Medical Biomaterials
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Lecture - 37
Demonstration of Surface Modification of Polymer Dip Coating of Polymer

This experiment is about surface modification of a polymer which we are going to work on is polyester is used as a large diameter vascular graft it is used in valves. So, many other biomedical applications in order to prevent bacterial attachment and biofilm formation you can quote this polyester with the antibacterial agents antibiotic here I am going to talk about whether we can coat a material called a curcumain which is a natural product as well as which is used in food and flavoring applications as you know curcumain is a product of turmeric and turmeric is widely used in Indian food industries it has got anti inflammatory antibacterial even anticancer properties so by quoting this polyester surface with that we will be able to prevent bacterial attachment as well as biofilm formation.

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We cannot directly coat curcumain on to the polymer. So, we use poly vinyl alcohol this is a FDA approved polymer this is of molecular weight 140 kilo Dalton. So, we have to prepare a PVA solution in water. So, what we do is we take five hundred milligrams of PVA in 2 ml water we heat it to seventy degree centigrade in a water bath for fifteen

minutes. So, that the PVA completely dissolves in that we take 200 milligrams of curcumain curcumain is not water soluble. So, we need to dissolve it in ethanol. So, we add 1 ml of ethanol.

Now, we need to mix it thoroughly using a water bath sonication curcumain has to be dissolved and dispersed in ethanol. So, we use a water bath sonicator now we mix this curcumain in ethanol to PVA which we have dissolved in water together and then again we need to mix them thoroughly in the water bath sonicator this is the curcumain completely dispersed in PVA solution we are going to use this for coating the polyester film.

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This is called a dip coater we can coat polymer surfaces using this dip coater, we place the polymer film here and we set the program here and the solution is placed here the poly biofilm goes down dips in to the solution and the coating is achieved we can dip it several times we can dip it once twice many times depending upon the thickness of the coating design here is where we set the program for the dip coating I already have a program is called the program 2 yeah, it gives the dip speed millimeter per minute it gives the lifting speed millimeter per minute it is giving the length of the film that is how long the film is it gives how long the dipping has to be in minutes it gives you how long the drying has to take place in minutes and then how many times you want to repeat. So, here I given cycles. So, we can do it three cycles four cycles many cycles

We need to place the film at the tip this is the polyester film you place the film here curcumain solution a curcumain solution is placed below and we start the run now we can remove our sample this is a curcumain coated polyester with the PVA as the binder this experiment is a demonstration of coating a surface using a spin coater previous experiment we talked about a dip coating where the sample moves in to a solution containing whatever material needs to be coated here the sample will be rotating at very high RPM and when we drop the solution containing our coating material like antibacterial or antibiotic it uniformly spreads on the surface because your sample polymer is rotating at very high velocity.

So, this is the setup here we are going to use a polyvinyl pyrrolidone as material with the curcumain as I said, curcumain has antibacterial anti inflammatory even anticancer activity curcumain is found quite a lot in turmeric which is widely used as a flavoring food agent and many South East Asian countries especially India it is reported to have antibacterial activity. So, we are going to work on that polyvinyl pyrrolidone is used as a drug delivery material and for drugs encapsulation.

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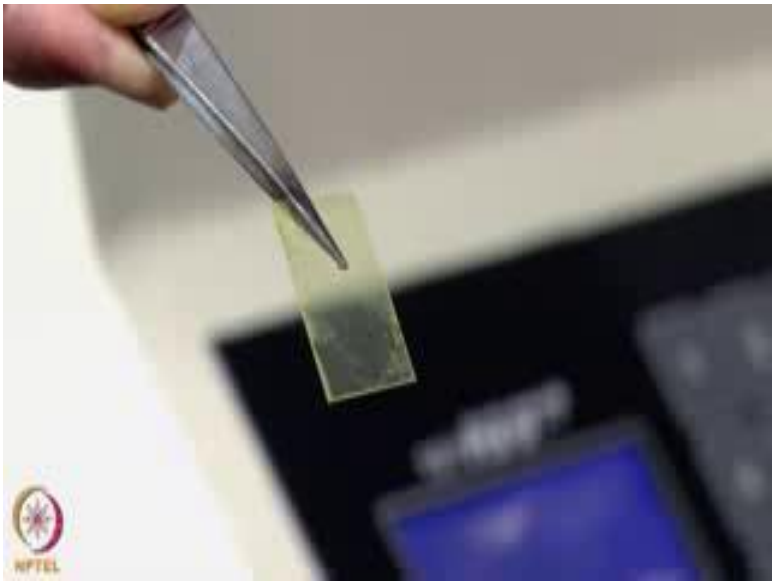

I take this polyvinyl pyrrolidone that is PVP; 1 gram of it just got a molecular weight of 40,000 in 10 ml ethanol and then we mix it thoroughly for about 5 minutes, we use a vertex mixer for mixing this thoroughly we take 5 milligrams of curcumain and we add 1

ml of ethanol to it; as you know curcumain is not soluble in water and once more we mix them.

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We add this curcumain solution to the PVP and again we mix them using this vertex mixer now the solution is ready we can coat it on polyester as I said before polyester is widely used for large diameter vascular grafts diaphragm valves and so on. So, polyester is fixed to glass slide using a tape and it is placed inside the spin coater here this spin coater also has a vacuum arrangement. So, that the solvent that is coming out will be sucked out now we load the program as you can see it will be rotating at 1,00 RPM acceleration in 10 seconds and then contact time is 100 seconds, we press 1 here and then we say run (Refer Time: 13:17).

I take this solution and add slowly drop by drop and as you can see it gets uniformly distributed along the polymer surface, it forms mono layer once the coating has been done we switch off the program stop the program we can remove the glass slide as you can see curcumain and PVP mixed material has been well coated on this polyester and now we can fill out this polymer from the glass slide this is the polymer polyester coated with PVP and curcumain. So, this will have antibacterial activity. So, we can use this for preventing biofilm formation on polyester surfaces.