Non specific binding of iron oxide magnetic nanocrystals with various surface modifications

Introduction

Non-specific binding (NSB) is a common problem for nanocrystals due to the large surface area to volume ratio. Non specific binding includes charge-charge interaction and hydrophobic interactions of the nanocrystals with different kinds of molecules especially proteins, DNA, etc. The most popular surface modification method to eliminate NSB of nanocrystals is with the use of poly ethylene glycol (PEG). We demonstrate here a comparative study of NSB among different iron oxide magnetic nanocrystals that were modified with different types of PEG.

Materials:

Ocean's iron oxide magnetic nanoparticles SHP (with -COOH groups on the surface), SPP (with -COOH groups on the surface and PEG coating), SMG (-OH groups on the surface with PEG coating); horse radish peroxidase (HRP) as the indicator protein; blocking buffer (cat# BBB); washing buffer (cat #WB).

Procedure:

1. **Protein binding with IO magnetic nanoparticles:** Incubate IO magnetic nanocrystals diluted to 1 mg/mL in washing buffer with 200x molar excess HRP at RT for 2 h.
2. **Washing:** Wash the particles with 1 mL BBB twice and washing buffer twice.
3. **Substrate coloration:** Determine the number of HRP on the surface of the IOs by substrate coloration. The colors of substrates caused by HRP on the surface of IOs were compared with the linear range of the HRP-substrate standard curve.

Results and Discussions

The comparison of non specific bindings among Ocean's iron oxide nanocrystals SHP, SPP and SMG was presented in Table 1. With PEG coating, non specific binding decreased 10 times from SHP to SPP. The change of surface groups from –COOH to –OH decreased another 18 times.

Table 1. NSB of IO magnetic nanocrystals with various surface modifications. HRP was non-specifically absorbed on the surface of IO naocrystals. After extensive washing steps, HRP remaining on the surface was determined.

	SHP30	**SPP30**	**SMG30**
Number of HRP per IO crystal	**2.6**	**0.256**	**0.014**