Designed Nanocomposite Magnetic Beads for isolation of Circulating Tumor Cells (CTC)

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Abstract

In recent years, there has been an increasing interest in the isolation of Circulating Tumor Cells (CTC), which are metastasis cells circulating in peripheral blood of cancer patients, for prognostic, diagnostic and therapeutic applications. Magnetic separation is one of the methods of choice for cell isolation. For this purpose, submicrometer polymeric beads loaded with different content of magnetite nanoparticles (30-44 wt%) were prepared by mini-emulsion polymerization and characterized in terms of size, and magnetic properties. The beads were functionalized with a customized method with Protein A for incorporating antibodies and studying their interaction with EpCAM cancer cells. Superparamagnetic and colloidally stable polymeric beads with size between 140 and 200 nm were obtained. Moreover, they were covalently covered by protein A and therefore enabled to be coupled with antibodies. After incubation of the polymeric beads with EpCAM cells, it was confirmed by flow cytometry that the beads were specifically and efficiently adsorbed on the cell´s surface and without aggregation of free beads. It was found that the magnetic isolation of labelled cells, became more efficient as the magnetite content increased up to 44 wt%. Notably, the synthesized nanocomposite polymer beads were more efficient for cell isolation than micron-sized commercial beads, which much improves sample stability for handling and enables a larger specific contact area.

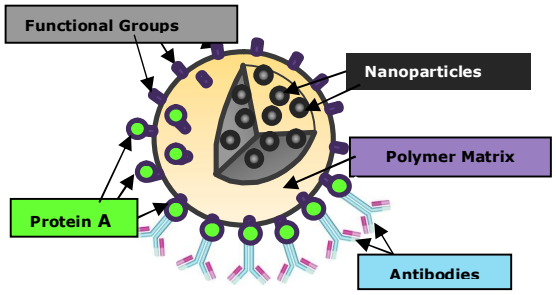

Figure 1: Bead Structure.

Magnetite content (wt%)	Average Size by SEM (nm)	Density (g/cc beads)	Saturation Magnetization (emu/cc beads)
44	**142**	**2.83**	**73**
40	**135**	**2.67**	**65**
32	**176**	**2.32**	**44**
30	**161**	**2.27**	**43**

Table 1: Bead Characteristics.

Magnetite content (wt%)	Average Size by SEM (nm)	Cell Isolation (%)
44	142	70
30	161	57
37 (Comercial)	1000	62
37 (Comercial)	2800	58

Table 2: Cell Isolation Efficiency of beads.

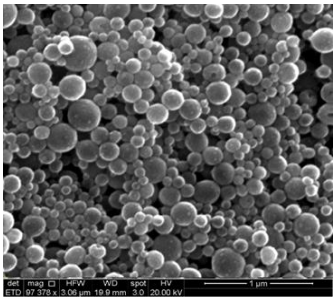

Figure 2: SEM image of beads.