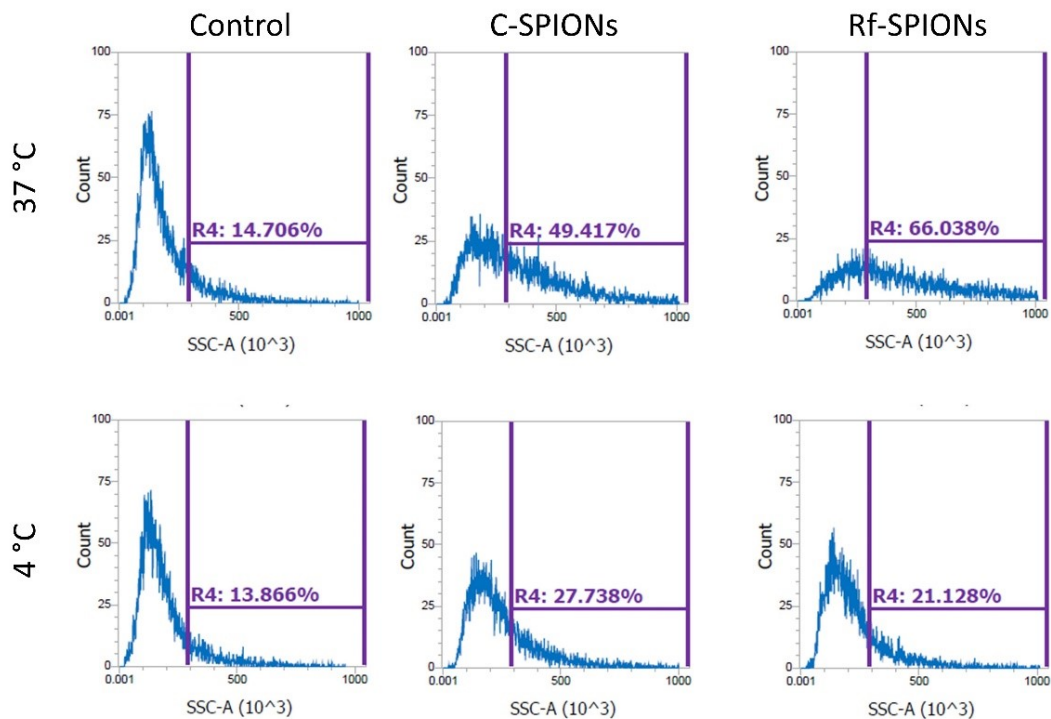


*Supplementary figures*

**Figure S5.** Plot of  $T_1^{-1}$  versus Fe concentration of Rf-SPIONs (blue) and C-SPIONs (red) in water



**Figure S6.** Histogram plots of SSC-A signals of MCF-7 cells incubated with Rf- or C-SPIONs for 24 h at 37 and 4 °C.



*Supplementary figures*

**Table S1.** Mean SSC-A signals of flow cytometry measurements.

<b>Temperature</b>	<b>Samples</b>	<b>Mean SSC-A signals</b>
37 °C	Control	189,437
	C-SPIONs	335,525
	Rf-SPIONs	423,807
4 °C	Control	188,018
	C-SPIONs	248,636
	Rf-SPIONs	223,897