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Magnetic Microparticles

- Super-paramagnetic particles yield fast, antibody assisted separations.
- Polymer spheres of controlled size and shape.
- Surface for passive coupling or covalent coupling of proteins.

Our polymer synthesis group, a world leader in the field of polystyrene latex manufacturing, has developed a unique polymer - iron particle hybrid. These particles are paramagnetic in the sense that they will respond to a magnetic field but will easily re-suspend in the absence of a magnetic field. This has been accomplished by incorporating small quantities of the iron material throughout the polymer. Thus relatively large amounts of iron (>20%) can be introduced into the particle without the particles retaining any residual magnetism (remanence).

Properties and Advantages:
The polymer background allows us to control many of the other variables necessary for successful biomedical applications. Some of the unique features that a polystyrene magnetic particle will provide are listed below:

- Low density - (2 gm/cc or less) will stay in suspension without settling for long periods of time.
- Spherical particle sizes - uniform surface area for coatings.
- High capacity of functional groups - covalent coupling sites for protein attachments.

The magnetic content of these particles is utilized as a fast, efficient means of separating the particles from the supernatant. The particles are packaged in DI Water. Separations can be realized in minutes using commonly available lab magnets. These magnets are generally referred to as "rare earth" magnets. We use cobalt - samarium or neodymium - iron magnets (Catalog #19772) during our production processes. The special properties of these magnetic particles are listed below:

- Easily dispersed after attraction to a magnetic field, gentle sonication or simply shaking the container.
- No leaching of iron from the particles.
- No aggregation of the particles on their own.
- Particles are compatible with aqueous solutions.
- Harmful, repeated centrifugation is avoided through magnetic separations.

Cellular Isolation Applications:
The principle application for these particles are for molecular or cellular isolation.[1] Immunoglobulins targeting the desired material can be attached to the surface of the particles for directed isolation. A typical isolation of selected lymphocytes is outlined below:
Step 1 Mononuclear cells may be isolated from whole blood or partially purified by any of a number of centrifugation techniques using density gradient media[2] or Nylon Wool Fiber filtration (Cat. #18369, Data Sheet #425).
Step 2 Wash cells in the appropriate cell suspension for the particular cell line.
Step 3 Prepare antibody coated magnetic particles using the protocols outlined in data sheets 238E, 238C and 238D. The antibody may be monoclonal or polyclonal but must be specific for the particular cell line to be isolated. Alternatively this technique can be used to remove such cells or compounds which are undesirable in a cell suspension by developing antibodies to the offending compound.[3]
Step 4 Incubate the cell suspension and the coated beads. The reaction should be completed in a brief amount of time with incubations from 15 to 60 minutes successful. Our work is generally done within 30 minutes using gentle agitation or mixing. The amount of beads to be added is generally about 10 times the number cells to be isolated. This will result in an excess of the beads as less than 5 beads are bound per cell. The size of these beads can be either the 0.05 micron or the 1-2 micron sizes.
Step 5 Subject a diluted amount of the incubation mixture to a moderate magnetic field and pipet off the supernatant.
Step 6 Wash the resultant material three times.
Diagnostic Applications:

The magnetic particles can be used as solid supports for immunoassays in single use or automated assays. Automated assays using the magnetic particles can quickly wash or separate the reaction components to reduce assay time or increase performance. The ability of polystyrene to bind protein molecules without significantly changing the biochemical activities is the basis for most particle immunoassays.[4] Our use of polystyrene as the backbone of these particles is crucial to the easy assimilation of our particles into most binding protocols.
For this application, our diagnostic clients rely on the services of a primary manufacturer. We manufacture individual lots in large bulk quantities. We can reserve entire lots for periodic releases and, as the manufacturer, we can control the lot to lot consistency of the products. For those customers requiring slight or major adjustments in the catalog offerings, our production staff can react to custom synthesis requirements.

Coupling of proteins:
Since the particles are primarily polystyrene, the normal methods for attaching proteins to particles will apply. The advantage of these particles is that magnetic separations are quicker and safer than centrifugation during the washing and isolation steps. Our proprietary methods for attaching proteins to polystyrene beads can be amended for use with these magnetic particles. Copies of these protocols can be sent upon request. Our protocols deal with passive adsorption to plain surfaces (Data Sheet #238E) and covalent attachments to functionalized surfaces. We offer 2 types of functional group surfaces carboxylate (Data Sheet #238C) and amino (Data Sheet #238D).

Our production staff has produced a limited number of magnetic particles with proteins already attached. The techniques we used are outlined in our binding protocols. FOR MORE INFORMATION ON OUR FULL LINE OF POLYSTYRENE PARTICLES AND FLUORESCENT PARTICLES, PLEASE SEE Data Sheets #238 AND #431.

Handling Information:
The particles are packaged in DI water only. We do not incorporate any biocides at time of manufacture. The particles are stable to additions of biocides such as sodium azide or thimerosol. Particles can be sterilized by gamma radiation, however autoclaving can result in irreversible aggregation. The particles should be stored at 4°C.

Ordering Information:

Cat. #	Description	Size
18190	Polystyrene latex particles, paramagnetic 1-2µ	5ml
18598	Carboxylated paramagnetic polystyrene particles, 1-2µ	5ml
19233	Carboxylated paramagnetic particles, 12µ, Range ±5µ	5ml
19133	Fluorescent paramagnetic particles, 1-2µ	5ml
18879	Amino paramagnetic particles, 1-2µ	5ml
19772	Neodymium iron magnet 1.65 cm x 0.88 cm x 0.20 cm	1ea
19544	Protein A-Micro Magnetite Particles 1.0µ	5ml

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Order online anytime at **www.polysciences.com**

ALSO, please see our extensive BioMag® line of superparamagnetic particles at www.polysciences.com

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2. Boyum, A., Methods in Enzymology, 108, 88, (1984).
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