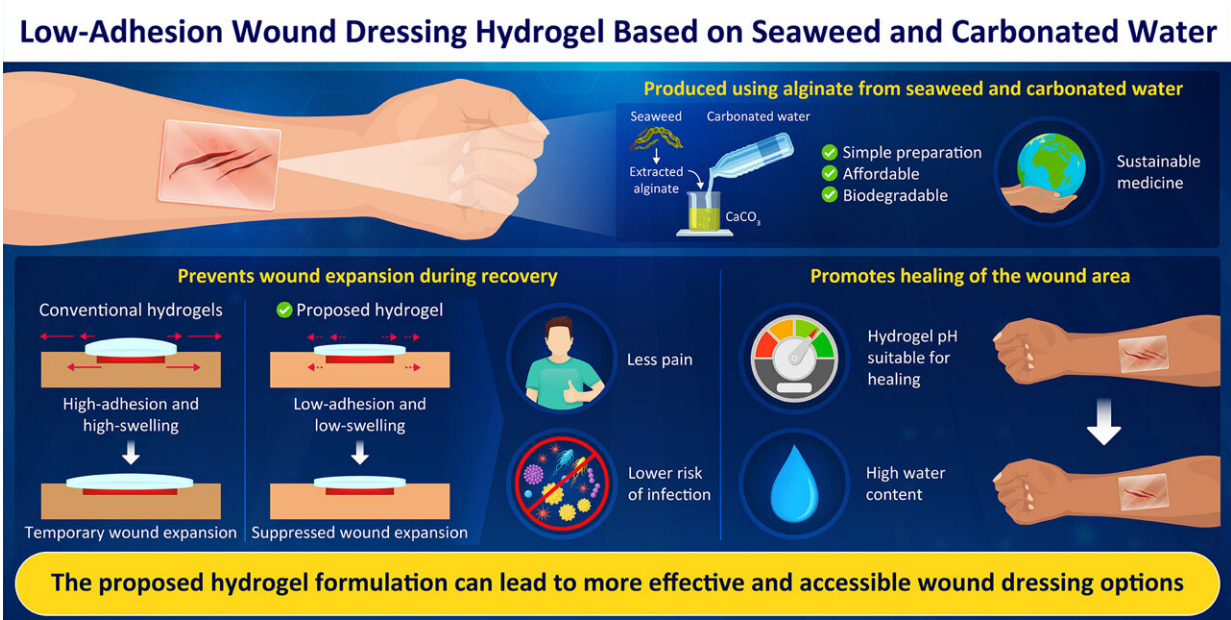


Researchers develop sustainable wound dressing hydrogel based on seaweed and carbonated water

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Low-Adhesion and Low-Swelling Hydrogel Based on Alginate and Carbonated Water to Prevent Temporary Dilatation of Wound Sites
Teshima et al. (2023) | *International Journal of Biological Macromolecules* | DOI: 10.1016/j.ijbiomac.2023.127928

Alginate is a biocompatible and biodegradable substance found in seaweed. Now, researchers from Tokyo University of Science have used alginate from seaweed washed ashore, CaCO₃, and carbonated water to develop a hydrogel which exhibits lower skin adhesion and swelling. These properties, though exactly opposite of conventional wound dressings, can help prevent the expansion of the wound site during recovery and the obtained hydrogel has high wound healing efficacy. Credit: Ryota Teshima from Tokyo University of Science

Acting as the main interface between the internal and the external world, the skin is the largest and most important organ of the human body. It is frequently exposed to many types of physical injuries or wounds, including cuts, scrapes, scratches, infections, and ulcers.

Unfortunately, as one ages, the skin becomes more frail and less capable of healing itself without help. With many countries experiencing a rapid rise in the aging population, the demand for treating such skin wounds has created a greater need for accessible and effective wound care products.

Over the past few decades, hydrogels have received a lot of attention for treating skin wounds. When applied over a lesion, these special gels can promote healing by absorbing discharged fluids (exudates) and keeping the wound protected, well-hydrated, and oxygenated.

However, most developed hydrogels are given adhesive properties to skin tissue to follow skin movement. Since these hydrogels are sticky and adhere to the skin and wound site, they stretch and expand the wound itself once they swell up after absorbing exudates.

This not only causes pain to the user but also puts them at a higher risk of bacterial infection due to the wound area expansion. Therefore, in order to create hydrogels that can effectively treat wounds without interfering with the wound-healing process, it is necessary to experiment with the preparation of hydrogels based on new ideas while utilizing existing [material properties](#).

Against this backdrop, a team of researchers from Tokyo University of Science (TUS), Japan, have now proposed an innovative and highly-value added medical material for treating skin wounds.

As reported in their recent study [published in the *International Journal*](#)

[of Biological Macromolecules](#), they developed a novel, low-cost hydrogel using a component found in seaweed, achieving physical properties utterly different from those of conventional hydrogels.

The study was led by Mr. Ryota Teshima, a Master's student at TUS. Assistant Professor Shigehito Osawa, Ms. Miki Yoshikawa, Associate Professor Yayoi Kawano, Professor Hidenori Otsuka, and Professor Takehisa Hanawa, all from different faculties and departments at TUS, were also a part of this study.

The method of preparation of the proposed hydrogel is quite straightforward. It was made using alginate, [calcium carbonate](#), and carbonated water. Alginate is a biocompatible substance that can be extracted from beach-cast seaweed.

Most importantly, it does not adhere strongly to cells or skin tissues. Thanks to the special structure formed by alginate and calcium ions, in addition to the protective effect of the CO₂ in carbonated water against acidification, the resulting hydrogel not only exhibited ideal pH and moisture conditions for wound recovery but also demonstrated significantly lower adhesion and swelling, compared to other commercial hydrogel wound dressings.

The researchers tested the effectiveness of their new hydrogel using cell cultures and a mouse model, both of which yielded excellent results.

"Through [animal experiments](#), we demonstrated that our hydrogel has a high therapeutic effect and at the same time can suppress the temporary expansion of the wound area caused by conventional clinical preparations," says Mr. Teshima. "This proves our initial hypothesis that gels with low skin adhesion and low-swelling properties are excellent as wound dressing materials, which is the complete opposite of conventional wisdom."

Worth noting alginate can be extracted from beach-stranded seaweed, a renewable resource that is often regarded as a coastal waste material. Since the proposed hydrogel is not only inexpensive but also biodegradable, this development marks an important step toward future progress in sustainable medicine.

"Medical materials still lack a sustainability-oriented perspective, and we believe this research will serve as a benchmark for the design of future medical materials and lead to sustainable and low-cost wound care," says Mr. Teshima. "Moreover, our findings can help clarify issues with [hydrogel](#) formulations currently in [clinical use](#) and provide new design guidelines for next-generation wound treatment gels."

More information: Ryota Teshima et al, Low-adhesion and low-swelling hydrogel based on alginate and carbonated water to prevent temporary dilation of wound sites, *International Journal of Biological Macromolecules* (2023). [DOI: 10.1016/j.ijbiomac.2023.127928](https://doi.org/10.1016/j.ijbiomac.2023.127928)

Provided by Tokyo University of Science

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