



Gwangju Institute of Science and Technology

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Professor Jae-Suk Lee's research team develops a new concept functional polymer fine dust filter with permanent electrostatic power and antibacterial properties

- In the School of Materials Science and Engineering at GIST (Gwangju Institute of Science and Technology, President Kiseon Kim), Professor Jae-Suk Lee and his research team developed anti-bacterial filter which is effective to filter fine dust with polymer filter material of permanent electrostatic force** by attaching zwitterion* to a polymer.

* Zwitterion: Molecules that are electrically neutral with both positive and negative in chemistry

** Electrostatic Force: The attraction between particles by electric charge

- In General, the filters for filtering fine dust use melt spinning of polypropylene to make non-woven fabric and give electrostatic force to it, but it has disadvantage that electrostatic force disappears easily by moisture, alcohol, oil particles, carbon particles etc.

* Polypropylene: A polymer with methyl groups separately attached to carbon in a polyethylene chain which is carbon chain with two hydrogens attached to each carbon.



** Melt Spinning: The process to make non-woven fabric fiber in the shape of a long, thin thread by extruding and cooling polymers through a fine hole.

- The functional polymer material developed in this research has advantage to keep electrostatic force permanently because zwitterion of high dipole moment is attached to a polymer. In addition, it is possible to design various chemical structures due to the characteristics of polymers. Therefore it can be used not only for indoor fine dust, but also for developing functional filter materials which could be applied to the environment of volatile organic compounds or viruses in the long term.

* Dipole Moment: Scale to measure polarity of substance made up of charges

- Filters are usually vulnerable to bacteria when it is exposed to moisture and etc. However, the polymer filter with zwitterion can prevent the growth of bacteria due to antibacterial property of zwitterion attached to the polymer.
- In this research, nanofiber fabric was produced by controlling the diameter of the nanofiber to the level of hundreds nanometer through electrospinning of the polymer attached by zwitterion. The produced nanofiber fabric showed excellent antibacterial property(99.90%) and high filter performance(98.5%/5.8 mmH₂O).

* Electrospinning: process of producing nanofiber from polymer solution or polymer melt by using electrical force

- Professor Jae-Suk Lee said, “We developed the filter with new material of permanent electrostatic power and antibacterial property, which can be applied to usual masks to prevent the spread of current covid 19 and to filter fine dust. In the future, it could be applied to make not only masks to filter fine dust but also masks of strong antibacterial property.”
- The research achievement was conducted by leading Professor Jae-Suk Lee (Corresponding Author) at GIST, Dr. Santos Kumar, Dr. Joseph Jang (Co-1st Author) and several corporate researchers with support from National Strategic Project for Fine Dust by National Research Foundation of Korea. The result was

published recently as a cover in *ACS Applied Nano Materials*, a renowned journal of American Chemical Society in the field of applied nanoscience.

