Anti-EpCAM-Immobilized Albumin-Coated Monodisperse Magnetic Poly(Glycidyl Methacrylate) Microspheres for Detection of Circulating Tumor Cells

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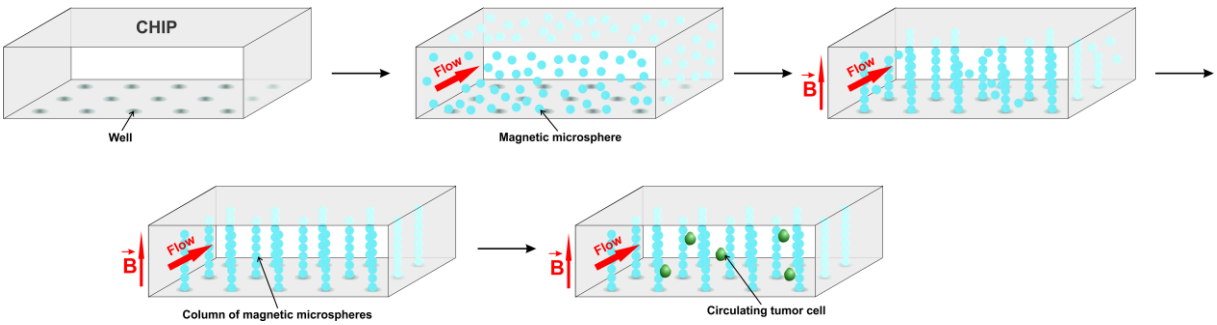
Highly magnetic and monodisperse microspheres were prepared for use in microfluidic immunomagnetic cell sorting, with a specific application to the capture of circulating tumor cells (CTCs). Multi-step swelling polymerization method in the presence of cyclohexyl acetate porogen was used for preparation of monodisperse (4 μm) macroporous poly(glycidyl methacrylate-*co*-2-[(methoxycarbonyl)methoxy]ethyl methacrylate-*co*-ethylene dimethacrylate) microspheres. After their hydrolysis and ammonolysis, carboxyl and amino groups were introduced in the microspheres. Iron oxide was then precipitated in the microspheres to render them magnetic. Repeated precipitation made possible to raise the iron oxide content to more than 30 wt.%. The microspheres were characterized by electron microscopy, atomic absorption and IR spectroscopy and superconducting quantum interference device (SQUID), To minimize non-specific adsorption of the microspheres in a microchannel, and of cells on the microspheres, they were coated with albumin crosslinked with glutaraldehyde. Antibodies of epithelial cell adhesion molecule (anti-EpCAM) were then immobilized on the albumin-coated magnetic microspheres using the carbodiimide method. Capture of MCF7 cells as a model of CTCs by the microspheres with immobilized anti-EpCAM IgG was performed in a batch experiment. Finally, MCF7 cells were captured by the anti-EpCAM-immobilized albumin-coated magnetic microspheres in an Ephesia chip. A very good rejection of lymphocytes was achieved. Thus, the feasibility of capturing of circulating tumor cells by albumin-coated monodisperse magnetic poly(glycidyl methacrylate) microspheres with immobilized anti-EpCAM in a microfluidic device was confirmed.



The Ephesia system. Alligment of magnetic microspheres into columns inside the chip under magnetic field and capture of epithelial cells.

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