Adhesives and sealants are ubiquitous in numerous industries, including automotive, aerospace, packaging, and construction. Many adhesives and sealants, however, are toxic, which results in harmful effects on health and the environment. Two new adhesives formed without toxic byproducts have been developed. The first is a complex coacervate based adhesive formed by mixing oppositely charged polyelectrolytes (PEs). The PEs can rapidly change forms as solution conditions alter, allowing the adhesive to be injected as a liquid and then coagulate into a solid hydrogel adhesive as pH or salt concentrations adjust. Gelation would keep the material in place to fill voids and the material could be either biodegradable or non-biodegradable depending on the application. Initially designed for physiological conditions, the coacervate offers potential application in depots, fillers, and adhesives. The second adhesive is a viscoelastic hydrogel with an adhesive surface comprised of cross-linked acrylic polymers. The new adhesive exhibits resilience and high stiffness at low strains but low resilience and high flexibility at high strains. Heat is released as covalent bonds break and the hydrogel recovers its original stiffness as strain is alleviated, preventing failure. The adhesive layer adheres to wet and submerged substrates, enabling underwater use.

**TECHNOLOGY SUMMARY**
Adhesives and sealants are ubiquitous in numerous industries, including automotive, aerospace, packaging, and construction. Many adhesives and sealants, however, are toxic, which results in harmful effects on health and the environment. Two new adhesives formed without toxic byproducts have been developed. The first is a complex coacervate based adhesive formed by mixing oppositely charged polyelectrolytes (PEs). The PEs can rapidly change forms as solution conditions alter, allowing the adhesive to be injected as a liquid and then coagulate into a solid hydrogel adhesive as pH or salt concentrations adjust. Gelation would keep the material in place to fill voids and the material could be either biodegradable or non-biodegradable depending on the application. Initially designed for physiological conditions, the coacervate offers potential application in depots, fillers, and adhesives. The second adhesive is a viscoelastic hydrogel with an adhesive surface comprised of cross-linked acrylic polymers. The new adhesive exhibits resilience and high stiffness at low strains but low resilience and high flexibility at high strains. Heat is released as covalent bonds break and the hydrogel recovers its original stiffness as strain is alleviated, preventing failure. The adhesive layer adheres to wet and submerged substrates, enabling underwater use.

**FEATURES AND BENEFITS**
- Eliminates harmful byproducts.
- Enhances mechanical properties, such as elasticity and strain, in adhesives.
- Exhibits adjustable properties.

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**INVENTOR PROFILE**
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