

## **Supplementary information (SI)**

### **Protein Corona Composition of Superparamagnetic Iron Oxide Nanoparticles with Various Physico-Chemical Properties and Coatings**

**Usawadee Sakulkhu<sup>1</sup>, Morteza Mahmoudi<sup>2,3</sup>, Lionel Maurizi<sup>1</sup>, Jatuporn Salaklang<sup>1</sup>, Heinrich Hofmann<sup>1</sup>**

<sup>1</sup>Laboratory of Powder Technology, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

<sup>2</sup>Department of Nanotechnology, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

<sup>3</sup>Nanotechnology Research Center, Faculty of Pharmacy, Tehran University of Medical Sciences, Tehran, Iran

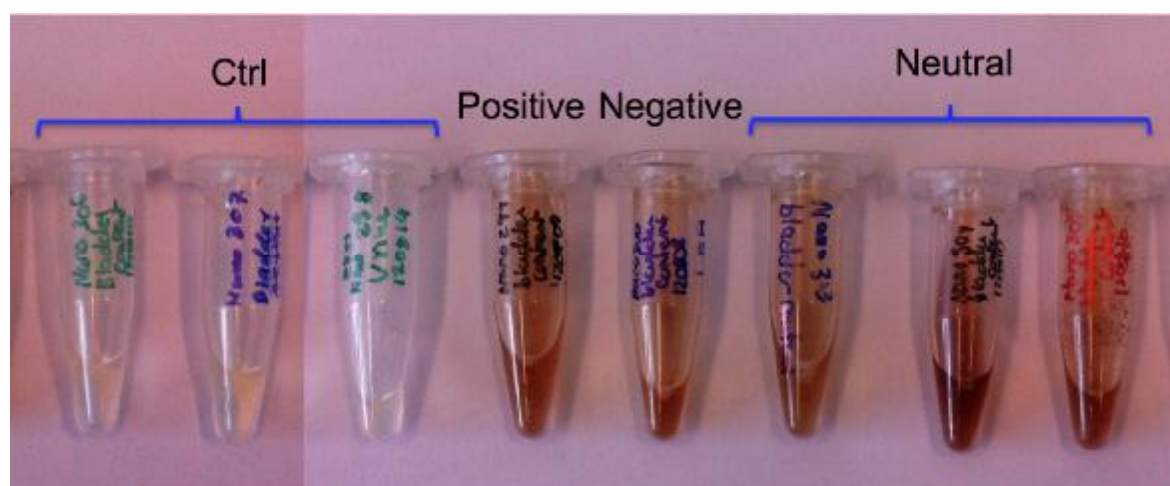
Correspondence to: (MM) [Mahmoudi-m@tums.ac.ir](mailto:Mahmoudi-m@tums.ac.ir); (HH) [Heinrich.Hofmann@epfl.ch](mailto:Heinrich.Hofmann@epfl.ch)

### Biodistribution and Renal Excretion of PVA coated SPION

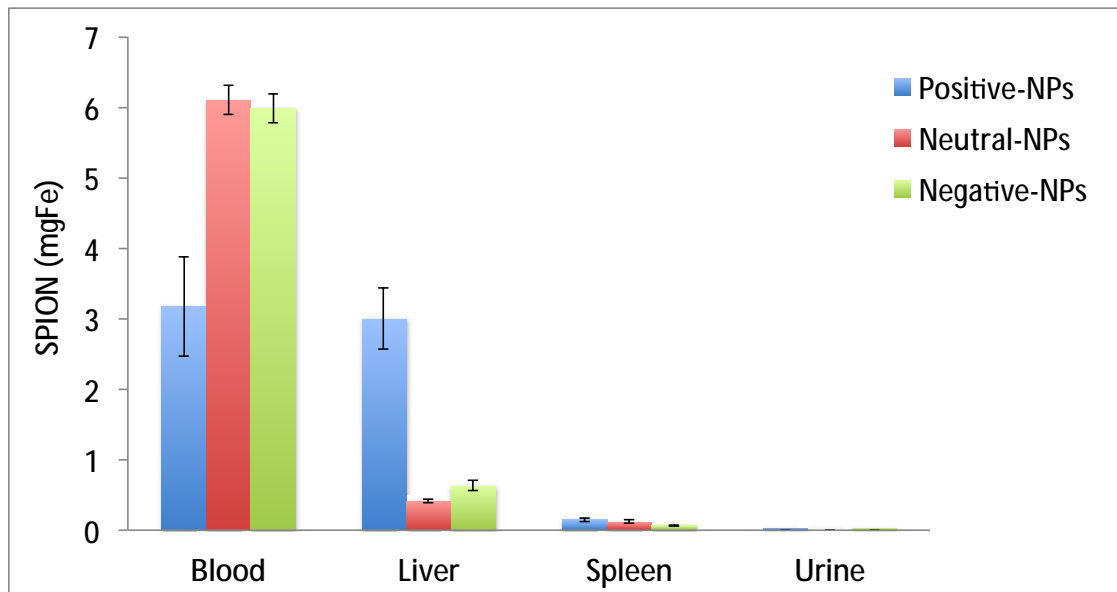
The urine fractions of NPs-injected rats are brownish colour while the urine fractions of control rats are clear light yellowish (Figure 1). No magnetization was observed in the brownish urine samples indicating an absence of SPIONs in urine. This brownish colour is the aggregates of excreted PVA and urine pigment as reported by Jiang et al.[1] who studied a biodistribution of intraperitoneally administered PVA in mice. Glomerular membrane in a kidney plays an important role on a size and molar mass selective filtration of NPs and biomolecules. In addition, the renal filtration efficiency also depends on shape, charge, and flexibility of the molecules.

Molecule Rh (nm)	Filtration efficiency	Note
<1.8	fully filterable without any hindrance	molar mass < ca. 10,000 g/mol
1.8 < Rh < 4	partially filterable	
Rh > 4.4	usually cannot be filtered	molar mass > 80,000 g/mol, e.g. globulin

For instance, the spherical molecules of the same molar mass are more difficultly filtered compared to flexible and linear molecules. In addition, due to the negative charge on the membrane pores, the size cut off is smaller for negative particle (such as plasma proteins) than for neutral or positive particles [2]. The reported critical cut-off of PVA in renal filtration is 30,000 g/mol. Jiang et al. [1] observed that PVA up to 195000 g/mol with molecule size (Rh) of 13 nm that are far above the limits of glomerular filtration can be excreted gradually through kidney for a long time without damaging renal glomeruli [1]. The polymer using in our work are 14000, 80000-140000 and 30000 - 50000 g/mol for neutral (-OH), positive (-NH<sub>2</sub>) and negative (COOH) PVA, respectively. Regarding to these statements in literature, we expected that only PVA, but not SPIONs, could be eliminated through the kidneys into the urine. This interpretation is confirmed by the absent of SPIONs in urine. Different surface NPs showed different biodistribution. As revealed in Figure 2, NPs mostly retained and found in the liver for positive NPs and in the blood for both neutral and negative NPs. The remaining was found in the other organs for instance brain, thymus, heart and was detected in range of 0-0.2 mg.



**Supplementary Figure S1:** Urine fractions of control (Ctrl=urine from non-NPs injected rats) and NP-injected rats



**Supplementary Figure S2:** Biodistribution of 7 mg<sub>Fe</sub> PVA coated SPION in rats 15 min after the injection. The experiments were done with 3 rats per each type of NPs.

**Reference**

1. Jiang YJ, Schadlich A, Amado E, Weis C, Odermatt E, Mader K, Kressler J: **In-vivo studies on intraperitoneally administrated poly(vinyl alcohol)**. *J Biomed Mater Res B* 2010, **93B**(1):275-284.
2. Venturoli D, Rippe B: **Ficoll and dextran vs. globular proteins as probes for testing glomerular permselectivity: effects of molecular size, shape, charge, and deformability**. *Am J Physiol-Renal* 2005, **288**(4):F605-F613.