Pioneering Intergrated Biorefinery Approaches for Converting Agro-Food Waste into Food Industry Additives | Text Transcript | CIRCLE

This is a text transcription for the recorded event “Pioneering Integrated Biorefinery Approaches for Converting Agro-Food Waste into Food Industry Additives” presented by the Canada India Research Centre for Learning and Engagement (CIRCLE) at the University of Guelph. The event was recorded on January 30, 2025, and was moderated by Guneet Kaur. The guest speaker was Winny Routray.

Transcript:

Guneet Kaur:

Hello! Good morning, everybody. Welcome to this very interesting and really relevant in today's time webinar on pioneering integrated biorefinery approaches for converting agro food waste into food industry additives. And in a minute I would introduce our wonderful speaker for today.

Before that I would like to introduce myself. My name is Guneet Kaur and I am a faculty at the school of Engineering at University of Guelph. And in fact, my research aligns perfectly with today's webinar topic.

So my research is also focused on the conversion of agri-food residues or biomass resources that are available as a waste and how can the functional and the nutritional properties of those residues can actually be converted into something which is of high value. So we look into plastics, we look into biowaste chemicals, enzymes, novel foods as well.

And with that I would like to introduce CIRCLE, because this is the seminar or the webinar which is hosted by CIRCLE. That's the Canada India Research Center for Learning and Engagement Research Center at the University of Guelph.

So CIRCLE was established in February 2020 at the University of Guelph, and it aims to be an interdisciplinary nucleus in Canada for cutting edge research on India, on South Asia, and their diasporas to showcase, advocate, catalyze, and foster an equitable, respectful and a sustained exchange of knowledge between the Canadian and Indian scholars on complex and emerging, and sometimes unexplored topics. Related to sustainability, social, and economic well-being.

And since sustainability is almost a buzzword these days, but it really impacts everyone. It's a global phenomenon. So the purpose of CIRCLE is to bridge this gap between geographical domains and really bring together this research exchange between Canada and India and the diasporas.

So - before going on to today's webinar, I would like to invite the audience to check out this speakers, which are lined up for the winter term, and the next webinar is on 24th February, and is given by Dilshan Fernando. Who would be really talking about a social aspect related to destigmatization. So check out CIRCLES website and register for the for the next webinar as well.

Okay. So coming to today's webinar, we have our wonderful speaker, Dr. Winny Routray. Dr. Routray, is an assistant professor in the Department of Food Process Engineering at the National Institute of Technology, Rourkela, India, one of the prime research and teaching institutes in India. Where she joined in February 2020, she received her PhD in bioresource engineering from Mcgill University, Canada. And completed a postgraduate program in data science from Purdue University, U.S.A. In 2020.

Her main research interests encompass many aspects of food engineering, byproduct, and value addition of resources. Through downstream processing, focusing on sustainable biomaterials production, and value added product development.

Apart from research activities, she has a keen interest in transfer of knowledge between academia and industry, something that we all value a lot like everything that is produced in the lab must reach the market. So that is something which Dr. Routray is interested in, and she is also involved in mentoring fresh entrepreneurs and engaging in outreach activities.

So welcome, Dr. Winny Routray. It's our pleasure to have you here and listen to the interesting ideas that you have developed around value addition of resources. So a little bit about how this webinar would be organized. You'll have about 30 to 40 min to present your slide deck, so that it saves us about 20 min, 25 min for Q&A, and there could be a very interactive session with the audience.

So the Q&A would be at the end, not during the presentation. I would request the audience to keep themselves on mute and the video or the camera off. At the time of Q&A you are most welcome to appear on camera and have a virtual face to face interaction with Dr. Routray or you are also welcome to write your questions or comments in the chat box, and then I will read it out to to her so that she can answer your questions.

Okay. The event is being recorded in the hope that it can be made available later. And I think that's all which had to be covered before we listen to this interesting talk by Dr. Winny Routray. Dr. Routray, the stage is yours.

Winny Routray:

Thank you, Professor Guneet, and thank you for inviting me in CIRCLE. I can see quite a lot of my students also who are right now in Canada, and that's really joyful to see them there.

Guneet Kaur:

That's amazing! You have a huge audience.

Winny Routray:

Yeah and that includes our students too. So yeah, that's a pleasure definitely to see them. So should I share the screen now?

Guneet Kaur:

Yes, please.

Winny Routray:

Okay. So today, should I start? Is it okay?

Guneet Kaur:

Yes, yes, the slides are visible. Go ahead.

Winny Routray:

Let me just see if I can actually, right! Okay, okay, so. So today, we will see some of the biorefinery approaches. I mean, most of us, many of us. Maybe not most, I wouldn't say most. But many of us are currently working on utilization of the agri food waste. Okay? And that has a lot of applications.

And in which we are mostly concerned, is like to get it back into the food industry as additives or any other component. So some of the additives we will be definitely talking about. But I will be also discussing the areas in which this concept of conversion of agro food waste into viable products is quite prominent right now. So that also we will see.

So today we will discuss a bit about the food loss and waste and how it is happening in different kinds of, types of waste. For example, we can primarily divide it into 2 genres, plant and animal byproducts.

So what are the products which are already in the market? Probably some of, many of us, might be familiar with some of the products which I will show you in the start, like these are the commercial products which are present already, and then we will see some of the case studies. Mostly the products which we have developed in lab, and we have some interested parties.

And some of the entrepreneurs and startups are there who are collaborating with us in implementing or adapting those products for the market. Okay? Because that's definitely quite different.

And the other aspect which is also associated with this kind of byproduct, utilization is sensitization of the community. Because, like, as we will see in the later slide, some of the challenges which also come with byproduct utilization. Which makes it necessary that the people should know the value of these byproducts, and how should they treat it so that they are actually usable?

Okay. So mainly, most of us might be familiar that whenever we are talking about any loss or waste, it's the quantitative loss. So that happens because of the loss in the quality. That can be nutritional, cosmetic, and from the point of view of food safety.

So because any of these components if nutritionally something is not right, then we are not eating it. If something, a food has to have an aesthetic value, if that's not there, then we are not using it. Or if the date of expiry, or if we think that okay, this food is not safe, then we are not using it. These are the primary reasons.

So, apart from the agricultural practices, mainly the places or the, we can say down the stream, the processes or the phases when the losses are happening in, mostly household, retail, and food services. These are the 3 phases where we encounter a lot of ways.

And these are some of the numbers which are there present throughout the world. There's just few numbers which we can say that we encounter in general, and this kind of supports the fact that this is a global phenomenon where we are having so much of loss in this particular industry, agro, food industry. So mainly, phase wise we see what are the different ways which are there in case of which we are generating in case of plant byproducts.

It's like at each stage, harvest, we are generating few. We are not even considering what we encountered in the field. It's like from the phase of harvest, then harvested commodity in many

cases it's not marketable or it's not usable. So it has to be further processed. Minimum processing happens. So then again, we come across a lot of waste.

Different categories which includes stone, pulp, skin in case of fruit, and in case of cereals, for example, bran, skin, husk. We have different names, but and categorizations but these are mostly the outer portion of the cereals. And then we have vegetable based also. Because a lot of people are using right now, like, if not any other processed food, then canned and frozen food are becoming more and more common. So in that case we do have these kind of waste in case of vegetable waste, we are increasing that amount.

And then again, marketable products in many cases is further processed to processed products. For example, we have a different kind of noodles or flour, or in case of fruits, we are making jams and jellies and juices, so like there are certain food items which can be said as a secondary means which come we come across after secondary processing. So further, we are producing more and more byproducts and waste.

So one thing is clear here that when we increase the amount of processing we keep on adding the byproducts and waste. So minimal processing definitely leads to minimum amount of waste or byproduct as well.

In case of animal wastage, or this particular graph has been taken from FAO, FAO database. So it kind of gives you a gist, like how we are losing at each stage. As I said, more and more, processing, more and more waste. So initially, we have agriculture and fisheries. If we say plants and animals mainly this, this particular figure includes fisheries. So in that case, a major part in case of agriculture, is intended for the food especially, which are grown and harvested for the food industry.

Part of it is used as feed, seed, and some others have also industrial uses like cosmetics industry is a major industry which is using natural products. So there a portion of the produce is diverted, and there are some other minor applications as well. Now this intended for food part.

Then, again, further we can say that, okay, there is a portion which is food, and there are inedible parts. At that phase as well, or in that phase we are converting some part of the byproduct to feed, and there are some other applications. Now this food, again, is, can be categorized in terms of qualitative loss and waste and quantitative.

Now, further. So you can see that this green portion, which signifies the part, the intended part of the agriculture. Which is for food. That keeps on decreasing. So by the time the consumption by people. At that time, a major portion has been lost. Or we can say that a major portion is not definitely food.

But apart from that it's not eligible to be converted to any kind of, even high end product. Means mostly what happens is that we can see that many of the food byproducts, they are eligible to be converted to fertilizers, and side by side it is converted to biogas. That is a major application, because one, we are not segregating the waste.

The point is here that any kind of food byproduct, whether it is a plant byproduct or an animal byproduct, that's a biological material. So we do not preserve it. In the same way as we have different kind of systems, present refrigeration systems and other type of systems, which are there for the intended part for food.

So, as soon as it starts deteriorating more and more, that means we can only convert it to fertilizer or burn it in certain cases. As you can see here, this is an example of biochar. Okay? So that also happens. Now, industry also is using any of the plant byproducts which are very rich in cellulose. Those are being converted to cutleries currently. So, apart from these two, fertilizer and biochar, nowadays this is also quite popular application.

Okay. However, apart from these, we should also concentrate on high end application. So this is something which many of us might be familiar with; orange peel black tea. So there are a lot of extracts available right now in the market, which are basically extracts, but we have termed it as tea, right? So fruit based tea. So that's there.

Now, this is something which is which is a leafy byproduct of a processing plant, a plant processing plant. So that can also be used for example, extraction of colour, natural colour, which can be applied back into the food. Or else it can also be used as a part of tea.

Now, orange peel powder. This is quite hugely employed in case of bakeries. There are quite a lot of bakeries where dried peels, or even fresh peels, are applied and used. So these are some of the applications where probably we should concentrate more.

But any of the below three application for that, we need to actually preserve. Because if you're talking about orange peel, they're very susceptible to deterioration or any other kind of leaf that is also very susceptible to deterioration. So we have to preserve them, so that they can enter into like we can use them, or, use a particular processing mechanism for them so that they can be used.

Now, saying about this, there are like quite a lot of my research has been concentrated on utilizing the byproducts. Starting from the PhD work which I did in Canada. So there we were using the leaves of the blueberry to prepare extracts, rich in phenolic components as well as anthocyanins.

The anthocyanin content used to be very high in leaves towards the end of the fall. So this is the colour, and probably you guys see it more often now, right? And this was the favourite part for me, like collecting the sample, because the fields used to be so beautiful.

So that inspired me that this can be a natural colouring, and it was absolutely rich in anthocyanin. One of the challenges which we faced is like there is a conversion from one component to the other in case of phenolic compounds. So chlorogenic acid was very high in green leaves. However, anthocyanins were very high in case of the leaves which we collected at the end of the fall.

We did phase wise extractions, so we could optimize the combination of different solvents and time, as well as we could look through different kind of materials, how the chemical conversion, or biochemical conversion was happening, and we could say that, okay, green leaf when harvested, because obviously we do pruning in case of many tree plants.

It was done in case of blueberries also. So the green plants, what was the use for that? And what was the use for the red leaves? We were trying to devise different applications for different byproducts which were produced at different phases of growth of the plant. There was a necessity of pruning, by default, the leaves they would fall to the ground.

Rather, this was something which could be used as an additional income source. And luckily, I would like to share this experience that when we approached the farmer who was from, she was a lady, and we were collecting the leaves from a garden. She said that they actually drank the blueberry leaf tea and that was very popular in their household.

So there you go, like already the application was there, but it wasn't that advertised or commercialized? So we tried to devise the process technology so that it can be used. What was the proper drying temperature? What was the drying method temperature? Along with that, the extraction, solvent, and time combination methods.

And in this case we used microwave, which we have subsequently used in other cases as well. Like this is another medicinal plant. We have, you can say, Indigenous concoctions of Giloy. The scientific name is Tinospora cordifolia. So in this case, also, we use microwaves.

Microwave, if anybody is planning to use, is a very good extraction method, microbe assisted extraction method, is very helpful when it is targeted for small fractions. And it's very good for medicinal component extraction because it's a very fast method. And because it's very fast it does the damage to a very lesser extent. Okay, so that's actually quite helpful in case of many medicines.

In case of Giloy, we also used cold plasma. We were trying to like, we used actually cold plasma and microwave, both of them and we compared the results. Obviously microwave was much better as compared to cold plasma. But I would say, in case of cold plasma, there is way to go, because this is not a regular application of cold plasma yet. It's not that popularly used in case of extraction.

We have to tune up the method, quite a lot, I would say, to get the optimized machine, or I would say that optimized apparatus where cold plasma can be applied for extraction. And Giloy, generally leaves are used.

Okay, in that case, what does happen to the stem? So that was something which is not regularly used as a medicinal component. So we tried to use the stem, because that would be the byproduct if the leaves are used right? So we profiled the extract. What was the phenolic content? What was the antioxidant properties?

And we had quite good results in case of the extracts as well. And they were equally, if not, we cannot say in terms of quantitatively like how much the same plant sleeve would be, but it was comparable. So there you go.

This can come to the mainstream applications as well. Now we used this Pandanus amaryllifolius. Many of the, probably, Indians and Southeast Asian people will know that this particular plant gives exactly the same kind of aroma as is in case of basmati rice, attributed to 2-Acetyl-1-pyrroline. So that's the compound which is responsible for that.

Now the other aspects of Pandan, for example, the antioxidant activities, and all these things they have not been that extensively studied. So for that reason we use 2 methods in this case.

One was the cold plasma, pretreatment, and ultrasound. To see and to profile what are the other, like the phytochemical profiling, antioxidant activity, total phenolics, total terpenoid content, and flavonoid content. We wanted to profile that so that the extracts can be a product as well.

For example, extracts are also present there actually in the Asian shops in Canada, as well. Pandanis amaryllifolius. So, and in most of the cases it becomes like, for example, what was the purpose here?

When we are approaching any farmer or entrepreneur they want a very simple process. Okay? In that case, if I go and say that okay, you can make the extract of Pandanis amaryllifolius and then get the aromatic component concentrated. Now that is an extra effort for that person.

We wanted to suggest that, okay, this is a crude extract, and these are the benefits of this extract and use it. Okay. You can definitely readily use it. You do not have to have a refined Pandanis amaryllifolius extract. You can use the crude extract itself. So that was the purpose here of profiling it, so that we can say, okay, apart from 2-ACPY, 2-Acetyl-1-pyrroline, you have these other components, which are also very beneficial. So overall, the extract is a good product.

And this is more applicable in the cases where the leaves cannot be sent. I mean fresh leaves. If we are sending dry leaves, then in that case a certain amount of aromatic components are lost. In extract there is a possibility of preservation of the aromatic components along with the other additional phytochemicals which can be definitely useful. So that was the purpose there, to simplify the process.

Okay, here we have used some of the like high end, not high end, I would say, not non-traditional extraction methods, but solvent and the other part of it, that remains constant, which can be used in case of other extraction methods as well. Which is available.

So another industry is your milk, industry and whey protein is a major byproduct there. There's so much of application of whey protein right now that it's good to see that people are using it in different ways.

Apart from that, honey is quite a popular product as well right? And however, we wanted to have a dried honey which can be used as a replacement for traditional sugar. Okay? And in this case we like used whey protein because honey, as such, drying it is a bit difficult, not a bit actually, it is difficult. It doesn't dry completely. So for that reason we used whey, protein, and maltodextrin, so that we can have dried powder of honey.

That would be more viable as a replacement for sugar, right? And of course, there are some ways in which honey is mostly used. For example, warm water. People use it in tea as well. So this goes with that.

Of course, whey has its own taste, but it's not a bad taste. I mean anyone who doesn't want to have a traditional sugar, they can go with honey as well. And in this case we used a food industry by product. Okay, so that was the objective here to have a replacement for sugar. Honey, it's a very healthy choice, as well as whey protein is also a very healthy choice in terms of, you can say, for making powders. It's also a very healthy choice. So we combine both of these.

Now, another part on which some of my students are working is nanocellulose and cellulose has a lot of application. So in case of functional food, drug delivery, biosensors, emulsion stabilizer. And most of these as you can see are quite relevant in case of food industry.

In our group, we are using again a byproduct, a food industry byproduct rather than any other industry byproduct like wood chips or anything. We are using food industry byproduct, because generally there is more consensus on using a food industry byproduct in food industry. It's jackfruit peel from which we are extracting the cellulose, converting it to nanocellulose. And we are exploring different kinds of applications.

So in this case, obviously, it's not a direct additive with benefits, but it functionalizes different beneficial components. It acts as, you can say in certain cases, carrier material and a structural supportive material. In most of the cases, as you can see drug delivery and functional foods. It enhances the accessibility of different components. So that way it is very relevant. And we have some wonderful like observations with jackfruit peel, which we will be publishing in coming months as well. So now, these are some of the plant byproducts.

Now one of the animal byproduct industry which I would be discussing. Like is the fish industry, fisheries. You can say fishery industry. So majorly in among animal byproduct we can categorize mostly what we get. Head bones, scales, blood, internal organs, cut waste pieces, waste oil, and wastewater.

Wastewater is also a major byproduct in case of dairy industry. We have a huge amount of water, wastewater, which is released on a daily basis from milk industry. So in this case, as you can see, fishery waste. If we say finfish, that waste is there, seal waste, is there, shellfish waste is there, and other crustacean waste, and waste water. These are some of the major fishery wastes and byproducts which are there.

Now value-added products. Many of these, as you can see, are food additives. Fish oil, Omega-3 fatty acids, and also supplements. So protein, amino acids, anticoagulants, enzyme inhibitors. As you can see, there are a lot of products which are produced from fishery waste. So there is huge potential here.

And I was in Newfoundland for my postdoc. Their fishery industry is huge. So when we are on an island there is a requirement that we should be able to resource these waste materials into something. Because how much can you dump? And where would you dump? So that's the requirement there.

So now, if we look at the numbers here, so edible portion actually is very small. Whether it is for fin fish or for shellfish. And rest of it is waste byproducts. Apart from this logic that we are

generating a lot of waste or byproduct in the fishery industry. The other part is that why we are processing it.

Then at each stage, we are generating waste. Okay, quality assessment for retail. In that phase we discard a lot. Then undersized, unsaleable, unwanted fish. Those are also discarded, which are spoiled at sea or during landing, those are discarded. Many of these do not actually come to any kind of market.

Then waste generated during dressing, handling, processing. So in this case, fish and the frame. And apart from that internal organs, those are major. Then, when we are producing dry products, again, we have many different ways. Canned and frozen products. In that case, also, we are generating waste. And again, you see the logic here that more and more we are processing more and more, we are producing.

Now...here one of the products which is directly consumed or is part of food, industry is the fish lipids. So these are different parts, as you can see. And this liquid, which you see here, that is an internal organ, like in many cases, it's actually opens up. And it looks something like this, it liquefies very easily. And this is salmon actually, salmon byproduct.

Now, there, there is actually demand or application, a few application for the frame and the head. However, the internal organs, they are very susceptible to damage. Fast deterioration. So we need quite a lot of application, fast application for that particular part. So fish lipid, they are generally in case of tissue, belly flap, liver and muscle tissue in the head. Okay, these are the portions where we have a lot of fish lipid.

Now, why we need supplements? As, for example, fish lipids as supplements. Okay, that's a direct application. Now, the amount of the Omega-3 fatty acid, which is present in the fish and the amount which we should consume. There is a huge gap between that means we have to consume a lot of fish to attain that particular healthy amount of Omega-3 fatty acid. That's why people go with the supplements. So this there is a huge market here, and according to the quality, you will see that the price differs.

Now this this was something on which I worked. So here I would like to emphasize that we were using the enzymatic extraction in which we were producing a lot of different things. For example, bones were produced. This was the sludge which contained mineral also. And this was the protein hydrolysate. And this was the oil.

So we had different products, and we could convert it to different types of value added products. Because bone is, for example, rich in calcium. And this is protein hydrolysis, so there

is a direct application of that. And this is for Omega-3 fatty acids. So we might have to think a bit. But there's quite a big market for all these products.

Then, astaxanthin, that is traditionally produced using Haematococcus pluvialis. However, a lot of shellfish are there who have astaxanthin in it. And astaxanthin is predominantly discarded while processing those so that can be recovered from the shellfish processing industry and utilized back as a colour component. And it has excellent antioxidant properties as well. So it is a very important food supplement, you can say, or an additive.

Now chitin that has application, not a direct application as additive, but chitin is converted generally to chitosan and chitosan-based films are there which are edible films. They have antimicrobial properties, and they can be also combined with other components to enhance their properties. So it's an excellent like food packaging material with different advantages. So this is a process — due to time crunch actually I'm trying to finish it fast but I will definitely answer more during the question session.

The challenge here, in case of crustacean shells is that you have to decalcify, then deproteination steps is there. Then, decolorization, where we can separate out the astaxanthin in the current case, then, deacetylation, which will convert to like chitin to chitosan. So this decalcification, where we are getting rid of the minerals, the mineral component which is there in the shell, that is still a challenge. I mean there is not a eco-friendly method just yet. We have people are working on it so that we can use less chemicals to produce this particular compound. It's still a challenge.

Now, this is a concept which is here to show you that there are so many different products which can be produced at the same time from a fish processing waste, if it is preserved properly and processed properly. So all yellows which you see here, those are all products which can be produced. And many of these are food supplements or food additives, and rest of it are also value-added products.

Now, this is for crustacean shells. Again, at each stage we can choose what we want to do now because of the challenge that it has such a high concentration of mineral. So, the number of processing methods, or processing steps, is quite high for the recovery of these assets and from all crustacean shells. Simultaneously, for example, here you can see that we can produce chitin, chitosan, protein hydrolysate, astaxanthin, oil and fatty acids.

Whoever here actually consumes fishery products, fish and crustacean is a big fan of crab and shrimp, hey will know that it also has fatty acids. So that can be also used.

This is something which we definitely need to think about how to use it so that it can be most economically used. Now, the challenge here is that apart from processing step which are involved, the fact is that many people are not aware of options that the waste can be used in such ways. And we do not have enough facility to actually preserve this waste also, so that it can be further used, because nobody is looking towards having a high-end application of these byproducts.

Everybody is looking to us, okay, we can produce biogas, and we can produce fertilizer, but we have so many options which are there for utilization of these byproducts. Which should definitely be explored by current and future researchers so that we can make an array of product.And we should be able to give entrepreneurs, or the farmers, or anybody who is involved in this the option of choosing that you can make this high end product, and you can still go with whatever is discarded to make fertilizer and biogas. Which is still a very good option.

But that is most applicable for the most spoiled version of the waste. We can definitely use the byproducts if preserved properly for many other applications. This is one example. Many people are working right now also to actually create awareness and give more options. And we should definitely cheer for them. This is an example where this cup is a very sustainable choice. We have quite a lot of variety of products right now, if you look at it.

So in India right now, millet-based cups are also available, which, after use, we can eat it. So eatable cutleries are quite popular these days. That's a very healthy option. Millets. Those are healthy, and then it's used for example, drinking coffee or tea, and after that we can eat it. So that's the snack and that's the drink. So that's the logic there.

To curb this, we have this problem probably every year where a major part of this trouble is burnt. So organizations are there which are sensitizing the major mass there, farmers and all. There are other options. These can be used for making biodegradable packaging, and that will curb the pollution. Like the air pollution which is caused by burning it. At the same time it will reduce the solid material pollution as well, because somehow we have to dispose of the stubble, which is the agricultural waste.

So, people are working on these things but probably we need a younger generation who is motivated towards work towards this. Then probably the solutions which are generated, they will be more viable, and more people will know about it. More people will be interested, because this has to be a habit, we don't have to waste, we can use it in different ways. So that's there.

Thank you so much, and I would like to acknowledge Dr. Deepika, Dave. She is a part of this, which was focused on fishery, that I have used from a lot of literature and the work which was done in her group. So I would definitely like to thank her on this platform as well. Thank you very much. I will stop presenting now.

Guneet Kaur:

Sure. Thank you so much, Dr. Routray, for that very interesting and indeed very comprehensive presentation. Several examples. Especially what I liked was how the work was performed in both the relevant countries, Canada and India, which is the focus of CIRCLE., so thank you for that comprehensive presentation.

And now is time, for I think we have about 14 minutes for Q and A. So I would like to invite the audience to ask questions to Dr. Routray. You can raise your hand and then I'll invite you. You can ask the question. You can be on camera or you can just type in your questions, and I will ask those questions from Dr. Routray. Anybody? Maybe I can start with the first question then.

Oh, okay, Allison has a question. Do you know any community engagement work? I know you mentioned that you had spoken to a farmer about using their blueberry leaves, and they said they make tea, which is so interesting. So that's the I'm thinking, that's the kind of community engagement. Or do they further work with you and they give their supplies to you? How does that part work?

Winny Routray:

Well, for blueberry actually, only when we talk with the owner of the land, that she was used to drinking tea. However, they are not supplying it to anyone. But, once in the market we actually had discovered a tea which had a mix of berry leaves, and one of those berries was blueberry.

So it was there, but you know, the herbal tea section, which a lot of us do not go, we go to the coffee and traditional tea section, but we do not go there. But green tea drinkers, probably they were already exploring it, so those kind of products were there.

Now, community engagement when you say, we had more community engagement actually in Newfoundland. I have mentioned the Canadian context. During my stay there we used to go to different villages and we actually interacted with farmers and they were supplying us the shrimp shell on which research was going on, and there were some companies also who were buying the Chitosan, which was produced in the facility. And they were very interested in that

because those were cosmetics, like they were using in case of cosmetics. So yeah, there was an interaction with the community there.

If it has to be said in case of Indian context, then we do work with farmers because all these waste which we are procuring from different sources, those are directly coming from the farmers. I would like to also emphasize that in the case of the honey powder we directly procured it from a farmer who had collected wild honey and it was in one of our forests in Odisha.

So, we engage them actually and through these methods we are also telling them that you have many options, that you do not have to just sell your product, because wild honey is still very expensive, but there are also people who are not aware of the fact that wild honey is so expensive, I mean, it has so much of value. So our job becomes also to like sensitize them about that fact and to tell them that you have other options also, where you can further increase the value of the product.

Guneet Kaur:

Sure. Sure. We have one question on the carbon footprint. So Alison is saying, thank you for the answer. So we have a question on carbon footprint, but before we take that question there is an additional question, I think from me, since we are talking about the socioeconomic aspects and your experiences around it. So what is the perception of people, or their acceptance, towards these food additives which are derived from waste?

Winny Routray:

Okay. When, for example, we are saying about whey protein, whey protein is quite acceptable, because many are aware about it. And, for example, if I say pandanus, then that is also quite acceptable, Giloy, then it is acceptable. The major challenge comes from, for example, if I'm talking about cauliflower stem or apple peel. So those are some of the things which are not there in peoples mind, in that okay yeah, this we can actually use.

But then again, at the side by side — so mainly, my point would be that many of the things which are not traditionally consumed in many parts of the world, have not been explored traditionally.

Guneet Kaur:

Sure. Sure.

Winny Routray:

So now we are trying to tell people, okay, this has this benefit also. For example, many seeds, like pumpkin seed is traditionally used, watermelon seed, that is also, though we are moving towards seedless watermelon. But at the same time, watermelon seed has its use, and in certain countries actually, it is a popular snack.

Guneet Kaur:

I think now in India too, like all I hear all these chia seeds and pumpkin seeds.

Winny Routray:

Yeah.

Guneet Kaur:

They're becoming very popular.

Winny Routray:

Like mixed up seeds, salted seeds, it's there.

Guneet Kaur:

Yeah.

Winny Routray:

So there has to be a cross-cultural information dissemination as well, so that we know probably, which is not a traditional food in our case, is also being used there. So those options, people have to be aware about those options so that they can apply.

Guneet Kaur:

Sure. So I think it goes to you know. There's a little bit of educating people there, because perhaps you know, when whey protein was introduced, maybe at at the time that also raised eyebrows. But then it became more and more acceptable, so these newer waste food additives they take time but it needs educating people.

So we have a bunch of questions. [Laughs]. So there's a question from Dr. Priyanka Singh asking what about the carbon footprint generation from waste to final product? If you can just, you know, briefly talk about it.

Winny Routray:

That's where actually our job comes in. Like how to have optimized processing step or processing method, which will have least carbon footprint. So that probably, according to my experience, I would say two waste products which I have encountered, which we have not been fortunate to decrease the carbon footprint.

What one is the recovery of, for example, Chitin, chitosan, and astaxanthin from crustacean waste, and the other one is production of cellulose drom different kind of — probably pineapple is a more malleable byproduct.

But, for example, there are quite a lot of byproducts which have a substantial amount of cellulose, but to break it down and to extract the usable cellulose is quite a challenge, with less carbon footprint. So yeah, that's where actually our job comes in, yeah. Yeah.

Guneet Kaur:

Another question from Kerthika Devi. Is it possible to scale up the microwave assisted extraction to industrial scale? And if yes, what would be the challenges involved?

Winny Routray:

Actually some year back we were writing a chapter, in that case I encountered certain machines in China which were using multiple magnetron to scale up. So, it was still a batch process, but it was definitely higher than what we see in lab.

So, the people are still working on it. But I think the technology is already there, means bigger microwave. And the challenge is there like magnetron when we are using microwave, the radiation is the major problem. How to deal with that.

Guneet Kaur:

Yeah. Okay. So that would be some preliminary aspects there, in addition to technical.

Winny Routray:

Yeah. Yeah.

Guneet Kaur:

Another question is on, have you transferred any technology at industry level for additives? Given the fact that they are derived from food or waste residues. And were there any challenges faced? So I guess the challenges Malvika is more focusing on the regulatory hurdles.

Winny Routray:

Yeah, yeah, that's the part which is difficult. Still, we are figuring it out. And of course I would say, Omega-3 fatty acids and astaxanthin. Those were the ones which were quite a lot accepted. So we went with like, definitely, those were acceptable products. That's why we could commercialize it. And however for example, when — and yeah, for example, the pandanus extract, that is already there. So that's there, and challenges as such as you said, regulatory part, and the the biggest part in this case is that it's different from region to region.

Guneet Kaur:

Indeed.

Winny Routray:

That is standard that works here, then it will work there. So that's not there. So yeah.

Guneet Kaur:

So yes, Malvika, regulatory hurdles exist, and you need to be aware of the regulations wherever you are trying to bring your product to market. Okay? Another question from Charles is for the dry honey powder, how possible would it be to scale it up to industrial levels for export? I think this question is arising mainly from that.

Winny Routray: Actually it can be very much possible.

Guneet Kaur:

Yeah, some, but not all places, and not not all regions across the world produce honey. [Laughs]. So if you have to scale that.

Winny Routray:

Yeah, Yeah. Actually, it's very much viable because we had some solutions. What we saw in that case was different proportions when we keep kept on changing with maltodextrin and whey protein. We had different types of properties.

So somewhere like chips, we have sugar laced peanuts, those are chickies. So we had some products which were like those and we had fine powder in some other cases. So it's definitely very much scalable. That part I'm very much sure about. This honey powder. So, yeah.

Guneet Kaur:

So it, I think it just, you know, remains to be seen how to formulate that powder and whether to sell it as a powder.

Winny Routray:

On a larger scale, actually the challenge which is there in case of honey powder still is the drying method and how to get it like off the surface on which we are drying. And probably I think, it's still attainable, though there will be a portion which will be lost, but it's scalable, and it can be exported.

Guneet Kaur:

Okay. I think we have 2 more questions. So for products such as astaxanthin, that is derived from seafood, you also have to be concerned or have that accounted for that in terms of potential allergen risk. And it's not a vegan product per se, so how to counter that?

Winny Routray:

Actually there has to be a mention from the source from which it is being derived, because this question is very much valid, because we had one person in Newfoundland when we were working, she was allergic to the seafood and when she used to enter into the facility, none of the processing was going on. Everything used to be stopped, even though she was in Marine Institute [Laughs], but we used to stop working on anything because she was allergic. So it was just a demonstration, but nothing was there on the floor. I mean, nobody was working. We have to mention.

Guneet Kaur:

I'm assuming like as well sourcing of an additive that is coming from seafood, it has to come with a lot of precautions and information around the source.

Winny Routray:

Yeah. I think it is done in case of Omega-3 fatty acids already, I mean, they do mention which kind of fish it is sourced from. So the same thing can be done in case of — yes.

Guneet Kaur:

Yeah. So, Kyle, here you go, that's the answer. How it's done for Omega-3 fatty acids, which is a very acceptable product and has been on market for a really long time.

Another question is, Reema. I'm curious about the sensitivity of phenolics and anthocyanin to environmental changes, such as temperature and oxygen exposure. So how to maintain their optimal biological function when they are exposed to these variations in the conditions. I think this has to do with the stability?

Winny Routray:

Yeah, this is to do with the stability. That's where the encapsulation part comes in. So we have current projects on which we are actually working on encapsulation of the phenolics, so that it is more applicable because your question is absolutely valid, it is one of the most like unstable, very sensitive compound, very unstable. And to use it definitely we need some kind of binder around it so that the properties can be preserved. So we are currently working on it. Thank you for the question.

Guneet Kaur:

Thank you so much, Dr. Routray, and thank you for the wonderful audience that you have been. It was an amazing interactive session. Thanks for all the questions, and I hope your questions were answered. In case you still have questions or would like to interact with Dr. Routray, please reach out to me, I can pass on her email address and you can interact with her.

Again, thank you very much for this wonderful webinar, the slide deck and the Q and A session, Dr. Routray. It was really a delight to have you on this CIRCLE Webinar. For the audience again, please look at the next webinar by Dilshan Fernando who will be talking about the destigmatization of disability in employment, especially referring to the case of India.

So again, thank you very much, and have a great evening to people in India, and have a great rest of the day in Canada. Thanks.

Bye.

[End of transcript]