Tiny fibres which can stop bullets

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Yasir Al-Hilali from Auckland University of Technology. Photo / Supplied

A high-tech yarn with the potential to stop bullets is being developed by 23-year-old Yasir Al-Hilali from Auckland University of Technology (AUT).

The engineering master's student is working with Auckland-based company Revolution Fibres to create a nanofibre yarn that could revolutionise the use of nanotextiles worldwide.

Nanotextiles are a combination of tiny nanofibres, each about one-thousandth the size of a human hair. They are extremely strong and versatile but their use has been limited due to issues with manufacturing and lack of a user-friendly base material.

Nanofibre yarn would allow nanotextiles to be easily mass-produced and developed for a wide range of applications, including bullet-proof clothing and the treatment of wounds.

"Research shows nanofibre yarns made from PVDF (a polymer/plastic) can be stronger than bulletproof materials such as Kevlar (the most commonly used bulletproof material used in vests)," says Al-Hilali. "We are to produce a nanofibre yarn made of PVDF, starting next year, and want to achieve high rates of production."

Nanofibre yarns can also be used for a range of medical applications: "It can be used as sutures, for example, the thread surgeons use to stitch wounds or a surgical incision," says Al-Hilali.

"Sutures made from nanofibre could be made of a material that dissolves into the skin with slow-release drugs that can help heal the wounds and prevent infection."

Ian Hosie, technical director at Revolution Fibres, says nanofibre textiles are part of a new wave of "advanced materials" developed for various functions. The company is one of the

world's leading producers of nanofibre, known as one of the most efficient and innovative in the field, developing products such as air filters, facemasks and home ventilation filters, cosmetic and natural health products, carbon fibre reinforcement products and more.

Manufacturing limitations have largely curtailed the mass production of nanotextiles; nanofibre yarn would allow them to be created in much larger quantities. Al-Hilali's work is focusing on techniques allowing such fibres to be spun into a yarn to be incorporated into machinery already in use across industries.

"His work has the potential to open up many more product applications, such as wearable electronics and medical products," says Hosie.

Al-Hilali started working with textiles at the start of his Masters degree at AUT earlier this year. He was tasked with analysing potential uses for polyester, quickly discovering some interesting and unusual applications.

"I investigated uses for the different components of the textile," he says. "For example, some of its components can be used to conduct electricity."

His work with polyester brought him to the attention of the people at Colab, AUT's collaborative research facility for design and creative technologies.

"My supervisor Dr Andrew Lowe was directly involved with Colab and they were really interested in what I was doing," he says.

After attracting the attention of Colab he was offered an internship at Revolution Fibres earlier this year.

Hosie says the company started discussions with AUT last year when looking for a talented student to help develop a nanofibre yarn: "Callaghan Innovation funding was used to attract a student to prove the underlying concepts between electrospinning [nanofibre production] and yarning," he explains. "Yasir proved to have a good combination of technical and mechanical engineering skills and was recommended by AUT."

Next year will see Al-Hilali spending 50 per cent of his time developing nanofibre yarns at Revolution Fibres while completing the theoretical components of his master's degree.

The addition of an easy-to-use microfibre yarn to the company's arsenal of products will see its appeal broaden to an even wider international audience and lead to future innovations and cutting-edge products.