COVID Information Commons (CIC) Research Lightning Talk

Transcript of a Presentation by Jamie Hestekin (University of Arkansas), January 13, 2021

Title: RAPID: Sprayable Cellulosic Nanoparticle Coatings for Covid 19

Jamie Hestekin CIC Database Profile

NSF Award #: 2031111

YouTube Recording with Slides

January 2021 CIC Webinar Information

Transcript Editor: Macy Moujabber

Transcript

Jamie Hestekin:

Slide 1

Thank you very much for this opportunity. Well, this is a RAPID project started in June and I am the PI and the co-PIs are Dr. Christa Hestekin and Dr. Peter Crooks.

Slide 2

So, what I wanted to tell you all about- first a little bit about is long-term disinfectants. So, this project is to make long-term disinfectants for disinfecting hard surfaces, soft surfaces, lots of different surfaces. We were working on an NSF project where we had- we're making TEMPO modified cellulose so TEMPO-Oxidized Cellulose, and we found that by attaching certain groups we could get it to be a disinfectant. There is currently only one long-term disinfectant that has been approved for emergency use by the U.S. EPA [Environmental Protection Agency]. There's the website. Dealing with that- normally it takes about 18 months to get a disinfectant approved. This one was obviously approved faster because of COVID. There is a need for long-term disinfectants for both bacteria and viruses for now and when COVID beyond. We're working with the University of Arkansas Medical School on these long-term disinfectants and what we're really looking at is all of what goes into this. What's the best chemistry? What's the best application procedures? And what sort of potential lifetimes can you expect from these surfaces? And this started as part of this NSF EPSCOR [National Science Foundation's Established Program to Stimulate Competitive Research] as I said, so.

Slide 3

And if my slide will advance then we can… Okay, so we started looking- we were making a lot of these different chemistries. I'm going to tell you- to show you one specific result today, but the easiest way to make the chemistry is ionically bonded materials. There is long lists of approved disinfectants for different viruses and bacterias, and you can take those disinfectants and ionically bond them to the surface- your own surface and so then and coat that surface onto whatever hard surface you want. So that's the easiest form. That's the form over here on the left. The- one of the more difficult forms is we have a something that will make up for acid and so what this will do is it will make hydrogen peroxide over the course of time, and so by doing that for long term, you can put an oxidizing agent in which will destroy things. So that's a material we're testing as well. And then the third one is to try to take these chemistries and covalently attach them to the TEMPO modified surface. We've developed the ability to put [click?] chemistry on the surface of these TEMPO groups and so because of that, we can really attach just about anything we want and we're looking at some of the approved disinfectants for doing that.

Slide 4

What this shows you is some of our initial results. So, this is with the easiest form- the ionically bound disinfectant. we used a common disinfectant DDAC [Didecyldimethylammonium chloride] and attached it to Form 1 which is one form of our temple modified cellulose. The Form 1 says that every other carboxyl or every other hydroxide free group has been converted to a carboxyl, and Form 2 is one where they're all converted and so it becomes water-soluble in things. And what we did here is we used E. coli as a first test. This is how fast E. coli grows when you look at it on a 96 well plate and these are the different things that- and how they're growing out. And so, if you look at this, our Form 1 doesn't do much at all to stop the growth. The DDAC and the Form 1 with the DDAC both stopped the growth when you did that. You move on to 48 hours. You can see that our surface is doing pretty well after a week. After two weeks, we're still seeing close to complete- basically a complete ability to destroy E. coli when we when we put it into the surface and this has a lot of error bars because these are all 96 wells the piece that are doing this and the reason I put it on here- it's kind of messy when you when you do all that stuff. But over two-week time period so far, we can see that these ionically bond surfaces work pretty well.

Slide 5

As far as how they work on the surface, I'm going to start a video here, as you can see, and I guess the- on this video that we have a surface, that we've coated this on with a spray sort of surface. It is a green gray surface because we put the colorant in. We can scrape it, but if you just rub hard on it, it does not come off. If you spray it with water and a little bit of surfactant on the other hand, you can get it to come off very easily. And eventually here in about five seconds it's going to show that you can remove it all and your door handle looks the same way that you had before. Right now, we were adding- the green color has nothing to do with science, it's a marketing thing that people are interested that how would you know that something had this spray done? But you can see it can go on and off pretty quickly. And so right now we are also tests, which I'm not going to show today of rubbing hard on this surface to see you know how much you can get off of the surface and such.

Slide 6

And then just the last really quick slide, because I know my time is coming up is- we started with bacteria because bacteria is easier to test, not necessarily easier to kill, but viruses are a little bit difficult. We are in the process of doing that right now to show- we'll do that as well. We are developing the covalently bond groups, and there's a lot of interest in this sort of thing and we're interested in collaborating with any one of you as well. Thanks.