

Pulling, not pushing, silk could revolutionize how greener materials are manufactured

September 20 2017





Silkworm 'pulling' silk from its body. Credit: University of Sheffield.

New insights into how animals spin silk could lead to new, greener ways of producing synthetic fibres, according to academics at the University of Sheffield.

Researchers from the University of Sheffield's Department of Material Science and Engineering have shown that animals spin silk by pulling rather than pushing it out of their bodies. They suggest that if this process can be copied in an industrial setting, it could improve how synthetic materials are processed and offer more environmentallyfriendly alternatives.

Conventional synthetic textiles are made by extrusion—pushing a liquid feedstock through a dye and then using high changes in temperature and exposure to harsh chemicals to solidify. However, silk can solidify into a fibre at room temperature and leave only water - therefore causing less environmental damage.

The new study, by academics at the University of Sheffield, is published in the journal *Nature Communications*.

Lead author Jamie Sparkes, a PhD student in the University of Sheffield's Natural Materials Group, said: "Silk is one of the most promising green biomaterials, and could be the perfect replacement for nylon and polyester based clothing.

"Traditional production process for silk is both arduous and timeconsuming, but if we can bypass that by mimicking nature in an industrial setting, we could improve not only silk, but also how we process our <u>synthetic materials</u>."



Researchers examined how animals, including silkworms and spiders, push <u>materials</u> like silk out of their bodies.

Dr Chris Holland, Head of the Natural Materials Group, said: "While it is easy to assume that silk is propelled out of the <u>body</u> like we see in comic books, we wanted to put that to the test."

He added: "By combining computer models with experimental data and practical measurements, we determined the forces needed to squeeze unspun silk down the animals' silk gland and spin a fibre."

Jamie Sparkes added: "We found that to spin silk by extrusion (pushing), means a silkworm would have to squeeze itself hard enough to generate more pressure than a firing diesel engine.

"This isn't possible as the animal's body would be unable to contain that pressure. It seems that you can't squeeze silk like a tube of toothpaste."

However, by measuring the forces required to pull <u>silk</u> from the animal's body, the researchers found that it was well within the capability of the silkworm to pull a fibre, a process they refer to as pultrusion.

The researchers achieved this by adapting a rheometer, a machine used normally to measure the viscosity of liquids, into a highly sensitive spinning wheel, capable of measuring the forces needed to spin.

Dr Holland said: "If I gave you a piece of chewing gum and asked you to make me a <u>fibre</u>, you wouldn't push it through your teeth as it's too stiff. You'd grab one end and pull it out - and that's what the silkworm and spider do."

More information: *Nature Communications* (2017). <u>DOI:</u> 10.1038/10.1038/s41467-017-00409-7



Provided by University of Sheffield

Citation: Pulling, not pushing, silk could revolutionize how greener materials are manufactured (2017, September 20) retrieved 28 April 2024 from <u>https://phys.org/news/2017-09-silk-revolutionize-greener-materials.html</u>

This document is subject to copyright. Apart from any fair dealing for the purpose of private study or research, no part may be reproduced without the written permission. The content is provided for information purposes only.