

## WORLD ENVIRONMENT DAY SYMPOSIUM ORGANISED BY THE GREEN INSTITUTE

JUNE 5, 2023

### ECDUCATION SESSION

**DR. HELEN ONYEAKA:** Associate Professor, School of Chemical Engineering, University of Birmingham, United Kingdom.

#### **DR. HELEN ONYEAKA: MICROORGANISM FOR SUSTAINABLE AGRICULTURAL PRODUCTION, ENVIRONMENTAL CONSERVATION REDUCED LAND USE AND FOOD SECURITY**

**Moderator: Oluwatomi Abraham**-Leadership Development Manager, Teach For Nigeria, Nigeria.

**Abraham:** So, right about now, I'll be calling Dr. Helen Onyeaka.

Good afternoon. Welcome and Happy World Environment Day to you, Dr. Helen. So we are, we can't wait to hear you and then you will come on.

**Dr. Onyeaka:** Good afternoon.

**Abraham:** We can't wait to hear you. So I will just treat your biographical profile briefly and then you would come on. Dr. Helen is an Industrial Microbiology with over 25 years of experience. Her career in microbiology to date has been varied with experience gained in industry as well as academia (both teaching and research). Dr. Onyeaka's PhD researched the impact on individual microbial cells due to a changing microenvironment with regard to their physiology and metabolic pathway and suggested how this knowledge could be used to predict as well as optimize future process performances in the industry. She received the Briton postgraduate and IChem Biochemical Engineering award for this doctorate thesis. Dr. Helen you have the floor.

**Dr. Onyeaka:** Thank you so much

**Abraham:** We can't wait to hear you

**Dr. Onyeaka:** Yeah. Is it possible to have my slides on please? Thank you. Hi everyone. My name is Helen Onyeaka from the University of Birmingham. My talk today is Microorganism for sustainable food production in Environmental Conservation and food security. Next slide please; today our planet faces several critical environmental challenges such as food waste environmental pollution climate change loss of biodiversity and also the ever-increasing global populations. Among some of the problems were facing today. These problems have far-reaching Consequences because they do affect an ecosystem. Human health also is impacted and the source of the beauty of our planet is in question. So it's very important that we understand and address these challenges to ensure a healthy and prosperous future for the future generations to come next slide. Now, more than 888 hundred million people are affected by viscosity In terms of malnutrition, we have more than two billion that suffer from malnutrition and environmental cost of food production and no longer sustainable. However, there is a need to increase the food production by more than 60%. And in the next three decades to meet the demands of the growing world population and usually current matters of reproduction, it is estimated that a global greenhouse gas will increase by up to 80% for example Lifestyles hello recount produces 14.5, percent of the global greenhouse gas emission at the majority that is in the form of BJ. So we need a better solution. What can we do next? Slide please we are actively working to address this environmental issues through various Innovative approaches and what we do with Pursuit initiatives and Innovations. Our aim to contribute to be no new sustainable practices resource conservation and education of the environmental challenges in the food industry and beyond. So have four key areas microbial based food production My remediation of heavy metals in water and wastewater food, food safety, food waste valorization. Those are the four key areas and I'll talk about them briefly because I know we are time limit next, slide. The first part of our

research is using algae to produce flour for baking industry. So we all know that I'll get is very sustainable and nutritious, you know we are using algae coral. They are highly sustainable organisms because you can cultivate them in minimum resources. They have a very high growth rate, they can amplify by fast. They require less land for water and fertilizers when compared to traditional crop production. They are able to thrive in diverse environment. They are also very rich in nutrients, by-actives, vitamins, minerals, omega-3. This is just telling you how good they are.

So the idea is we grow algae in large-scale fermentation. We produce a powder, can engineer it to produce more protein produce powder, you know, and flour, we can use that to make cakes and bread. So, watch out for green bread and green cakes coming very soon. Next slides please. Then the other thing we're doing also is bioremediation, and by bio-recovery of heavy metals and water and wastewater, particularly when using *E. coli* gram negative organisms, to buy your bio-accumulate those heavy metals like lead and copper we are working on at the moment. And I told myself telling Helen you get to be very rich in future because if you can get this microorganism to bio accumulates diamonds. Voila made lots of millions than this my job with students you know the idea is to use *E.coli* to accumulate these heavy metals then we can then have that they have metals to be reusing batteries or other things, and also have portable water free of heavy metals. This is a win-win solution. Next Slide, please. The other thing we're doing also is using microorganisms to produce antimicrobial peptides and the idea is to be able to preserve food because food with is a very, you know, critical problem we have now, tons of food is wasted. So what we do in this, in a way, you get using lactic acid bacteria to produce a viable bacteriosins, microbes encapsulates this bacteriosins, use them as food preservatives And there's quite a lot of research going on at the moment in this area, either as active packaging or inside the food once it microencapsulated. So the idea is to extend shelf life, so the food waste be reduced, thanks the next slide. Another amazing, really exciting research, we're doing is reducing and valorization food waste. So using food, waste for money and cellular economy. So most of the waste we generate goes to landfills and that contributes to greenhouse gas. And environmental degradation which is a major problem. So, imagine if we were to have excess waste, use them to produce bio-based products for biofuels that is the ultimate plan we have in Akita, but, right now what we are working on is using, you know, chemical valorization, what coming onto this biological valorization, which is the next phase of our work. So the next slide please. So what do you do with the air waste, coffee waste? Millions of coffee waste being a couple. Shells are with that every day and chocolate waste well. So what we tend to do and heater we're doing this at the moment and it's really successful is we collect this waste from the Food Industries and then we you know extract you know the bio actives are phenols, amino acids flavinols, almost even oil and fiber that can be used for animal feeds. So this reduces cost food recycling which is far more important and it's very sustainable. However, you know have natural food additives look again because can get some vitamins are very important or they can be useful. Functional foods right now we're doing quite a lot of research in this area and we'll sing result very promising results. So once we have finished affecting both, this is chemical extraction. You know, it isn't communicating and also using a critical fluid extraction, will bring to them move on to biological extraction of food valorization next slides Thanks. So in conclusion, it has actively addressing critical environmental issues by implementing innovative solutions to food and agricultural processes. We're really excited what we're doing and our efforts are targeted. You know to food waste, water pollution, climate change and resource conservation through the production of bacteriosins, for example, from lactic acid bacteria, Algae flour formulation, mopping up heavy metals. By biominning or bioaccumulation, and also with using a valorizing food waste. We are taking steps towards mitigating these environmental challenges that we face, you know, because don't forget we have lots of people that suffer from malnutrition and videos of people affected by food, scarcity. So by prioritizing sustainable practices and optimizing resources. We aim to contribute to the more environmental friendly and sustainable future reducing pollution, promoting a healthy environment for generations to come. So this is what we do at Akita Food Research Institute. Thank you so much.

**Abraham:** For that and I will come back to you. Thank you so much for your pain. We starting my question with you Dr. Drew have given your wealth of experience with Marine Plastics missions. I would like to ask as the Executive Vice President for conserving chance motion, at Ocean wise, could you share some ocean solution

**Dr. Drew:** Single use plastic and you can do that at the design end, you can, for example, start using biopolymers much more to replace those single uses

Asia in North America and also in Europe bags are one example, but there is much more also that's Broad and utensils and you name it for some meat Alternatives. She trapping, for example, and biopolymers are coming very handy because they can be biodegraded, they can be produced from a larger Network form from kelp from algae. So that's definitely a way forward. The other one that concerns is me microfibers are shed. When you wash your apparel your fleece. Jackets, your synthetic fiber clothing and they are everywhere. They can be found, 1000 meters down under the sea, is that he can be found everywhere. And reducing microfibers is a big deal. If you wash, you think the gentle cycle with your washing machines, they will cycle. You will reduce microfiber shedding significantly as some of the recent ocean wise, research found. So those are just examples, but we need to think beyond Plastics reduction plastics. It's just one way of relating to the ocean reducing, the impacts of climate change. Are formidable Challenge, and here, restorations of kelp forest like the one I have behind me? Come in because kelp grows 30 times faster than terrestrial plants. So it's very good at converting, CO2 into Shoes. And then eventually that that tissue or a part thereof, can be deposited in the offices of the ocean vents sequester for good. So I think it's a combination of nature based Solutions and also Lifestyle Changes. What we need to be looking forward.

**Abraham:** Thank you. Oh, thank you so much, doctor Drew. I'm so out, quickly, go to the to Helen and my question to you is a collaboration between Academia industry and Regulatory, bodies is crucial for driving Innovation and adopting sustainable practices in the future. So I'm showing you that we with that. I'm so happy. How do you Foster collaboration and knowledge exchange between these stakeholders to make sure people Asian American groups in based solutions for sustainable agriculture and environmental preservation, Foster collaboration and knowledge exchange between Academia and Industry. And also regulatory bodies,

**Dr. Helen:** we can start by establishing partnership and networks. So can create platforms where representatives from Academia industry or regulatory bodies that can come together and share their expertise. Establish collaborations and this can be achieved through conferences, workshops, and seminars focus on microorganisms, you know Solutions. Microbial Solutions, also encouraging participation from other Stakeholders, you know, like Dr. Carlos, it's quite important, which you facilitate exchange and knowledge of ideas. Another thing we can do also is facilitated information sharing so can develop online portals or database, where research findings case studies are best practices related to microbial based Solutions, are compiled and made readily immediately available to all stakeholders. This will enable Academia industry and Regulatory bodies.

The latest advancements are first up a shared on the status. That is quite challenging though. It's really important. It's funding, you know, funding collaborative research projects. This will encourage joint research projects that involve collaboration between industry and Academia and also the regulatory bodies and this can be done through dedicated funding stream or programs that can support interdisciplinary Initiatives. I think the other thing is promoting knowledge transfer also, you know, organizing through painting in programs and seminars, workshops that are targeted and Industry professionals are regular to an expense. I'm the last thing I like to say is probably encouraging public, private partnership. So foster partnership between Academia the industry and also the regulatory body is to develop joint initiatives that addresses specific. Eric challenges in the sustainable agriculture or conservation environment. So such Partnerships can combine all the expertise and the resources and also understand the perspective of the different angle, stakeholders leading to a more effective and holistic approach, I believe. Thank you,

**Abraham:** Thank you so much, Dr. Helen and thank you so much