CLAIMS:

1. A polyacrylamide-based copolymer comprising:

a water-soluble carrier monomer selected from the group consisting of *N*-(3-methoxypropoyl)acrylamide (MPAM), 4-acryloylmorpholine (MORPH), *N*,*N*-dimethylacrylamide (DMA), *N*-hydroxyethyl acrylamide (HEAM), and acrylamide (AM); and

a functional dopant monomer selected from the group consisting of *N*-[tris(hydroxymethyl)-methyl]acrylamide (TRI), 2-acrylamido-2-methylpropane sulfonic acid (AMP), (3-acrylamidopropyl)trimethylammonium chloride (TMA), *N*-isopropylacrylamide (NIP), *N*-*tert*-butylacrylamide (TBA), and *N*-phenylacrylamide (PHE).

2. The copolymer of claim 1, wherein:

the water-soluble carrier monomer is selected from the group consisting of *N*-(3-methoxypropoyl)acrylamide (MPAM) and 4-acryloylmorpholine (MORPH); and

the functional dopant monomer is selected from the group consisting of *N*-isopropylacrylamide (NIP) and *N*-phenylacrylamide (PHE).

3. The copolymer of claim 1 or 2, wherein the weight percent (wt%) of the water-soluble carrier monomer is about 70% to about 98%, about 70% to about 95%, about 75% to about 90%, or about 74% to about 80%.

4. The copolymer of claim 1 or 2, wherein the weight percent (wt%) of the functional dopant monomer is about 2% to about 30%, about 5% to about 30%, about 5% to about 26%, or about 5% to about 10%.

5. The copolymer of claim 1 or 2, wherein the functional dopant monomer is NIP and is about 5% to about 30%, about 10% to about 28%, about 2% to about 30%, about 5% to about 26%, or about 20% to about 26% by weight of the copolymer.

6. The copolymer of claim 5, wherein the water-soluble carrier monomer is MORPH.

7. The copolymer of claim 5, wherein the water-soluble carrier monomer is MPAM.

8. The copolymer of claim 1 or 2, wherein the functional dopant monomer is PHE.

9. The copolymer of claim 1, wherein the functional dopant monomer is TRI and is about 3% to about 17%, about 4% to about 6%, about 7% to about 12%, or about 13% to about 17% by weight of the copolymer.

10. The copolymer of claim 1 or 2, wherein a degree of polymerization is about 10 to about 500, about 20 to about 200, or about 50.

11. The copolymer of claim 1 or 2, wherein a molecular weight of the copolymer is about 1,000 to about 40,000 g/mol, about 1,000 to about 30,000 g/mol, about 2,000 to about 10,000 g/mol, about 3,000 to about 7,000 g/mol, or about 4,000 to about 6,000 g/mol.

12. A polyacrylamide-based copolymer comprising:

a water-soluble carrier monomer; and

a functional dopant monomer; wherein:

a weight percent (wt%) of the water-soluble carrier monomer is about 70% to about 98%;

a weight percent (wt%) of the functional dopant monomer is about 2% to about 30%;

an average molecular weight (M_n) of the polyacrylamide-based copolymer is about 1,000 g/mol to about 30,000 g/mol; and

a degree of polymerization is about 10 to about 250.

13. The copolymer of claim 12, wherein the water-soluble carrier monomer is selected from the group consisting of *N*-(3-methoxypropoyl)acrylamide (MPAM), 4-acryloylmorpholine (MORPH), *N*,*N*-dimethylacrylamide (DMA), *N*-hydroxyethyl acrylamide (HEAM), and acrylamide (AM).

14. The copolymer of claim 12 or 13, wherein the functional dopant monomer is selected from the group consisting of *N*-[tris(hydroxymethyl)-methyl]acrylamide (TRI), 2-acrylamido-2-methylpropane sulfonic acid (AMP), (3-

acrylamidopropyl)trimethylammonium chloride (TMA), *N*-isopropylacrylamide (NIP), *N*-*tert*-butylacrylamide (TBA), and *N*-phenylacrylamide (PHE).

15. A composition comprising the polyacrylamide-based copolymer of any one of claims 1-14 and a pharmaceutically acceptable excipient.

16. A composition comprising the copolymer of any one of claims 1-14, wherein the composition is a cosmetic product, a hair product, a lotion, a food product, a veterinary product, or a nutritional product.

17. A composition comprising the copolymer of any one of claims 1-14 and a protein.

18. The composition of claim 17, wherein the protein is susceptible to aggregation in an aqueous medium.

19. The composition of claim 17 or 18, wherein the protein is selected from the group consisting of antibodies and fragments thereof, cytokines, chemokines, hormones, vaccine antigens, cancer antigens, adjuvants, and combinations thereof.

20. The composition of claim 19, wherein the protein is a monoclonal antibody.

21. The composition of any one of claims 17-20, wherein the protein is insulin, or an analog thereof.

22. A method for increasing stability of a protein formulation, comprising adding about 0.005 wt% to about 5 wt% of the copolymer of any one of claims 1-11 to the protein formulation.

23 A method for reducing the rate of aggregation of a protein in an aqueous composition, comprising adding about 0.005 wt% to about 5 wt% of the copolymer of any one of claims 1-11 to the protein formulation.