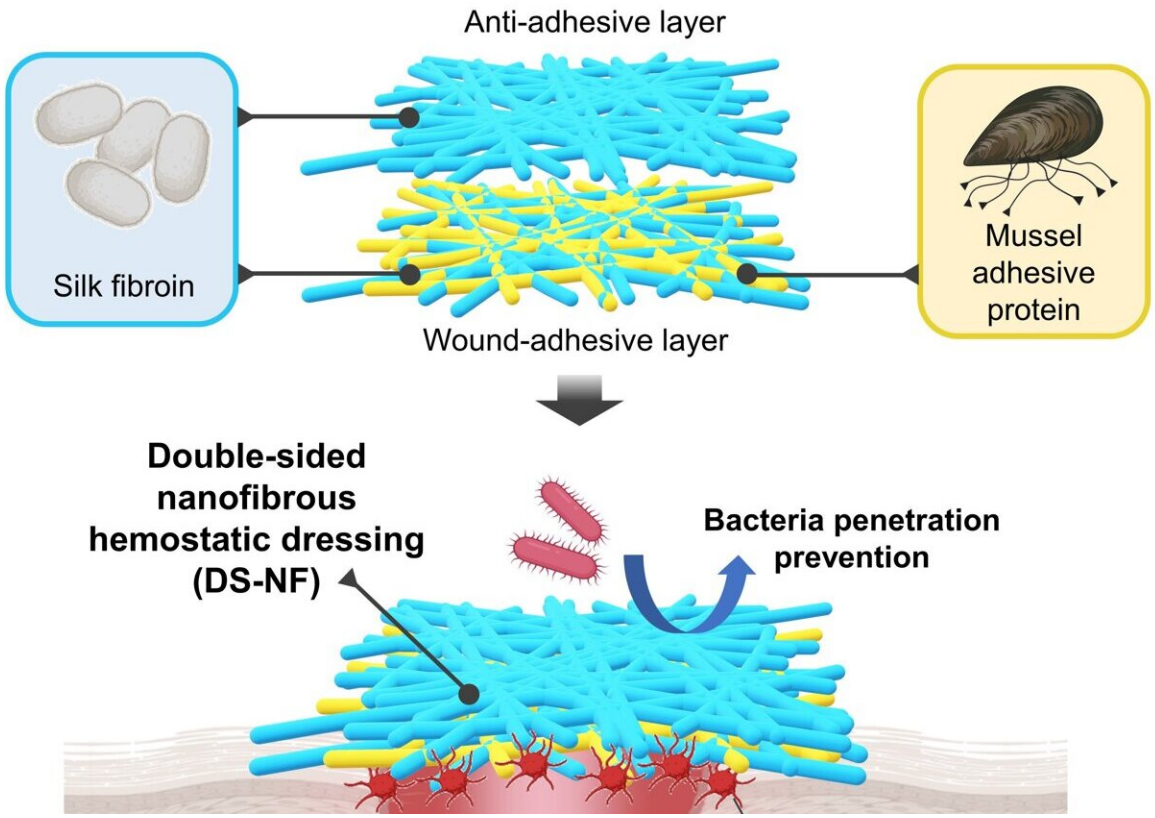
Researchers develop hemostatic agent from mussels and silkworm cocoons to stop organ bleeding

February 23 2024



An absorbent bilayer nanofiber membrane adhesive hemostatic dressing based on mussel adhesion protein and silkworm silk protein. Credit: POSTECH

In recent news, there has been a case where a patient experienced pain

due to a surgical procedure involving sutures, resulting in the unintended presence of gauze within the patient's body. Gauze is typically employed to control bleeding during medical interventions, aiding in hemostasis. However, when inadvertently left in the body, it can lead to inflammation and infection.

Addressing this issue, recent research has been published by researchers focusing on a hemostatic agent derived from mussels and silkworm cocoons. This hemostatic agent has garnered attention in the academic community due to its efficacy in clotting blood and its safety within the body. The paper is published in the journal *Small*.

A collaborative team, led by Professor Hyung Joon Cha (Department of Chemical Engineering and the School of Convergence Science and Technology) and others has developed a bilayer nanofiber membrane hemostat using natural proteins derived from mussels and silkworm cocoons.

Conventional hemostatic agents such as gauze or medical bands are limited to application on the surface of the skin. Although there are certain materials that naturally degrade within the body like fibrin glue and collagen sponges, they necessitate proteins sourced from humans or animals, making them considerably expensive. Moreover, existing hemostatic materials lack consistent adherence to bleeding sites and are prone to infection from external contaminants.

In response, the researchers developed a bilayer adhesive hemostat utilizing mussel adhesive proteins that exhibit strong tissue adhesion underwater and silk fibroin extracted from silkworm cocoons.

In the research, mussel adhesive proteins demonstrated excellent hemostatic effects including platelet activation. The researchers employed methanol vapor to modify the secondary structure of silkworm

silk proteins, resulting in a nanofiber membrane with a hydrophobic outer surface.

In light of this, the team engineered a hemostatic agent featuring an inner layer with mussel adhesion proteins for wound adhesion and an outer protective layer entirely composed of silkworm silk proteins.

Through animal experiments, the hemostatic agent demonstrated rapid acceleration of tissue adhesion and hemostasis in bleeding wounds, effectively preventing the infiltration of water-containing infectious agents such as bacteria. Using two proteins that are both highly biocompatible and biodegradable, the researchers have introduced a novel hemostatic agent capable of clotting blood and providing defense against infection.

Professor Hyung Joon Cha of the POSTECH who led the study said, "We have validated the exceptional hemostatic performance of a multifunctional topical adhesive hemostatic agent that is derived from nature and is based on degradable proteins in the human body." He added, "We will continue further research to assess its applicability in real-world patient care or surgical settings."

More information: Jaeyun Lee et al, Protective Topical Dual-Sided Nanofibrous Hemostatic Dressing Using Mussel and Silk Proteins with Multifunctionality of Hemostasis and Anti-Bacterial Infiltration, *Small* (2024). DOI: 10.1002/smll.202308833

Provided by Pohang University of Science and Technology

https://phys.org/news/2024-02-hemostatic-agent-mussels-silkworm-cocoons.html