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Zein and Tannic acid based bio-inspired adhesives for surgical applications

Bio-inspired zein/tannic acid sealants outperform fibrin glue for surgical wet-tissue repair.

Researchers at Purdue University have developed wet-tissue adhesives that can be used to seal tissues instead of sutures and staples. Although several surgical sealants and adhesives are available commercially, most of them do not meet all the desired design criteria: be able to set in a wet environment, create strong bonds between tissues, and exhibit no toxicity. The Purdue researchers' adhesives meet all three criteria. The adhesives are derived from zein (a corn protein) and a catechol-containing compound such as tannic acid, a compound used by mussels for adhesion. Varying the solvent concentration, ratio of the solvents, ratio of zein to tannic acid, and pH of the solvents can affect the properties of the resulting sealant, allowing a specific application for the adhesive.

Technology Validation: The Purdue researchers made holes in pressurized tissues to create rapid fluid flow from the sites of damage. These holes were repaired with the new bio-adhesive/bio-sealant. Fluid flow was stopped. Burst pressures of the resulting repairs with bio-adhesive/bio-sealant were tested on a variety of tissue substrates including porcine skin, intestines, liver, heart, stomach, lungs, dura, and aorta and showed that the adhesives

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can withstand pressures higher than normal physiological pressure experienced. The adhesives also performed better than the commercial standard fibrin tissue sealant (Tisseel) when tested on most tissues. Ex vivo studies on rat cadavers validate tissue sealing ability on topical wounds. Ex vivo studies on intestines and porcine stomach validated tissue sealing ability of the sealant on internal wounds and long-term adhesion in wet environments. The researchers' adhesive Z40T7 demonstrated instant sealing ability in actively leaking wounds on an ex vivo intestine model at physiological pressures of 0.6 psi.

Advantages

- Inexpensive

- Bio-based

- Non-toxic

- Formulated around neutral pH

Applications

- Adhesives for medical and/or surgical applications

TRL: 3

Intellectual Property:

Provisional-Patent, 2022-08-19, United States

PCT-Patent, 2023-08-21, WO

NATL-Patent, 2023-08-21, Mexico

NATL-Patent, 2023-08-21, Canada

NATL-Patent, 2023-08-21, Europe

NATL-Patent, 2023-08-21, India

NATL-Patent, 2023-08-21, China

NATL-Patent, 2023-08-21, Republic of Korea

NATL-Patent, 2023-08-21, Japan

NATL-Patent, 2025-02-19, United States

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