COVID Information Commons (CIC) Research Lightning Talk

Transcript of a Presentation by Gloria Oporto (West Virginia University), December 9, 2020

Title: RAPID: Prototype of a medical mask using a novel antimicrobial/antiviral biofilter material

Gloria Oporto CIC Database Profile

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Transcript

Slide 1

Good afternoon everybody, and thank you very much for giving us the opportunity to present our research titled "Prototype for Medical Mask Using a Novel Antimicrobial / Antiviral Biofilter Material." I am Gloria Porto, Associate Professor at the Wood Science and Technology department at West Virginia University. And here is the team that is working in this project: Dr. Rakesh Gupta, Co-PI, Dr. Edward Sabolsky, Co-PI as well, Dr. Sushant Agarwal, Dr. Jonathan Boyd, Dr. Rosaysela Santos and our graduate student Kevin Sivaneri. So, let's see. Let me move this. There you go.

Slide 2

The synergetic efforts to perform these projects are coming from three different departments and colleges at West Virginia University: the College of Agriculture, Natural Resources and Design, the College of Engineering, and the college of Health Sciences.

Slide 3

So now, considering that there is an important increase of healthcare's associated infections in hospitals due to the increased load of diseased patients and the lack in proper and effective protection for the medical community. The common personal protection equipment are disposable, non-degradable, single use items vulnerable to penetration by microorganisms. And also, the common type of particulate filtering facepiece respirators are made of non-degradable non-woven polypropylene fiber and removes 95 percent of airborne particles. So, our main goal is to develop a novel biofilter that will be a non-woven material prepared with polylactic acid fibers in combination with nanocellulosic fibers, which in turn will be coated with copper nanoparticles. So, the final material will be able to remove 99.999 percent of airborne particles and will have antimicrobial properties, and those are going to be provided by the application of copper nanoparticles. So, the central hypotheses of this project are that by coating efficiently and quickly bionano composite filaments, polylactic acid plus cellulose nanofibers with copper nanoparticles, we will reach the effectiveness of these particles towards killing 99.999 percent of bacteria and viruses. And the second is considering the diameter of the nanocellulosic materials that is smaller than the common size of the new coronavirus, COVID-19, which is spherical with a diameter of approximately 129- 125 nanometers so it is suspected that the viruses can be retained in the biofilter prepared with an optimum and well-distributed amount of nanocellulosic material.

Slide 4

So, to move fast we printed a prototype of a mask in a 3D printer using two different filaments- polylactic acid that you can see here in white, and polylactic acid reinforced with wood particles. So, in this design, we are focusing our attention in developing our biofilter that will be incorporated here. So, in the pictures on the right you can see some examples of 3D printed specimens prepared with a polylactic acid and wood, however, our attention right in this presentation will be in the biofilter that will be here.

Slide 5

So, in the preparation of our bio filter we are using two approaches: electrospinning and force spinning processes.

Slide 6

In the electrospinning process, electric forces are used to produce the fibers, and here you can see some examples of polylactic acid fibers produced, right, and here you can see different magnifications of these fibers and it is suspected right that the porosity that you can observe here can help us for a better incorporation of the antimicrobial copper nanoparticles.

Slide 7

So, in the case of force spinning process, centrifugal forces are used to generate fibers and here also you can see the final porosity, right, generated for this specific process.

Slide 8

So, we have been also following different approaches in order to incorporate copper nanoparticles on the fibers, and one of them is using a master batch copper polylactic acid provided by a Chilean company. And here you can see also that the particles right on the surface of the fibers correspond to copper that we analyze and, of course, confirm that there are copper nanoparticles on the surface of these fibers.

Slide 9

So, regarding to testing, we are using again a 3D printing process to optimize a filtering device that will be used for all the specific tests that are related to our biofilter in terms of breathability, filtration, and fit test.

Slide 10

So finally, our ongoing work is combining our polylactic acid fibers with nanocellulosic fiber and copper nanoparticles and determining their antimicrobial properties. And almost in parallel, right, we are starting with the full characterization of the biofilter following standards presented in this slide.

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So, with that, I am finishing. Thank you very much for your attention, and thank you NSF for giving us, for providing funds to execute this project. So, thank you again and if you have any questions, I will be on the chat answering and my email address is also presented here. Thank you again.