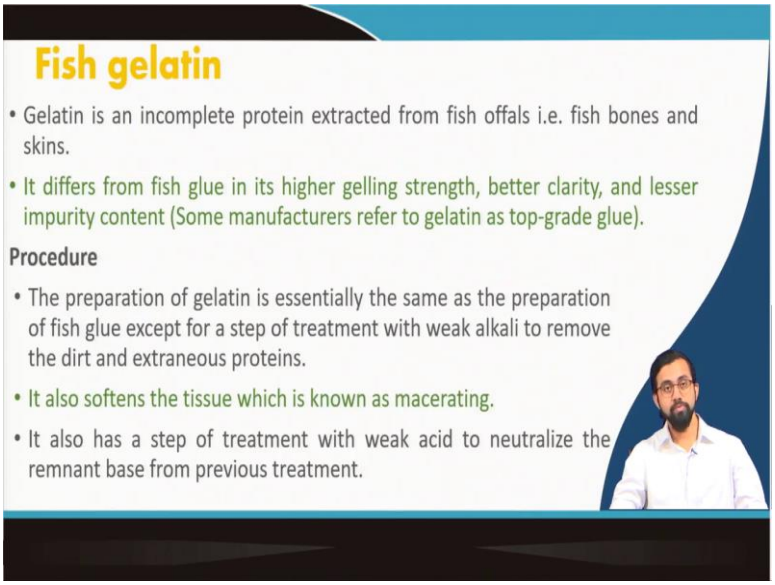
Advanced Aquaculture Technology
Professor Gourav Dhar Bhowmick
Department of Agricultural and Food Engineering
Indian Institute of Technology, Kharagpur
Lecture 54
Fish by-products (Contd.)

Hello everyone. Welcome to the fourth lecture of module 11 Agricultural Products and Industries where I will be discussing about the fish-byproducts in the continuation of the earlier lecture. My name is Professor Gourav Dhar Bhowmick, I am from the Agricultural Community and Department of IIT, Kharagpur.

(Refer Slide Time: 00:41)

The concepts that I will be covering in this particular lecture are the important things-byproducts like the Fish Gelatin, Roe and the Caviar, Fish Maws the Isinglass and the Pearl Essence.

(Refer Slide Time: 00:57)



So, to start with, you remember when we start discussing about this fish-byproducts in the earlier lecture, we mainly focusing on the stuff that we can actually use from the fish processing industries or aquaculture products which I know which we normally do not use it, which we normally throw it away and all.

But however, if we can scientifically properly, we have proper scientific equipment's and all scientific process we follow. We can easily use those products the waste products and we can make very useful stuff out of it. Very useful products out of it and which can be further be beneficial for aquaculture or pharmaceutical or personal care products and different uses for different industrial uses as well.

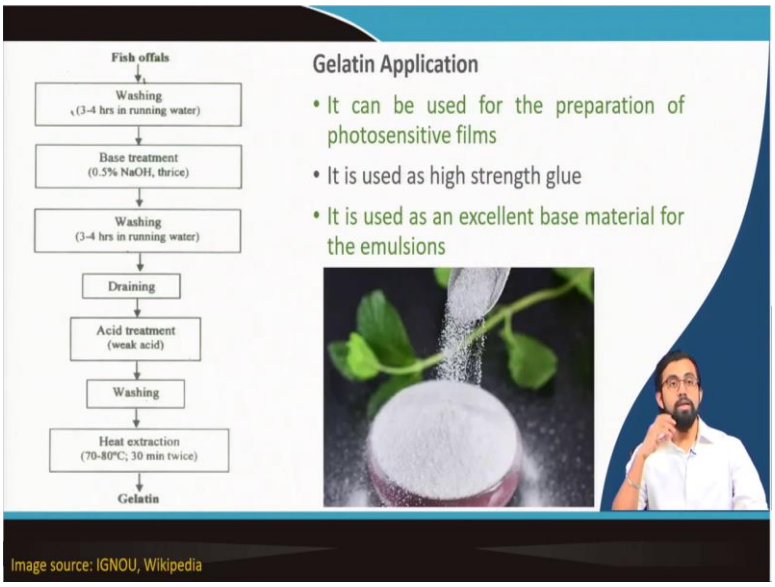
So, one of them one of these waste products that can be utilized as a fish-byproduct is this gelatin. It is an incomplete protein extracted from like in a fish offals mainly the fish bones and the scales. So, what is the difference between this fish gelatin and the fish glue? The only difference is like the that in case of fish gelatin it has much higher gelling strength, it is much clear in nature like the loop wise and it has very lesser impurity content.

Some manufacturers even refer that gelatin as a top-grade glue and why they have the lesser impurity content. I will discuss about it in details now like in few minutes. So, in general, it actually one of the main reason is the procedure that we use. The procedure that we use to produce this fish gelatin it is actually the reason why we have a less impurity content than the normal fish glue, which we normally extract from the fish scales and all scales and all. So, what is the procedure? In general, we it is like almost same as fish glue, but the only

exception is at the step of pretreatment or the treatment we treated with the weak alkali medium to remove the dirt and extraneous proteins.

Because of this weak alkali treatment, it actually has lesser impurity than the fish glue. It also soften the tissue, which is also known as the macerati. So, because of this macerati or macerating, what happened is fish gelatin formed and it actually soften the tissue like much better within the other procedures. And also, it also has a step of treatment with a weak acid at the end to neutralize the remnant based on previous treatment and at the end, the product that we get it has very high adhesive properties.

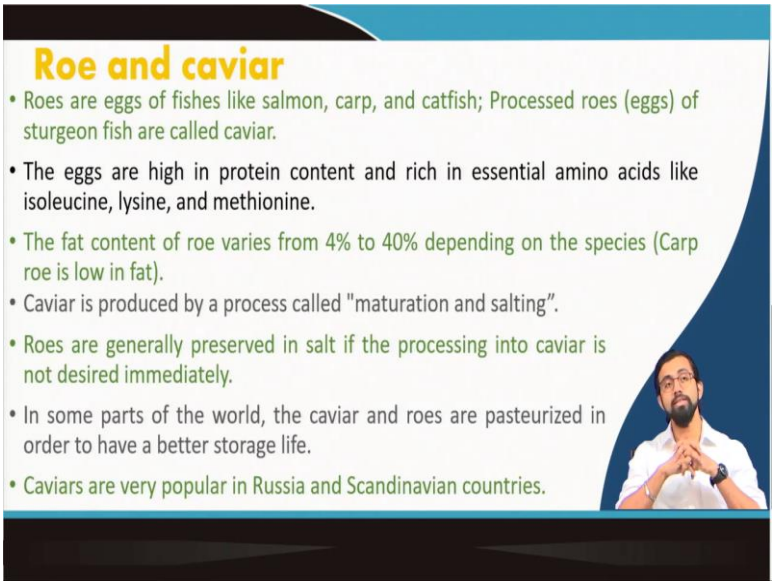
(Refer Slide Time: 03:52)



You can see the procedure. First, we take the fish offals. We wash it 3 to 4 hour in running water, preferably cold water. Then we go for this best treatment what we call this a week alkaline treatment. 0.5 percent is sodium hydroxide, 3 times. Then we wash it again 3 to 4 hour in the running water. Then we drain the water and then we go for the acid treatment. Acid treatment with the using the weak acids. Then the washing is done. Then the heat extraction is done to get the gelatin out of it.

So, what is the application of this gelatin that we can get out of this aquaculture this fishery byproduct is it can be used for the preparation of photosensitive film. It can be used for high strength blue as we already discussed, because of it is a very high adhesive properties. It can be used as an excellent base material for the emulsion preparation. So, these are the different procedures, I mean like this is the difference applications of gelatin in that we can normally utilize.

(Refer Slide Time: 05:00)



Then another important byproduct of fish is roe or the caviar or in simple word it is like the fish egg. This roes are the eggs of fish like salmon, carp and catfishs and the process flow is all the eggs of starch and fish are called the caviar. This caviar is it is a delicacy in the northern I mean if you go more towards the Russian area I mean like all the countries which were in USSR earlier and also if you go to the Scandinavian countries there this caviar is a kind a delicacy.

The preparation procedure is there. You can find caviar with like 5 dollar packet and when you can get it in 5,000 dollar of packet which people give it you as a gift for a very high costly gift for even your in with different functions and also. That means you can realize a food is given as a gift in even marriage ceremony even and also that means it does contain it does have a very high value or it does have a very high amount of acceptance reading in this region and they really love it and this caviar. In India it is not very famous because first of all the in a caviar form it is not famous but we normally eat the fish eggs. But caviar is really tasty and it needs some treatment procedure. There are some procedures by which we can prepare it. I will discuss about it in coming slide.

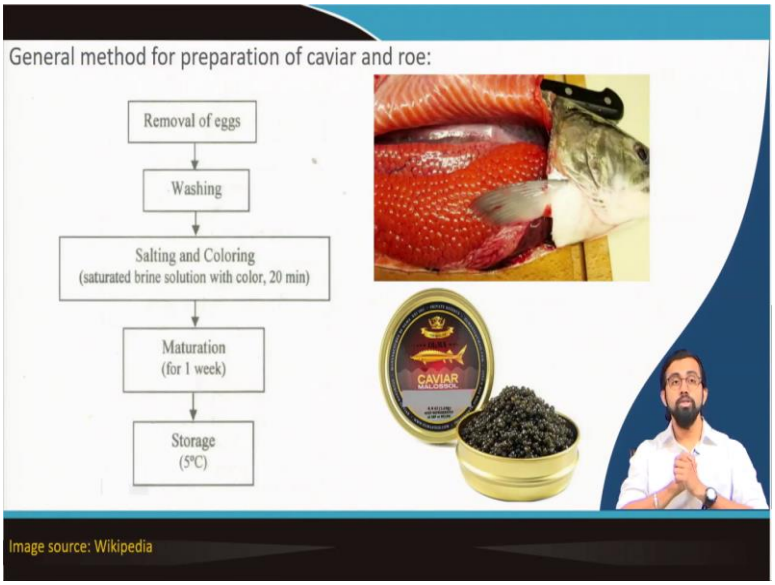
In general, what is the reason behind it? Why we want to go ahead with the caviar? It does contain high amount of protein almost 30 to 40 percent of protein. It does contain some amount of fat also. It almost most carbohydrate free. It is like almost carp free. It has protein, it has fat at a proper content and also it contains a huge a lot of different important micronutrients and vitamins and all. All the vitamin be various vitamin A, vitamin K and

also. So, all because of the presence of this enriched nutrient, the caviar is not only a delicacy but it is very much sought after for your health benefits as well.

So, also it is rich in different essential amino acids like the isoleucine lysine and the methionine. And the fat content as we just as I told you like 4 percent to 40 percent it varies depending on the species. The caviar the procedure of the process that by which the caviar is produced, it is called maturation and salting. The rules are generally preserved in salt if the processing into caviar is not desired immediately but even in caviar after you form it caviar and then also it is you use some brine solution.

There is a very specific way of preparing this brine solutions and then you use it for preserving so that is my caviar it is little bit salty in nature because of the presence of this brine solution. In some part of the world the caviar there is a pasteurized in order to have a better storage life. It is very popular in Russia and the Scandinavian countries as I told you.

(Refer Slide Time: 08:19)



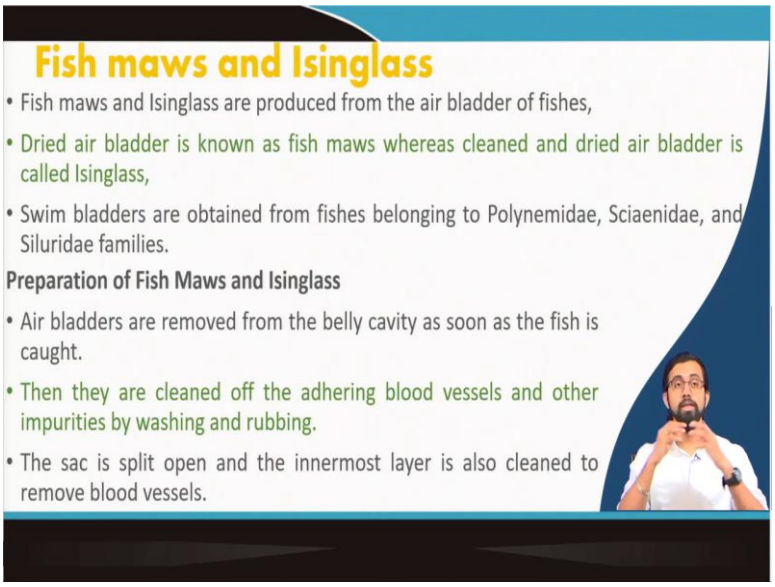
So, the what is the procedure? You first remove the egg. Then you wash it and then salt and the coloration is done. After then on the maturation is when after it reaches the maturation stage you store it at 5 degrees Celsius. Though, you store it at 5 degrees Celsius that proper storing and all proper packaging and all, still it is better to have it as soon as possible. It has a very low shelf life. In general, it has a very low shelf life, so better to have it as soon as possible it prepare.

So, that is it like it is if you see in future if you go in a European region and if you see the caviar in the supermarket and all you see the when you buy it, the one specific type of caviar

which called beluga, this is the most costliest one. This beluga species they can live up to 100 years and all but they can only give you egg like 5 or 6 times in your lifespan and that is why it makes it so rare. And because of that it is that costly it is beluga species the caviar coming from the beluga species.

Other than salmon and all this other cat fishes if you collect they are very they are even local. You can have it as low as 5 dollar for this kind of packet and all. I am just giving you just example. But whereas if you want to buy the beluga, this black caviar, it is super costly. It is called Black Gold almost.

(Refer Slide Time: 09:50)



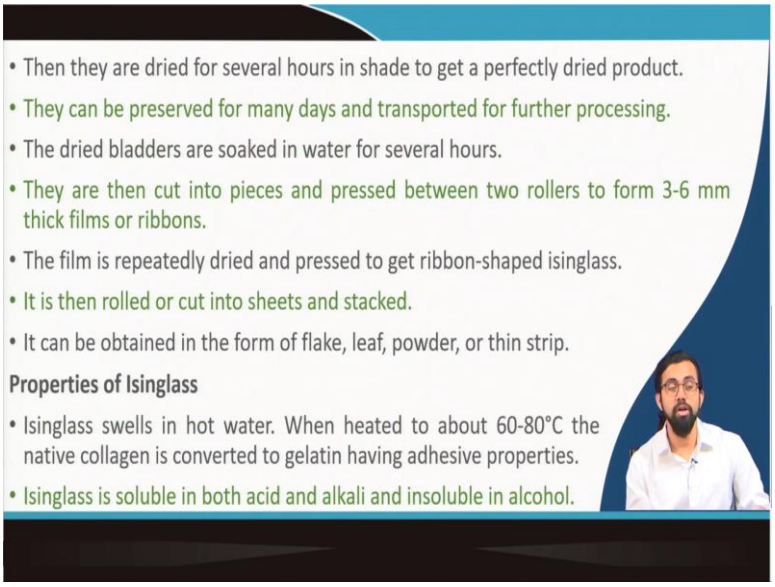
So, what are the other types of byproducts that we can get the fish maws and the isinglass? It is actually produced from the air bladder of the fish. What we do? We use the dryer air bladder which is known as the fish maws and when it is clean and this dried air bladder like when it is there as it is we call it is isinglass.

So, that means when it is clean condition is drying in a air bladders and all so, then we call them it is fish maws and another one is very isinglass. This swim bladders which are obtained from fish belong to this Polynemidae, Sciaenidae and this Siluridae families are normally used for this isinglass preparation.

So, normally what we how what is the preparation procedure? We try to get we remove it from the fish from its belly cavity this air bladders and then they are cleaned off by with all the adhering floods blood vessels and other impurities by washing and rubbing. And then the

sac is split open and the innermost layer is also cleaned to remove the blood vessels. And that air bladder is actually used for this fish maws or preparation of fish maws or the isinglass.

(Refer Slide Time: 11:05)



So, in general after you take out this after the inner layer and outer layer and all the blood vessels and all its removed, then it is dried for several hours in the shade to get the perfectly dried product. Then it is preserved for like many days and transported for the further processing. In general, in the processing what they do?

They again soaked in water for several hour. And they cut into small pieces and placed between the two rollers to form 3 to 6 millimeter thick films or the ribbons. This is repeatedly dried and again placed in this ribbon this make this thick film or even to make it the isinglass that we talked about.

So, it is then rolled and cut into sheets and stacked. It can be obtained in the form of flake, leaf, powder or thin strip as well. So, what is the properties of this isinglass? This actually isinglass has a very specific property when the moment you take it and when you put it in the water, it will swell a lot. And specifically, when it is heated at 60 to 80 degrees Celsius, the native collagen is converted into gelatin and having a adhesive property as well. In the one of the major use of isinglass is impurity in the alcohol. It is soluble in both acid and alkaline but it is insoluble in alcohol.

(Refer Slide Time: 12:32)

Because of this reason, it is used in the alcohol industries and all as a clarifying agent. You see the fish swim bladders and all and this commercial fish maws and the isinglass how it looks like. An application, you see the application the first and major application is the clarifying agent as in beverages.

It also can be used in as adhesive base when it is when you hit it a little bit 50 to 60 degree Celsius and then use it as adhesive base as well. It can be used as a chill proofing agent. It can be used in the manufacture of the Indian ink. It is a specific type of ink that is used that is sometimes we call them Indian inks, sometimes it is called a Chinese ink also. So, it is used for preparation of this Indian ink or the Chinese.

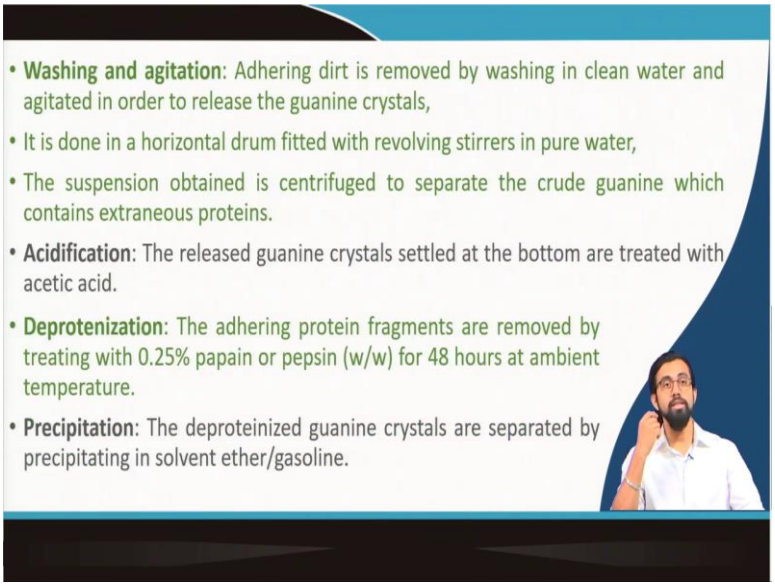
(Refer Slide Time: 13:21)

What are the another byproducts that I will be discussing and which will be the like the last I would say like discussion about the different byproducts, fish-byproducts, but though there are plenty of others. But I will stop here with this pearl essence only because like because of time constraint I cannot discuss more and more. But I definitely request you to go ahead and search for the additional information about the different fish-byproducts.

In case of pearl essence, it is actually commercially it is a commercial product. It is prepared from the scales of finfishes. Why it is called pearl essence, I will tell you in couple of minutes. So, in general these scales. It is a shiny and lustrous substances this pearl essence that we prepare. It is extracted from the scales and when it is used for different decorative coating. Because of his texture because of its look, and all it is called it can it is it replaced the pearl, I am telling you the reason why the skills in general it contains a material called guanine which is an organic compound. It is a lustrous material actually, which is organic components with a purine bas, 2 amino 6 oxypurine.

This guanine when it combination with the collagen and the calcium phosphate, it yields a shining silvery metal which called the pyrolysis. So, this guanine is the reason which is present in the fish scale. This guanine when it reacts with collagen and the calcium phosphate it produces this pearl essence. So, let us go ahead with that step by step discussion about the preparation method of this pearl essence. First, the removal of scales. The scales are carefully strapped off from the fishes. To start with then the scale of this fish processing industries can also be used for this purpose.

(Refer Slide Time: 15:26)



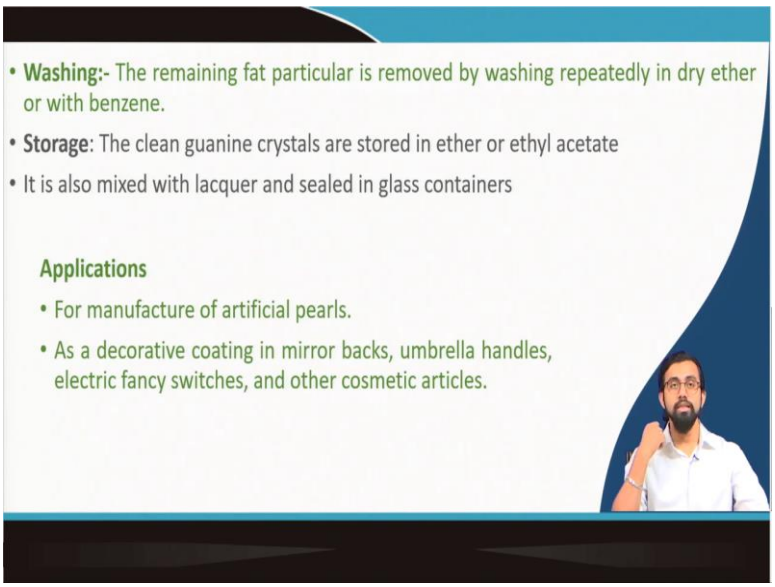
And then the washing and agitation is done. Adhering the dirt because the scale it has a lot of different foreign particles and solid particles. So, to remove this dirt it is done by washing in clean water and agitated in order to relieve the guanine crystals. So, once it is done, it is normally done in the horizontal drumless structure.

Fitted with the revolving stirrer with the pure water and the suspension which obtained in centrifugation this is after the centrifugation is done to separate the crude guanine which contains the exogenous protein as well. This released guanine crystals or the guanine material that which we get from after this drum filtration is done I mean like the drum filter based centrifugation is done and this what we call washing agitation process.

This guanine crystals are settled at the bottom of bottom and which is treated with acetic acid. So, once we treated with the acetic acid and in order to further remove all the microbial content and all if any other foreign particles are there to get rid of it and then we can use it for the deproteination.

Deproteinization is what it is a to adhering the protein fragments like which are there in this guanine crystals are removed by treating it with a 0.25 percentage papain or pepsin weight by weight percentage for 48 hours at ambient temperature. After then this deproteinized guanine crystals are separated by precipitating solvent ether or gasoline. So, once the precipitation process is done, now you have your guanine samples ready with you which is like in ether or any ether type solution or gasoline solution.

(Refer Slide Time: 17:25)



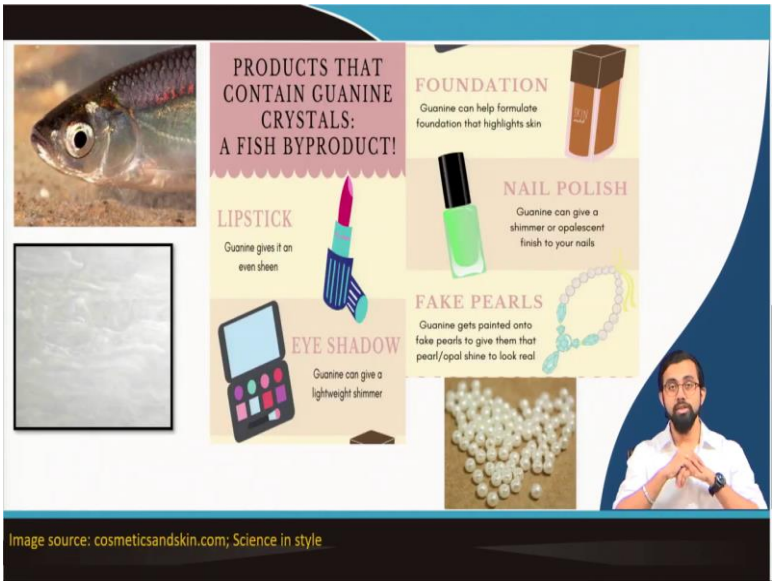
Then you can wash it the remaining fat. You can normally wash it with the dry ether or the benzene and then you can store it as a clean guanine crystals. This guanine crystals which are normally stored in ether and ether acetate. They can be mixed with lacquer and sealed in a glass container or this can be used for this is the this guanine actually the material that we normally we the major I would say like raw material for this pearl essence preparation. So, what is the reason why do we want to go for this pearl essence? There is different reason for it.

First of all, the actual pearl which we normally get from the wastage and it is very costly. But this is an alternative procedure for manufacturing the artificial pearl. It has a very good property. It is almost similar properties and texture as like pearl and it can be utilized to alternate to mimic the natural pearl. As a decorative protein in the mirror blacks you might have seen in the mirror the backside of the mirror we have this silver coating in general normally we do it.

So, earlier days, people used to do mercury coating and all sometimes people like in general this is also a famous alternative this pearl essence with that it is very low-cost metal so with that you can put a coating so that it is a very essential when you prepare this mirror backs. It is used for coating in the decorative coating in the umbrella handles, electric fancy switches and also other cosmetic articles.

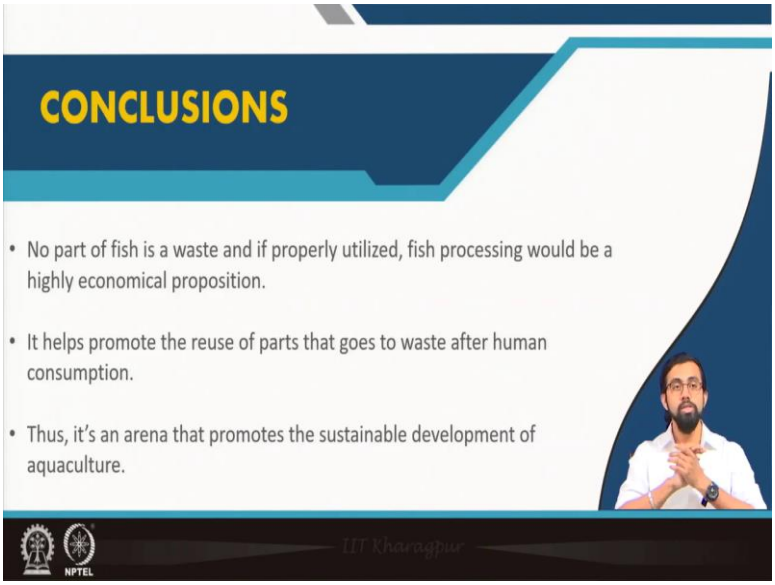
So, these are the different users of the like users of this pearl essence and this just I am reminding you this pearl essence is not actually coming from the pearl as we discussed it is coming from the fish scale. So, there are a procedure of sea water pearl, freshwater pearl and this is the artificial pearl that is how we can make the artificial pearl from the any from any fishes.

(Refer Slide Time: 19:40)



You can see the products that this content guanine crystals. It can make this glass mirror which is in the left bottom. If you see which is coming from this silvery anyway you see like the silvery shade of this scale in any fish normally the spin fishes. So, that can be used for foundation which is used to formulate a foundation that highlights the scale. It is used for nail polish, which can give this proper finish to your nail. The fake pearl it can or artificial pearl it does not seem fake pearl. It can be utilized for replacing the actual making the natural pearl. It can be used for different other personal care products like lipsticks or even the eyeshadows.

(Refer Slide Time: 20:28)

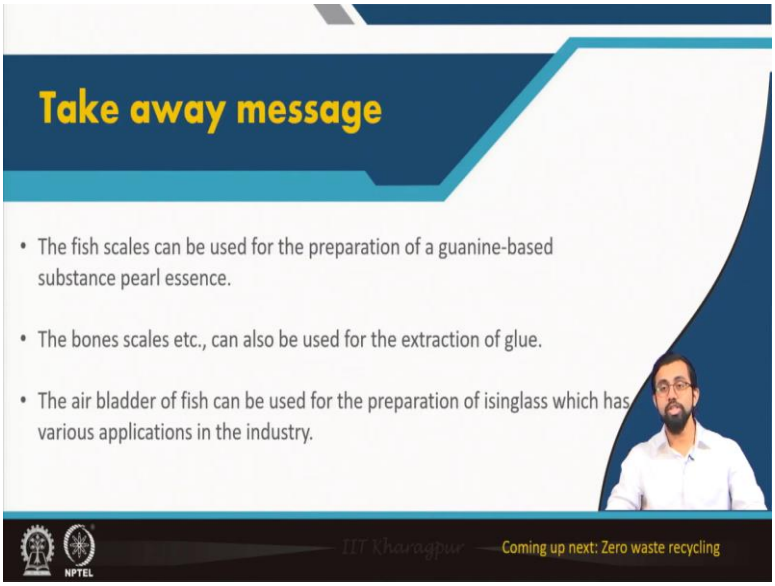


So, in conclusion, like from this last two lecture, what we have understood that there is no part in the fish that can go waste. As I already mentioned, I am again saying it to you that

waste is nothing but a misplaced resource. We just need to know that how we can utilize. So, it is properly utilized, this fish processing byproducts can be a very highly economic proposition or very high economic return you can get out of it once you go for this kind of byproduct utilization. It not only reuse this product, which are normally we throw away, which can be considered as waste.

So, it will also help, somehow sustaining the proper sustainable application of aquaculture because you are not creating any environmental nuisance, is not it? So, that the other way it is like it is it is outside like as a perfect example of sustainable development of aquaculture. And that is why we really should go ahead with this byproduct utilization.

(Refer Slide Time: 21:47)



So, the takeaway message that we know that fish scales can be used as a guanine based fish essence pearl essence, and which is something I hope like you really are very much enthusiastic to know more in detail. So, I would definitely request you to go ahead with the Google you can search it. There you can find more details about it and it is very fascinating. The bones scales can be used for the extraction of glue and gelatin.

The air bladder can be used for the preparation of isinglass, which has various application. One of the most important application is the clarifying agent in beverage industry, because it is insoluble in alcohol, but it is soluble in alkali and the acid. So, these are the takeaway message from this last two lecture material, I would say.

(Refer Slide Time: 22:37)

This the reference you can see. You can go ahead and so in general, I hope you get to know about the essential the requisites for preparation of different kind of fish-byproduct or I would say aquatic species byproducts, and how we can utilize them and how we can make some product out of it so that it can be beneficial for you as the farm manager, or suppose if you are a service provider, you can utilize each and every part of your farm product.

So, that is how you not only creating further employment opportunity, further economic return, but also you are helping the environmental sustainably like I mean, like you are not ruining the environment in because of this waste deposition. So, I hope these lectures is actually helpful to you. You got to know a lot of information's. And I hope it will steer your mind to go ahead further and learn more about it. So, definitely I would be very happy to help you if I can do it by anyhow. So, that is it for now. See you in the next lecture. Thank you so much.