Solving the Worldwide Mask Pollution Crisis: A Biodegradable High-Performance Low-Cost Mask Made From Natural Polymers

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In the worldwide COVID-19 pandemic, a large number of masks have been discarded which brings serious environmental pollution to the world. Inspired by spider silk predation, this research proposed to design and fabricate a low-cost, high-performance, and fully biodegradable mask from natural polymers (gelatin and cellulose) by electrospinning techniques. Specifically speaking, cellulose napkin with micro-sized fibers and macropore structure is used as the carrier to guarantee high mask strength and following electrospinning; Electrostatic gelatin nanofiber film, as a filtration layer, is made by electrospinning with rare earth cerium as a crosslinking agent; Gelatin elastomer, as a mask strap, is achieved by casting gelation/glycerol solution. The results showed that with 15wt% aqueous gelatin solution mixed 1:1 with carbitol and total 8.6wt‰ cerium salt, high-performance gelatin nanofiber film can be prepared by electrospinning on the cellulose napkin carrier. After assembling, the mask filtration efficiency reaches higher than 95% with a respiratory resistance lower than 40 Pa. And it is also low-cost due to the low price of raw materials and the simple fabrication process. Moreover, this mask can be quickly degraded in moist soil within 1 month. This study firstly explored the composite method of cellulose napkin and gelatin nanofiber film to prepare a low-cost, high-performance, and fully biodegradable mask which provide a new way to solve the global disposable mask pollution.