Colloidal Hydrogel Particles with Tunable Chemistry, Geometry, and Flexibility
Technology #13461

Applications
This technology is a method for synthesizing micro-particle colloids with applications in food, cosmetics, paint, or as a pharmaceutical therapeutic or diagnostic.

Problem Addressed
Colloids are a suspension of micro-particles contained in another medium, such as a liquid or gel. Colloids can occur naturally, for example, blood and milk, and synthetic colloids are important in a wide variety of industries including food, cosmetics, and paints. Micro-particle colloid manufacturing has thus far been limited in the range of sizes, shapes, and varying stiffness that can be achieved using current technologies. This technology is a novel micro-particle manufacturing technique that gives complete control over size, shape, chemical composition, and stiffness.

Technology
This technology uses stop-flow soft-lithography to make micro-particle colloids. First, a light-polymerizing pre-polymer mixture is flowed through a microfluidic chamber. Next, the solution flowing through the chamber is exposed to a pulse of shaped illumination to polymerize the pre-polymer mixture into the desired shape and size. Finally, the flow carries the micro-particles out of the microfluidic chamber for collection. Importantly, all characteristics of the micro-particles can be controlled. The chemical composition dictates the functional properties and physical stiffness of the final micro-particles, and the size/shape are dictated by the illumination filter used to polymerize the particles. Additionally, the particles can be functionalized with coatings such as antibodies or imaging molecules. As a proof of principle, the inventors demonstrated generation of ring-shaped micro-particles with similar size and stiffness to red blood cells (RBCs), and these micro-particle RBC-mimics can deform to fit through capillary-sized openings with physiologically relevant flow forces.

Advantages
- Micro-particle colloids with fully tunable stiffness, size, shape, and chemical properties
- Can be functionalized with modifications such as antibodies or imaging agents

Categories For This Invention:
Materials
Micro & Nanotech
Polymers (Materials)
Intellectual Property:
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Publications:
Squishy Non-Spherical Hydrogel Microparticles
Macromolecular Rapid Communications
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External Links:
Doyle Group
https://doylegroup.mit.edu/
BioMEMS Resource Center
http://www.biomemsrc.org/