Novel Biodegradable Cellulose N95 Masks for Protection against COVID-19

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The current coronavirus (COVID-19) pandemic overwhelmed the global healthcare systems with more than 8 million patients worldwide. To prevent the spread of the virus, especially, from and to healthcare personnel, the use of face masks and personal protective equipment (PPE) is a necessity. The shortage of N95 masks worldwide and the threat posed by standard disposable nondegradable polypropylene masks on the environment inspire the development of alternative environmentally friendly biodegradable masks. The conventional currently used surgical masks result in microplastic accumulation in landfills or 50 g of CO_2 emissions in air when incinerated. Therefore, we propose to manufacture biodegradable N95 masks from the most abundant natural material on earth, cellulose. The mask will be developed by initially extracting cellulose nano and micro-fibers from agricultural bio-waste such as sugarcane bagasse or banana pseudo-stem that constitute of about 50% cellulose by weight. The filter will be produced by electrospinning cellulose fibers since it has shown success in water and air purification membranes. Alternatively, wet lay-up or 3-D printing techniques will be adopted as contingency approaches. Finally, the physical, chemical, and mechanical properties, filtration efficiency, and biological performance of the masks will be assessed. The success of our approach will have major implications on the current pandemic by reducing local and global pollution resulting from disposed non-degradable masks.