Recyclable nano-fiber filtered face masks: A boon for supply fiasco?

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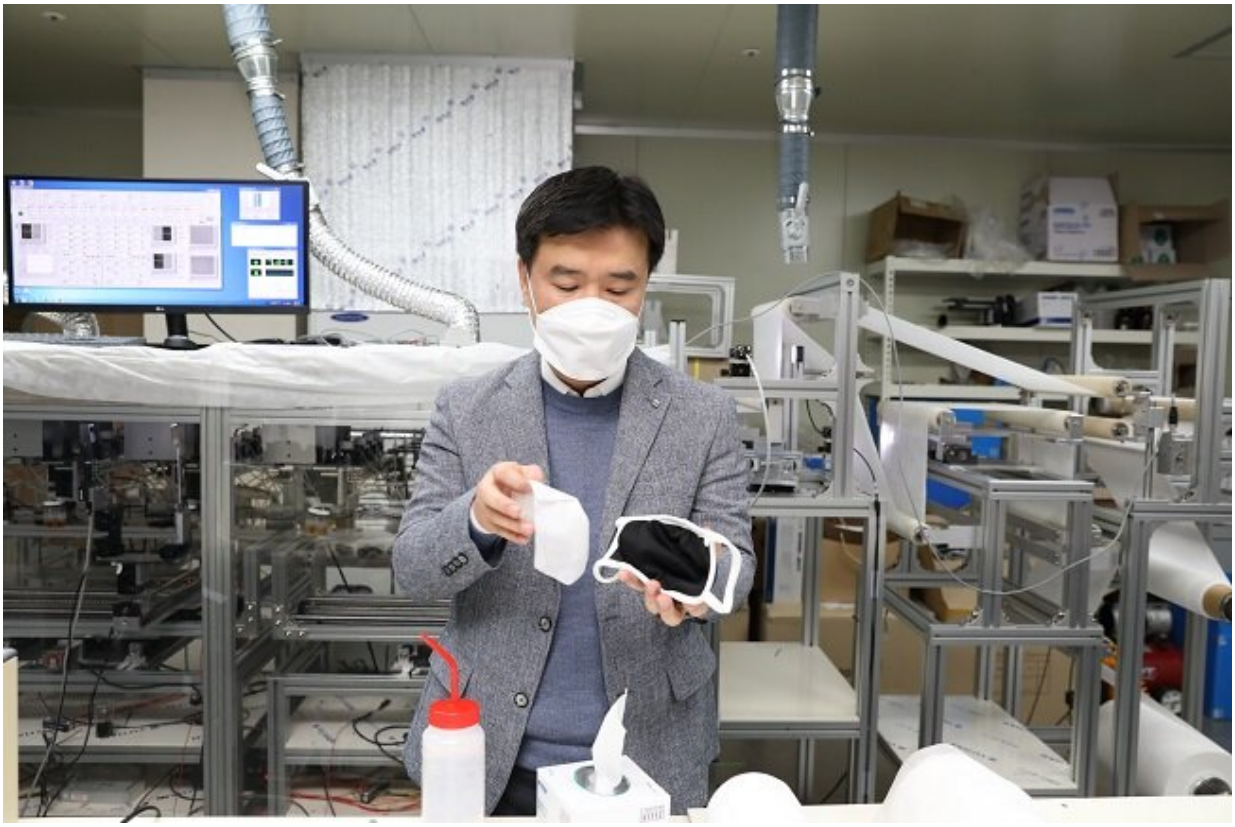

Professor Kim and his researcher demonstrate recyclable nano-fiber filter for mask. Credit: The Korea Advanced Institute of Science and Technology (KAIST)

Wearing a face mask is a common sight in Korea during the COVID-19

outbreak. Due to the overwhelming demand, last week the government started to ration two masks per person per week, as a drastic measure to address the supply fiasco.

The face masks most commonly used are disposable ones, originally made for filtering out up to 94 or 95 percent of fine dust, referred to as N94 or N95 masks.

A KAIST research team announced that they have developed a nano-filter that maintains excellent filtering efficiency even after hand washing through the development of proprietary technology that aligns nanofibers with a diameter of 100~500 nm in orthogonal or unidirectional directions. This reusable nano-filtered face mask could help to relieve the challenges arising from the supply shortage of face masks.

Professor Il-Doo Kim's nano-fiber filtered mask will maintain its sturdy frame and filtering function even after being washed more than 20 times. Professor Kim, who has continued to study the filtering of fine dust using nano-filters, is now awaiting final approval from the Ministry of Food and Drug Safety to bring his product into the market.

Professor Kim used an insulation block electrospinning process to manufacture orthogonal nanofibers by controlling the alignment of nanofibers. This structure can minimize delivering of the pressure toward the air filter and maximize the filtration efficiency, which is different from existing disposable masks without nano-fibers.

Existing masks also fail to maintain their air filtering function because their electrostatic function disappears when exposed to water. Thus, their filtering efficiency is reduced significantly, making it almost impossible to reuse them. However, this nano-fiber design was proven to be water resistant with more than 94% filtering efficiency in 20 repeated

bactericidal tests with ethanol. The nano-fiber mask also showed no deformation in its nano-membrane structure despite the 20 hand washes. In particular, it was confirmed that there were no deformations in the membrane, even after soaking in ethanol more than three hours.

Professor Kim said, "We believe that this mask can be reusable for about a month even after washing in ethanol. The inner filter can also be replaced." He added, "We found that the mask filters out up to 80 percent of 600-nanometer particles even after undergoing a bending test more than 4,000 times."

Professor Kim established his startup company, the "Kim Il-Doo Research Institute," last February. It can currently produce 1,500 nano-fiber filters per day.

Provided by The Korea Advanced Institute of Science and Technology (KAIST)