CLAIMS

1. A hydrogel composition comprising:
a plurality of alginic acid molecules;
divalent cations crosslinking the alginic acid molecules;
a plurality of branched polyethylene glycol molecules comprising a plurality of attachment points; and
one or more binding agents,
wherein the alginic acid molecules are conjugated to the branched polyethylene glycol molecules by a first of the attachment points, and the one or more binding agents are conjugated to the branched polyethylene glycol molecules by a second of the attachment points, and wherein the hydrogel composition dissolves in the presence of a chelator.

2. The composition of claim 1, wherein the branched polyethylene glycol molecules are four-arm molecules.

3. The composition of claim 1, wherein the one or more binding agents is an antibody, antibody fragment, peptidomimetic compound, peptide, small molecule, or nucleic acid.

4. The composition of claim 3, wherein the antibody is selected from the group consisting of antibodies against GPR49, LGR5, CD24, FLK1, CD45, CD31, CD34, and sca-1 proteins.

5. A method of capturing and releasing target biological materials from a sample, the method comprising:
(a) providing a microfluidic device comprising one or more chambers for receiving fluids, wherein at least one of the one or more chambers comprises a surface coated with a hydrogel composition, the hydrogel composition comprising:
a plurality of alginic acid molecules; divalent cations crosslinking the alginic acid molecules; branched polyethylene glycol molecules comprising a plurality of attachment points; and one or more binding agents that bind to the target biological materials;
wherein the alginic acid molecules are conjugated to the branched polyethylene glycol molecules by a first of the attachment points, and the one or more binding agents are conjugated to the branched polyethylene glycol molecules by a second of the attachment points, and wherein the hydrogel composition dissolves in the presence of a chelator;
(b) introducing the sample comprising target and non-target biological materials into the one or more chambers under conditions effective to bind the target biological materials to the hydrogel composition; and

(c) releasing the target biological materials using a chelator.

6. The method of claim 5, further comprising removing the unbound non-target materials from the sample prior to step (c).

7. A method of making a hydrogel composition, the method comprising:
(a) reacting branched polyethylene glycol molecules comprising a plurality of attachment points with one or more binding agents in a buffer; and
(b) reacting the branched polyethylene glycol binding agent solution with alginic acid molecules and divalent cations to form a functionalized hydrogel, the functionalized hydrogel comprising branched polyethylene glycol molecules conjugated at least one alginic acid molecule by a first of the attachment points and further conjugated to one or more binding agents by a second of the attachment points, wherein the hydrogel composition dissolves in the presence of a chelator.

8. The method of claim 7, wherein the polyethylene glycol molecule is a four-arm molecule.

9. The method of claim 7, wherein the one or more binding agents is an antibody, antibody fragment, peptidomimetic compound, peptide, small molecule, or a nucleic acid.

10. The method of claim 9, wherein the antibody is selected from the group consisting of antibodies against GPR49, LGR5, CD24, FLK1, CD45, CD31, CD34, and sca-1 proteins.

11. The hydrogel composition of claim 1, wherein the divalent cations are Ca^{2+} cations.

12. The method of claim 5, wherein the divalent cations are Ca^{2+} cations.

13. The method of claim 7, wherein the divalent cations are Ca^{2+} cations.