

## SUMMARY REPORT

### ***IUFoST SRD - Scientific Roundtable Discussion #12***

#### **Sustainable food packaging: environmental and food safety issues**

Jun 8, 2023 07:00 AM Eastern Time (US and Canada)

#### **Programme Order:**

##### **Background**

Addressing safety and environmental concerns while creating sustainable food packaging was the theme of the IUFoST Scientific Roundtable Discussion (SRD). The focus was on new innovations, regulatory aspects, labelling and food safety issues. Key experts from France (Dr. Nathalie Gontard), USA (Dr. Young T. Kim), India (Dr Vimal Katiyar), and Australia (Dr. Deidre Mikklesen) provided the perspective and leadership, and all were encouraged to participate by asking questions from the panelists.

The co-chairs were Dr Charles Aworh (Nigeria) and Dr Carol Wallace (UK)

##### **Introduction**

Traditional petroleum-based polymers are generally non-biodegradable but there are some exceptions such as poly( $\epsilon$ -caprolactone) (PCL), polybutylene adipate terephthalate (PBAT), and polybutylene succinate (PBS). On the other hand, bio-based polymers originate either entirely or partially from renewable biomass resources. Bio-based and biodegradable packaging materials have gained increasing global attention in recent years. Some of the drivers for more sustainable packaging materials are the growing environmental awareness, accumulation of plastics in the ocean, waste legislation, waste management and landfilling, depleting resources, producer and consumer accountability, the need to reduce energy consumption and marketing trends.

As compared to petroleum-based polymers, biobased polymers offer a solution which can effectively benefit from the above pressures, due to their sustainability, biodegradability, biocompatibility, availability, and non-toxicity. In addition, they could also bring about an overall reduction in the carbon footprint.

Packaging plays a crucial role in ensuring a safe, wholesome, and nutritious food supply. However, poor package design and integrity, poor choice and improper use of packaging materials, package composition and migration of potentially toxic package constituents into foods, and other factors may lead to food safety concerns. One of the environmental concerns that sustainable packaging or green packaging addresses has to do with the life cycle of packaging materials. Billions of tonnes of plastics have been produced since the 1950s and the upsurge in the use of plastics for food packaging in the 1970s, due to their many desirable properties including versatility and low cost, occurred without due concern for the environmental consequences such as the huge quantities of plastic wastes on the land and in

the oceans and the adverse ecological consequences including the damaging effects on marine life and safety of fish products and other foods from marine sources. The overall efficiency of the food supply chain should be the primary concern in sustainable food packaging and sustainability requires that packaging must protect foods and provide adequate information to consumers in an affordable manner, without negative environmental impacts such as generation of greenhouse gases, heavy metals and particulates, and pollution of air, land, and water. Ensuring food safety, reducing post-harvest losses, including transportation, distribution and marketing losses, meeting consumer demands and protecting the environment, at affordable costs are primary considerations in the choice of packaging materials and design of sustainable food packaging systems. Safety concerns associated with food packaging and developments in sustainable food packaging including the nature, features, benefits and limitations of sustainable packaging strategies such as smart packaging, recycling, bio-based and biodegradable packaging, amongst others, were discussed.

### **Resource personnel**

1. Dr. Nathalie Gontard, Director, Agropolymer Engineering and Emerging Technologies Unit, French National Institute for Agriculture, Food and Environment (INRAE), Montpellier, France.
2. Dr. Young T. Kim, Associate Professor, Packaging Systems and Design, Department of Sustainable Biomaterials, Virginia Polytechnic Institute and State University, Blacksburg, USA. He holds PhD in Food Technology (2005), majoring in Packaging Science, from Clemson University, USA. He has published 55 peer-reviewed journal articles, 11 book chapters and holds 8 patents.
3. Dr. Vimal Katiyar, Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati. His main area of research includes bio-based and biodegradable polymer production, bioplastic processing, and their structure property relationship, rheological aspects, migration studies of polymers in relation with food storage, toxicological effects, polymer degradation, polymer-based nanomaterials, food packaging, edible food packaging and circular technologies. He had published more than 150 peer reviewed research articles in highly reputed journals, more than 250 conference papers, six books, 85 book chapters and has 29 granted/filed patents.
4. Dr. Deirdre Mikklesen, Senior Lecturer in Microbiology, School of Agriculture and Food Sciences, University of Queensland, Australia.

More than 100 participants attended the SRD session from all over the globe. The session was co-chaired by Dr Charles Aworh (Nigeria), the president of IAFoST and Dr Carol Wallace (UK) IUFoST Scientific Councillor. The session was opened by Dr Aman Wirakartakusumah, President of IUFoST. The whole programme was coordinated by Ms Judith Meech, Secretary General of IUFoST.

## Sessions:

Dr Aman Wirakartakusumah, President of IUFoST in his initial remarks welcomed all the speakers and participants. He mentioned that the World Food Safety Day was the 7<sup>th</sup> of June 2023 and the SRD on sustainable packaging: environmental and food safety issues was organised to coincide with that event.

Dr Aman highlighted the need for collaboration with science and technology and the need for innovation to overcome the challenges in developing new sustainable packaging materials. He said that IUFoST could play a significant role in such developments, and that the organization will work with the scientists and other organizations to overcome the challenges in developing sustainable packaging to address the environmental and food safety issues facing the world.

## Summary

**Dr. Nathalie Gontard's presentation is on "Plastic in the agricultural and food sector: how to reduce plastic pollution due to food".**

This presentation sets the stage for the webinar on food packaging and how to reduce its environmental impact.

Plastics are generated from three key steps: production, usage, and post-usage. Plastics at production can be renewable or non-renewable, and in general has a negative impact on the environment. Plastics at usage stage often focus on functional properties adapted for food preservation, hence has a positive impact and less environmental burden. Plastics at the post-usage stage can be accumulated, recycled, or biodegraded; it may have a negative outcome for our environment. Recently there emerged a fourth step, end-of-life, which captures the aging of plastics into micro and nano plastics. This also has a negative environmental impact. Aging and pollution of the plastics starts at the usage stage. Plastic pollution is mostly about micro particles, which we cannot see with our eyes. But these micro particles detriment both environment and human health.

Scientists conduct life cycle analysis to study the environmental burden cast by plastic pollution. Yet, this analysis currently cannot take into account the end-of-life micro and nano plastic particles. Because of the progressive, persistent fragmentation, absorption and diffusion of plastics, there is a need to understand the plastic footprint to reduce plastic pollution, the way we do for carbon.

In a linear economy, all the plastics produced go to waste. In order to reduce plastic pollution, circular economy seems ideal – it regenerates plastic wastes and reduces resource exhaustion, resulting in zero waste. A recycling economy can also effectively reduce plastic pollution so that  $Q_{waste} = (Q_{virgin})/(n+1)$ . A downcycling economy is not a good way to reduce plastic pollution. In a downcycling economy, plastic bottles may be turned into clothes, creating more micro and nano particles during each wash, and it cannot be recycled

anymore at this stage. Downcycling is not contributing reducing the plastic consumption and pollution, and we should avoid this kind of waste treatment as much as possible.

The No. 1 priority to reduce plastic pollution is to reduce plastic uses at the source. We need to ask ourselves: if there is a real benefit, if we really need it, is there a better alternative?

**Dr. Young Kim's presentation is on "How we are using sustainable packaging materials in food packaging and what is next?"**.

The presentation continues Dr. Gontard's line of thought by calling attention to the increasing global demands for sustainable food packaging solutions. Drivers of such global demands include societal and environmental concerns such as ocean pollution, circularity and recyclability, safety concerns regarding BPA and phthalates, as well as poor traceability in recall and bioterrorism contexts. These problems related to food packaging escalated post-pandemic, primarily due to the rising e-commerce, home delivery, use of single plastic, etc. Therefore, sustainable food packaging solutions become essential.

Moreover, there has been increasing regulatory emphasis on plastic pollution and sustainability. UN called for ending plastic pollution in 2022. Legislations in USA has started regulating biotechnology and biomanufacturing innovation for sustainable, safe, and secure bioeconomy. It is for good reason – as 90% of the plastic pollution comes from packaging!

Sustainable packaging solutions need focus on making materials more recyclable and biodegradable. It also needs to take process/reuse/carbon emission into account. While circular economy is ideal in resolving plastic pollution issues, safety considerations related to hygiene, bacteria contamination, and food safety are also critical as plastics progressively break down during its lifetime. A new packaging/structural design may be needed.

Bioplastics are a type of plastic derived partially from renewable materials, as opposed to traditional plastics that are made from petroleum. Bioplastic use alone does not make products sustainable; it is more important to understand their different degradation properties end-of-life. Taking a look at a few popularly used bioplastics, most of them are industrially compostable. PBS is not ocean biodegradable and is not recyclable; PLA is not biodegradable; PHA and starch is home compostable; cellulose acetate can be both home compostable and be recycled.

Yet, there are four major difficulties with bioplastics. They endure pasteurization and heat treatment; only a few facilities can handle and break down bioplastics properly at the high temperature required – but otherwise, bioplastics are hardly biodegradable at all. Bioplastics also have durable gas barrier and physical property, which render them hard to break down. Their processability also poses a challenge depending on the type of bioplastics.

In order to tackle the bioplastic issues, we need collaboration with all the stakeholders, including academics and regulators. There is no single solution to make bioplastic market dominant in the world.

A few sustainable food packaging solutions have gained some tractions in the last few decades. Edible packaging, being one of them, entered the market in 1990s. This kind of packaging uses biobased polymeric materials from seaweeds or other plants. It gets more popular to reduce food packaging waste, one example being the edible water pods. However, it is not for mass production due to the onerous amount of customization as different food products demand different coatings. The edible biopolymer coating has lower decomposition temperature than bioplastic, and it can be easily destroyed, therefore difficult to cover from farm to fork. Paper bottle is another idea for improving packaging sustainability. Yet, the cost is high and the lining inside the bottle often contains plastic and acts like regular water bottle.

A misconception of sustainable packaging is focusing on the usage but rather the end-of-life degradability. Food packaging with multilayered structures, such as a coffee K-cup, contains bioplastics, foil lid, and other components. At the end of the day, all these components are disposed together, despite they require different treatments to be decomposed. The chance is that they will end up in the landfill.

Dr. Kim's current research is on discovering innovative, antimicrobial active food packaging material, using modified titanium oxide. The aim is to improve food safety from packaging systems.

Dr Katiyar spoke about **“Sustainable polymers and their formulations for food packaging applications”**.

He defined sustainable packaging as materials that are safe for food contact surfaces, which protect the food from the external environments such as contamination from microorganisms, chemical taints, oxidation, and water vapour, that could change the shelf life, acceptability, taste, and texture of the product, which he defined as - Food “health”

He said that sustainability also means that the integrity of the product is retained during storage which he defined as - Home “health”. Thus, the packaging material will retain all the components of the food without losing them to the environment.

He also defined Environmental “health” as the ability of the package to be readily composted or recycled without impacting the environment.

His talk was based on the bio-based polymeric packaging materials for sustainable food packaging applications. He said that polylactic acid (PLA), Polylcapro-lactone (PCL), and Polyhydroxy-alkanoates (PHA) as having the potential to replace some of the petroleum-based polymers as packaging materials for food applications.

Polylactic acid (PLA) is a thermoplastic material derived from renewable, sources such as corn starch or sugar cane by bacterial fermentation.

Polycaprolactone (PCL) is a synthetic polyester that is partially crystalline, having a low melting point (60°C). Polycaprolactone can be readily degraded by lipases and esterases produced by microorganisms and so is ready compostable.

Polyhydroxy-alkanoates (PHA) are polyesters produced in nature by numerous microorganisms, by bacterial fermentation of sugars or lipids. A number of different monomers can be combined within this family to give materials with extremely different properties. PHAs are a very versatile set of polyesters that change their physico-chemical properties with their monomeric unit composition.

Physicochemical properties such as melting point, stiffness, heat stability, and gas and water vapour barrier properties of biodegradable plastics are generally poor and limit their use in food packaging applications.

He also spoke about new materials, for example, stereo-complex PLA (sc-PLA) – a material with long, regularly interlocking polymer chains that can overcome some of the above-mentioned drawbacks of bio-based plastics.

Dr Katiyar's group has synthesised these new sc-PLA and sc-PLA-bio-nanocomposites using bio-nanofillers such as cellulose nanocrystals, silk nanocrystals, modified chitosan, etc. to produce polymers with novel physicochemical properties. They were able to improve O<sub>2</sub> transmission rate and water vapour transmission rate by several fold using such nanofillers.

They developed compostable extruded films with good oxygen barrier properties which is essential for food packaging applications.

Stereo-complex PLA with improved Heat Deflection Temperature (HDT) of up to about 140°C can be prepared by loading with bio-nanofillers, thus providing a wide range of uses and applications for them in the food and beverage industry.

Fabrication strategies for synthesis of these polymers and their nanocomposites and modification of their properties for packaging applications were briefly mentioned.

His Group is also working on biopolymer based edible coatings which can prolong the shelf life of various fruit and vegetables.

### **Dr. Deirdre Mikkelsen spoke about *Safeguarding Food Safety: Navigating Sustainable Food Packaging with Food Safety in Mind.***

Dr Mikkelsen opened her talk by discussing the functions of food packaging. She spoke briefly about the principal polymer materials used for food packaging and some of their advantages and disadvantages. She also spoke about biobased films versus edible film for certain types of food packaging. The main functions of the package are the protection of the food from microbial, chemical, and physical contamination as well as offering physical

protection of the integrity of the food. Some of the sustainability packaging design strategies are:

1. Adopting more recyclable materials
2. Reduce packaging waste
3. Reduce amount of packaging used
4. Reducing plastics
5. Incorporating more recycled content
6. Adopting more recyclable packaging formats
7. Adopting compostable materials
8. Increasing the use of bio-based material.
9. Reusable packaging material

She stated the main Objectives of sustainable food packaging as to conserve use, reuse, reduce waste and minimize the environmental impact

The potential food safety concerns of sustainable packaging materials are:

1. The lack of barrier properties,
2. Inconsistent quality and durability
3. Migration of substances
4. Inadequate labelling

Moving forward, she said the technology is still developing and more research is needed to commercially produce sustainable food packaging that can compete with petroleum-based polymers in terms of physico-chemical properties, ease of use, mouldability and cost of material.

In 2022, the cost of global plastic packaging materials was US\$369.21 billion. Cost of materials for petroleum-based polymers was US\$1.2-1.3 /kg but the raw material cost of biobased material is much higher.

She said that sustainable food packaging is an increasingly vital aspect of the food industry, as it aims to address food waste and loss reduction, by embracing circular economy principles, to keep products and materials in use as long as possible.

She also addressed some of the potential food safety implications associated with such packaging choices, to ensure the protection of public health, and the integrity of packaged food products.

She said that by striking a balance, between sustainable food packaging, and food safety, it is possible to promote a healthier, and more environmentally friendly food packaging landscape.

### **Views of Experts and General Discussion:**

Dr Vish Prakash mentioned that the plastics used in the food industry is only about 2% compared to the overall use of plastics in the world. Therefore, any advances made in food

packaging materials may not have a significant impact on the overall use of plastics in the world.

Dr Wallace in closing, noted that it was a very informative roundtable discussion with a lot of knowledge brought out.

Most barrier materials used in today's industry are either petroleum-based or metals. Because of the increase in environmental awareness, as well as legislation, new and environmentally benign alternatives are at the centre of scientific and industrial interest. Wood-based products have received great attention for their air/oxygen resistance. As far as their properties, microorganism-derived biopolymers are comparable to conventional petroleum-based thermoplastics, but their cost may be an issue. Both, cellulose, and microbiologically derived biopolymers are challenged when moisture, grease and oxygen resistance are simultaneously required. Hence, multilayer structures and composites are needed to fulfil the most demanding requirements of food packaging materials.

**IUFoST Scientific Roundtable Discussion (SRD)**  
**Sustainable food packaging: environmental and food safety issues**  
**June 8, 2023**

- Overview
- Speakers' profiles, presentation titles
- Programme order

**Scientific Roundtable Discussion (SRD) Overview**

Packaging plays a crucial role in ensuring a safe, wholesome and nutritious food supply. However, poor package design and integrity, poor choice and improper use of packaging materials, package composition and migration of potentially toxic package constituents into foods, and other factors may lead to food safety concerns. Sustainable food packaging is an increasingly vital aspect of the food industry as it embraces the principles of circular economy. One of the environmental concerns that sustainable packaging or green packaging addresses has to do with the life cycle of packaging materials. Billions of tonnes of plastics have been produced since the 1950s and the upsurge in the use of fossil-based plastics for food packaging in the 1970s, due to their many desirable properties including versatility and low cost, occurred without due concern for the environmental consequences such as the huge quantities of plastic wastes on land and in the oceans and the adverse ecological consequences of plastics pollution. The Scientific Roundtable Discussion (SRD) on *sustainable food packaging: environmental and food safety concerns* focuses on new innovations, regulations and safety in food packaging. Discussion covers potential food safety implications associated with food packaging choices, to ensure the protection of public health and the integrity of packaged food products; circularity of packaging systems including recyclable fossil-based plastics and biodegradable bioplastics and biopolymers derived from renewable resources; the use of available bio-resources for value added sustainable polymeric products for food packaging applications; recent developments on the use of bio-based plastics with improved properties to replace some of the conventional fossil-based plastics for food packaging; biopolymer based edible coatings for extending the shelf life of fresh produce; societal demand to innovate the traditional packaging technology; and how societal issues such as post-pandemic, sustainability and environmental pollution concerns are impacting the demands for sustainable packaging systems. Striking a balance between sustainable food packaging and food safety will promote a healthier and more environmentally friendly food packaging landscape.



## Speakers



**Dr. Vimal Katiyar**, Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati. His main area of research includes bio-based and biodegradable polymer production, bioplastic processing, and their structure property relationship, rheological aspects, migration studies of polymers in relation with food storage, toxicological effects, polymer degradation, polymer-based nanomaterials, food packaging, edible food packaging and circular technologies. He had published more than 150 peer reviewed research articles in highly reputed journals, more than 250 conference papers, six books, 85 book chapters and has 29 granted/filed patents.

*Presentation Title: Sustainable polymers and their formulations for food packaging applications*

Three Questions:

1. Are currently available biodegradable plastics able to offer the solution to conventional plastics?
2. How are sustainable plastics relevant in relation to food contact material?
3. Why home composting characteristics of such plastics are favourable in comparison to industrial composting? Is it possible to have home compostable advance secondary packaging?



**Dr. Young Teck Kim** is an Associate Professor and a Co-founder of the program Packaging Systems and Design, Department of Sustainable Biomaterials, Virginia Polytechnic Institute and State University, Blacksburg, USA. He holds PhD in Food Technology (2005), majoring in Packaging Science, from Clemson University, USA. He is a global expert in sustainable food packaging and materials. His research projects have been sponsored by sustainable packaging industry and federal agencies. His research team has strong experience in commercialization of bioplastic packaging systems through technology transfer to industries. He has published 55 peer-reviewed journal articles, 11 book chapters and holds 8 patents, several in the areas of biopolymer, bioplastics, and packaging application developments. He has served as technical advisor for global leading companies such as LG Chemicals, Samsung Fine Chemicals, SK Chemicals, and CJ Bio who are global leading manufacturers of PLA, PBS, PHA, and PBAT.

*Presentation Title: How we are using sustainable packaging materials in food packaging and what is next?*

Three Questions:

1. Why is edible packaging system not fully commercialized yet?
2. How do we overcome the price concern of bioplastics for food packaging?
3. How do we improve food safety using sustainable packaging system?

**Abstract: Circularity of packaging systems is a global interest. Sustainable packaging polymers include both recyclable petro-based plastics and biodegradable bioplastics and biopolymers derived from renewable resources, belonging to the biological cycle of circular economy. During the global pandemic, single use plastic consumption enables customers to keep social distance and safety, while aggravating environmental and health problems, such as white pollution and microplastics. The recent trends in packaging show that there is a strong societal demand to innovate the traditional packaging technology through 1) utilizing more sustainable materials, 2)**

advancing the biodegradation process such as home-compostability and ocean biodegradability, and 3) expansion of recyclable mono-based packaging structures. Upon the above technical trends, this presentation will demonstrate 1) how societal issues such as post-pandemic, sustainability, and environmental pollution are impacting the packaging society on demands of sustainable packaging system, and 2) how packaging technology has evolved in academia and industry in the US.



**Dr. Nathalie Gontard**, Director, Agropolymer Engineering and Emerging Technologies Unit, French National Institute for Agriculture, Food and Environment (INRAE), Montpellier, France.

Nathalie Gontard is Research Director at INRAE (National Research Institute for Agriculture, Food and Environment) formerly Professor at the Universities of Montpellier in France and Kyoto in Japan. She is co-author of more than 500 A level papers (*h-index* 50). She is the promoter and leader of a research group working on “Circular Economy and Plastic pollution in the Agri-Food sector” with a focus on food packaging and plastic waste reduction, eco-

efficient and safe food contact materials, modeling and decision support tools, active, circular and nano-technologies bio-based solutions. She is involved in numerous international, national and industrial projects. She is the *coordinator* of the Horizon Europe and H2020 international Sino-European AGRILLOOP and NoAW project, EcoBioCAP FP7 and NextGenPack projects, *expert* for the European Commission (FETOPEN, NMBP, MSCA.), the FFEM (Fond Français pour l’Environnement Mondial), the EFSA (European Food Safety Authority), “Scientific Breakthrough” INRA’s Award and H2020 “Etoile de l’Europe” for “Climate Change and Environment”, “Chevalier de la Légion d’honneur”, IHEST auditor, strongly involved in science-society interactions.

**Presentation Title: Plastic in the agricultural and food sectors: how to reduce plastic pollution due to food packaging**

**Abstract:** After clarifying why plastic pollution is related to plastic particles footprint rather than carbon footprint, some examples of research developed in our INRAE’s laboratory are presented: decision support tool to help industries to reduce their consumption of plastic packaging and increase their offer of food free of plastic and novel biocomposites trays bio, but non food, sourced, bio-processed, bio-recyclable and biodegradable.



**Dr. Deirdre Mikkelsen**, is a Microbiologist and Senior Lecturer in the School of Agriculture and Food Sciences, at the University of Queensland, Australia. As a Teaching and Research Academic, Dr Mikkelsen is passionate about food safety, where at the start of each academic year she has the privilege of course coordinating and teaching undergraduate and postgraduate students undertaking Food Science as well as Food Safety and Quality Management courses. She also manages work integrated learning experiences for postgraduate students with food industry host partners. Dr Mikkelsen’s

research focuses on how food components are broken down by the host’s gut microbiota (be it in human and/or monogastric animal models), and understanding their role in promoting/maintaining host health. She has over 65 peer-review publications, with an *h-index* of 25 and 2494 citations. Dr Mikkelsen is a Member of the Australian Institute of Food Science and Technology, a Member of the Australian Society for Microbiology, and is delighted to be part of the International Union of Food Science and Technology (IUFoST) Food Safety Working Committee.

*Presentation Title: **Safeguarding Food Safety: Navigating Sustainable Food Packaging with Food Safety in Mind***

**Abstract:** Sustainable food packaging is an increasingly vital aspect of the food industry, as it aims to address food waste and loss reduction by embracing circular economy principles to keep products and materials in use as long as possible. This presentation will address some of the potential food safety implications associated with these packaging choices, to ensure the protection of public health and the integrity of packaged food products. By striking a balance between sustainable food packaging and food safety, we can promote a healthier and more environmentally friendly food packaging IProgramme Order:

Thursday, June 8

07.00 IUFoST President is introduced. Prof. Aman Wirakartakusumah) welcomes attendees and then introduces the two Roundtable co-chairs, Prof. Charles Aworh and Prof. Carol Wallace.

07.05 Charles Aworh provides a brief introduction and then turns the roundtable over to Carol Wallace to introduce the first speaker, Dr. Nathalie Gontard

07.07 – 07.17 approx. -

**Dr. Nathalie Gontard**, Director, Agropolymer Engineering and Emerging Technologies Unit, French National Institute for Agriculture, Food and Environment (INRAE), Montpellier, France.

*Presentation Title: **Plastic in the agricultural and food sectors: how to reduce plastic pollution due to food packaging***

07.19 – 07.29

**Dr. Young Teck Kim** is an Associate Professor and a Co-founder of the program Packaging Systems and Design, Department of Sustainable Biomaterials, Virginia Polytechnic Institute and State University, Blacksburg, USA

*Presentation Title: **How we are using sustainable packaging materials in food packaging and what is next?***

07.31 – 07.41

**Dr. Vimal Katiyar**, Professor, Department of Chemical Engineering, Indian Institute of Technology Guwahati.

*Presentation Title: **Sustainable polymers and their formulations for food packaging applications***

07.43 – 7.53

**Dr. Deirdre Mikkelsen**, is a Microbiologist and Senior Lecturer in the School of Agriculture and Food Sciences, at the University of Queensland, Australia.

*Presentation Title: **Safeguarding Food Safety: Navigating Sustainable Food Packaging with Food Safety in Mind***

07.55 Charles Aworh announces discussion period and he and Carole field questions to speakers and discussion with attendees.

08.15 – Discussion concludes and Rapporteurs **Conrad Perera** and **Sophie Tongyu Wu** provide main discussion points for next actions around subject and outcomes of Roundtable.

8.25 – Charles Aworh and Carol Wallace conclude Roundtable and draw attention to planned outcomes.

08.30 – Roundtable concludes.