Nanotechnology in Agriculture
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Lecture-33
Summarizing role of nanomaterials in animal production

Welcome back to the lecture series in nanotechnology application in agriculture, so in the previous class we talked about some of the diagnostics especially, we talked about the microcantilever and nanocantilever fabrication and how such small devices could be used for detecting the muscle physiology and understanding the muscle physiology and testing any kind of drug without getting into the animal system.

So, this is one of the area where there is tremendous amount of work which is going on across the world is how far we can avoid use of animal for testing different kind of drugs, different kind of molecules or series of cosmetics and all these sorts of things. So, we will come later into that but before we proceed further let us do a summary of different kind of nanomaterials which are found applications, so to start off with such we are all aware of the challenges what we all face.

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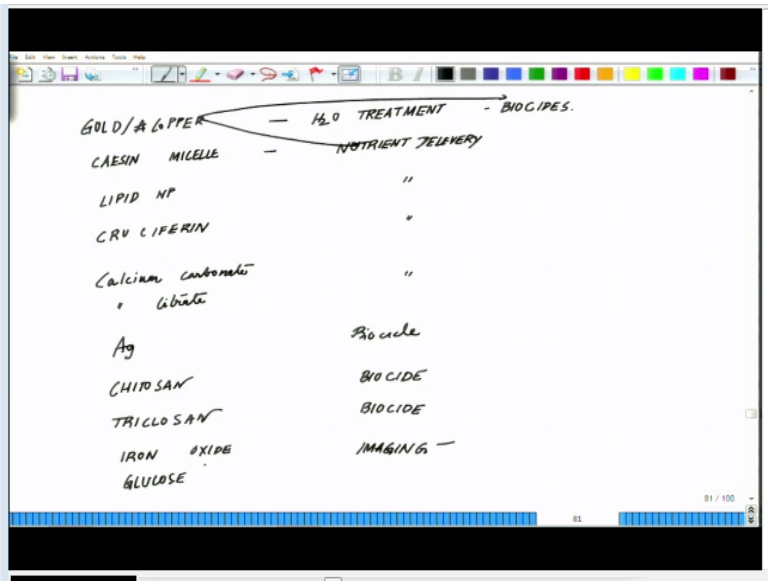

Because of excessive use of antibiotics and especially in the animal world the use of antibiotics is pretty rumpled, so in our country also among human that wherever even if it is not needed doctors will recommend okay take an antibiotic. The problem is that when you take excess

antibiotics you become resistant is several set up pathogens over a period of time. So in animal production there is no exception to this rule and incidentally the excess antibiotics comes in the food we derive from manual whether it is milk, whether it is meat or any kind of stuff what we are deriving from manual is very badly affected because of the antibiotics.

And not only that now it has been observe that several honey bees colonies and all or also affected because of different herbicides which are excessively used in the plant kingdom. So, the new way which is slowly coming is called biocides use of biocides. And there are several nanomaterials which found application as a biocide to, so to summarize with, so some of the nanomaterials like if you talk about golden Copper which are essentially your metal nanoparticle.

Golden copper nanomaterial found applications as a biocides for water treatment ok similarly, so these are acting as biocides ok. Similarly Caesin micelles those of you are not aware about casein, caesin is a milk protein for one of the very abundant milk protein. So, casein micelle is a natural source, so the experiment which was done was determining the storage capacity and stabilization of encapsulated bioactive compound and there bioavailability.

This is used for nutrient delivery, so almost like even this could be used for drug delivery to then you have lipid nanoparticles lipid NP. So these are used for simulated digestion as says to test the bioavailability of loaded compounds. So these are used for again for nutrient delivery cruciferin nanostructure these are used for same cruciferin for nutrient delivery. These are used for encapsulation of the material and you have calcium carbonate and calcium citrate**.**

So, calcium carbonate and calcium citrate metal nanomaterials are used for again for different kind of nutrient delivery applications. Similarly you have Silver, Silver is a eco-friendly biocide material Ag, so this is a biocide in animal systems, copper as a metal copper this is used both as we already talked about biocide activity. And this is also uses for nutrient delivery ok gold, gold is used as a biocides we have already mention it.

Then you have Chitosan polymer which is used as a biocide ok, similarly there is another molecule called Triclosan. Triclosan has antimalarial activity as well as Triclosan is used as

biocides, iron oxides nanomaterial and this is not an exhaustive list, these are some of the examples I am putting forward, so iron oxide is used for multiple applications, so this is used for imaging applications in animal system.

So, in a way it is a diagnostic stuff, then you have the carbon that is glucose and sucrose deliver nanostructure. These are used for different kind of drug delivery system and they are at times used for as a capping agent in different kind of nanomaterial.

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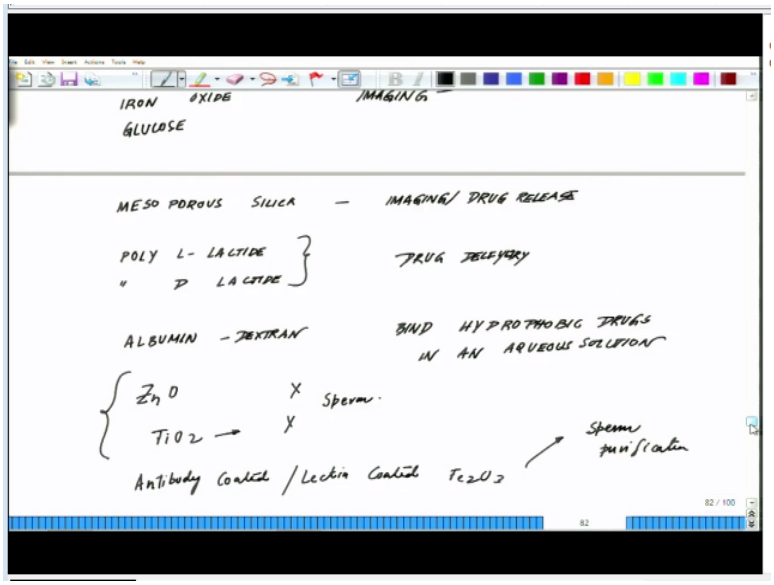

So, similarly mesoporous silica is used for special imaging and drug release in the body. So, these are the diagnostic part drug for release similarly poly L-Lactide and poly D-Lactide and poly acrylic acid, poly L-lactide, poly D-lactide. These are used for delivery of therapeutics again drug delivery. So, in other word these are all the molecules which are used for control release you have albumin dextrin.

Albumin dextrin is used to bind hydrophobic drugs to create aqueous solution bind hydrophobic or water heating drugs and aqueous solution. In other words they are increasing the solubility of these kind of material zinc oxide, zinc oxide has to be handle very carefully because zinc oxide has shown in several studies it is a toxic effect on livestock's sperms similarly titanium oxide.

So, these are some of the molecules like titanium oxide uses for water purification but one has to very careful because they have negative influence on the sperm quality of the animal. Similarly antibody coated or lectin coated iron oxide for nano purification of a sperm, antibody coated or lectin coated Fe2O3. This is used for purification of a sperms from purification; similarly you have silver metals which as you mention it as a biocides applications bio cellulose.

This is also designed as an antiseptic collagenous stimulating for wound healing. So what you absorb is that this whole list is pretty exhaustive as we go through like in the whole world of animal production there are 2 aspects which both of course not only animal both in the plant also in the agriculture production system.

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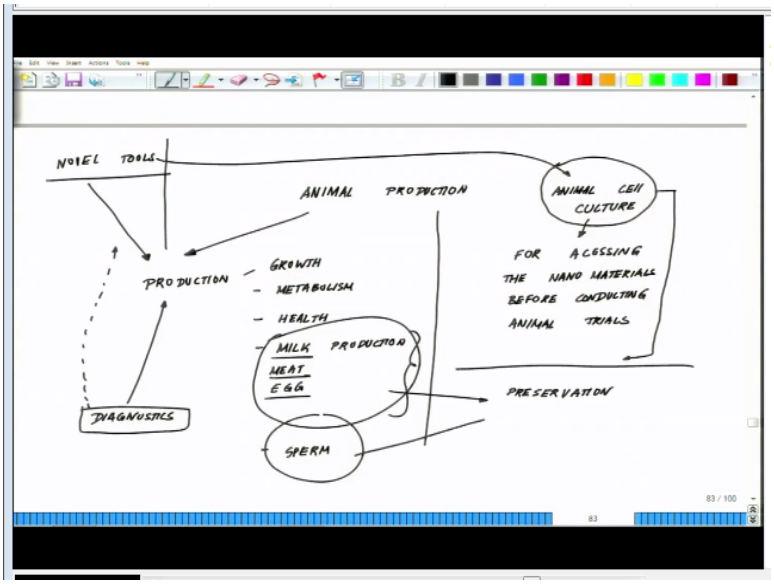

So, one what we kind of If I have to classify, so any kind of say animal production. So one part where nanoparticles or nanomaterials are getting applications is the production part ok or in terms of production we talk about growth, metabolism, animal health, milk production, milk, meat, egg ok. This is one aspect apart from it is another aspect in production which is a supporting aspect what we are talking about is the diagnostics.

We have talked about several diagnostics, this another side of the story which is kind of an extension of the diagnostics is novel tools where we have talked about cantilever systems and all these will the detect the muscle physiology several other aspects, here among the novel tools

another area which find tremendous application is animal cell culture for assessing the nanomaterials before conducting animal trials.

This was the very beginning of the class I was telling you, so this is another area which is getting tremendous significance for last several decades where there is a need is the thrust that we may need to figure out ways by virtue of which we can minimize the application of the drug in the animal directly instead is we evaluate the effect in a invitro say for example there is a refractive drug.

So, if we wanted to test it we should be able to test the drug on sperms, should be able to test the drug if it is a female related to female reproductive system should be able to have those tissues culture in a tissues and we could test it or say for example we say there is a particular nanomaterial which will have applications say in hormonal changing the hormonal profile. So, what you can do we could isolate those cells which produces hormones neuro-endocrine cells or endocrine cells.

And we can test the particular drug or particular nanomaterials to see whether it is really doing like that, that is not essentially it is going to happen once you get to the animal the story made completely change, but even before we move to the animal there is a need to explore the wide area of nanomaterials which are coming up into the cell culture tissues. So, this is one area where there is a lot of work which is going on.

So, the part 2 of the story is whatever the products in terms of say these are the products which are we are deriving from animal's preservation. And this is one area, the other one is of course when you talk about animal health sperm, this also falls under preservation. Because if you get a good quality sperm you prefer to store that sperm for artificial insemination and maintaining that particular quality for prolong period of time. Now for that you really needed to preserve the sperm.

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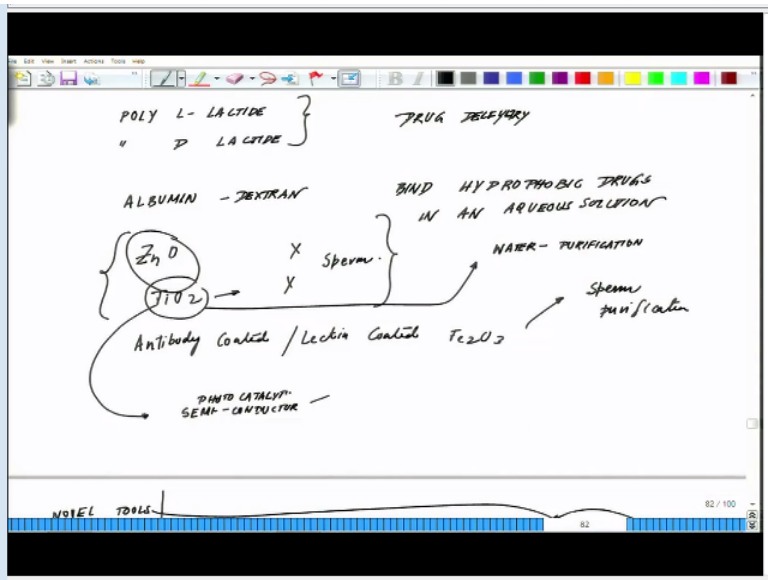

So, as we were talking about there are nanomaterials like zinc oxide, titanium oxide and why these are very critical is that, these are the molecules which are nanomaterials which are used for water purification. Now you realize that something which is used for water purification because titanium oxide is photo catalytic semi-conductor material ok. And we will talk about it once we talk about water purification how this could do photo catalytic ok.

So, this could split water even ok, so what is important is that while we are using these kind of nanomaterials one should be careful that it is not affecting the physiology of the animal. So, the same thing may affect the sperm and again if you remember when we talk about ceria I told you there are couple of contradictory stories which says that ceria is not that effective. But that is possible, how those are being synthesized.

So, synthesis, so what I expect from you people is that you should have a very holistic view from how the material is being synthesize, how it is being applied into the animal system. Because this list what I am showing you, you could go on and on there are so many studies happening. But really look at them very carefully and dug out, the key information is one of the challenges ok. So, what you expect from you guys is that look through any paper you pick up, any manuscript you pick up, look through the or any experimental design look through it carefully.

And try to rationalize it what has happen and what has been interrupted and where possibly things could have very long term effect which is not really mention in the literature. So if one looks at it very carefully one will be able to figure out what all experiments could be done can I justify some of the claims which are being made? So, having said this from here we will switch gears, we will move onto the zone of preservation.

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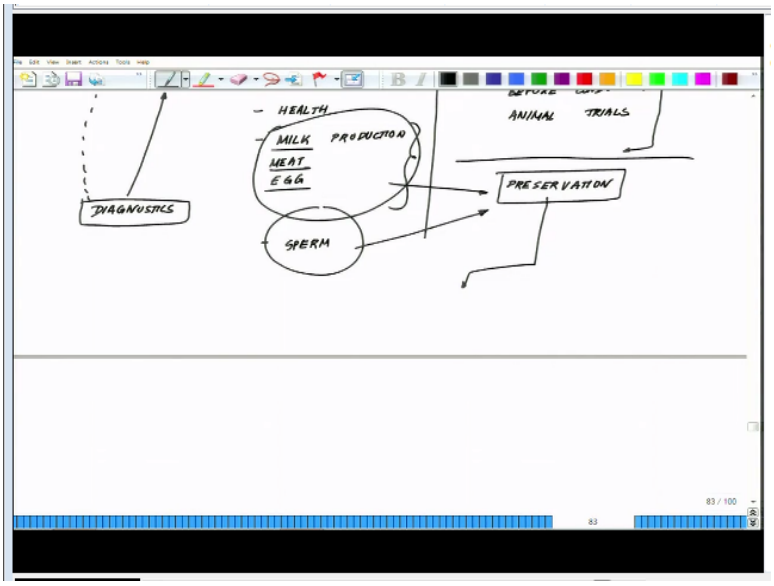

Our next couple of classes will be on food preservation or these animal product preservation and what are the basic aspects what has to be taken care. So I am closing in here, in the next class we move from the food preservation, thank you.