THE HINDU

» TODAY'S PAPER » EDUCATION PLUS

September 19, 2016

IIT Hyderabad develops sanitary napkins that absorb better

- R. Prasad

Prof. Chandra Shekhar Sharma, Shital Yadav (middle) and Mani Pujitha Illa used nanofibre that are biodegradable. Photo: Special Arrangement

Sanitary napkins which have greater absorption capacity than commercially available ones and can be safely disposed owing to their biodegradable nature may soon become a reality thanks to research work carried out by a team of researchers from the Indian Institute of Technology, Hyderabad.

Most commercially available napkins use cellulose fibre to increase their absorption capacity. But the lower surface area of the fibre limits the absorption capacity. In order to enhance the absorption capacity, some brands use superabsorbent polymers (cross-linked sodium polyacrylate gels). When polymerised acrylate is added to cellulose, the resulting product has enormous ability to absorb water, which has caused an increased use of this substance in the production of hygiene products such as sanitary napkins.

Chandra Shekhar Sharma from the Department of Chemical Engineering, IIT Hyderabad and his team turned to nanotechnology to produce cellulose-based nanofibre for use as an absorbent core in sanitary napkins. They chose cellulose acetate biopolymer and subjected it to electrospinning to synthesise fibre of nanoscale size.

Compared with micron-sized fibre used in commercially available products, the absorption capacity of napkins with nanofibre was higher due to greater surface area and higher porosity. “The more the surface area of the fibres the more will be the absorption capacity,” Prof. Sharma says. “The nanofibre has 4-8 times the surface area of microfibre.” The results were published in the journal *Applied Materials Today.*

They tested commercially available napkins and the nanofibre samples in the lab using distilled water, saline solution and synthetic urine. In the case of distilled water, at the end of 180 seconds, napkins with a superabsorbent layer had a higher absorption capacity compared with nanofibre samples. However, nanofibre samples had 50 per cent more absorbance than those that either had little or very less superabsorbent polymers.

In the case of saline solution, the nanofibre samples had 53-63 per cent greater absorption capacity compared with the rest of the commercially available samples, including those which had superabsorbent polymers. “The basic driving force for absorbency is the difference in osmotic pressure inside and outside the fabric,” Prof. Sharma says. “The superabsorbent polymers have sodium ions. So the osmotic pressure is less as there is sodium inside and outside the polymers. The more the osmotic pressure the more the absorption.”

Similar results were seen when synthetic urine was tested. The nanofibre samples had 28-66 per cent better performance than all the commercially available samples. “Like the sodium solution, synthetic urine, too, contains sodium. So the osmotic pressure is less, and there is less absorption of water,” says Shital Yadav from IIT Hyderabad, the first author of the paper.

The electrospun nanofibre samples performed better even when they were subjected to mechanical compression. In the case of commercially available napkins, compression decreased the surface area and porosity and restricted the absorption capacity of even the samples with superabsorbent polymers.

Also, compared with commercially available napkins, the mechanical strength and comfort were better in the case of electrospun nanofibre samples. “Unlike commercially available napkins that use microfibre, nanofibre is smooth and has uniform roughness. These make the nanofibre samples more comfortable,” says Mani Pujitha Illa, one of the authors of the paper, from IIT Hyderabad.

The team is carrying out studies to test the performance of electrospun nanofibre to absorb body discharge fluids. “The pH and ionic concentration determine the absorption capacity of superabsorbent polymers. Body discharge fluids have a pH and ionic concentration comparable to sodium solution,” Prof. Sharma says. So he is optimistic that electrospun nanofibre would be able to better-absorb body discharge fluids than superabsorbent polymers.

The absorption capacity of napkins with nanofibre was higher due to greater surface area