Policies, Standards, and Best Practices for Recycling Plastic Intended for Contact with Food to Reduce Marine Plastic Pollution Among APEC Economies

APEC Sub-Committee on Standards and Conformance

September 2026

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1. Glossary

APEC	Asia-Pacific Economic Cooperation
ASEAN	Association of Southeast Asian Nations
BPOM	Badan Pengawas Obat dan Makanan
CAC	Codex Alimentarius Commission
CEAP	Circular Economy Action Plan
CNIS	China Domestic Institute of Standardization
EFSA	European Food Safety Authority
EGD	European Green Deal
EPR	Extended Producer Responsibility
EPS	Expanded Polystyrene
EU	European Union
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
ISCC	International Sustainability & Carbon Certification
ISCC PLUS	International Sustainability & Carbon Certification PLUS
ISO	International Organization for Standardization
MFDS	Ministry of Food and Drug Safety
MHLW	Ministry of Health, Labour and Welfare
MINAM	Ministerio del Ambiente
MOE	Ministry of the Environment
OEFA	Organismo de Evaluación y Fiscalización Ambien
PCR	Post-Consumer Recycled
PET	Polyethylene Terephthalate
PET-PCR	post-consumer recycled PET
PRODUCE	Ministerio de la Producción
rHDPE	recycled High-Density Polyethylene
rPE	recycled Polyethylene
rPET	recycled Polyethylene Terephthalate

rPP	recycled Polypropylene
SDG	Sustainable Development Goals
UN	United Nations
UNEP	United Nations Environment Program

2. Executive Summary

The APEC Project on Policies, Standards, and Best Practices for Recycling of Plastic Intended to Contact with Foods to Reduce Marine Plastic Waste (SCSC_205_2024A) examines the regulatory landscape, technological practices, and market conditions associated with food-grade recycled plastics across APEC economies. Through a combined approach consisting of an APEC-wide questionnaire survey, comparative regulatory analysis, and synthesis of industry practices, the project provides evidence on how recycled plastics for food-contact applications are managed among APEC economies.

Overall, the project achieved its intended outputs and performance indicators. It produced a comprehensive research report synthesizing regulatory frameworks, authorization procedures, recycling technologies, and market dynamics; issued a multi-stakeholder questionnaire covering government authorities, resin manufacturers, packaging industries, and food companies across nine APEC economies; and generated evidence-based analysis to support regional dialogue and policy development. Together, these outputs fulfilled the project's objectives of enhancing knowledge exchange, supporting capacity building, and informing APEC economies on safe and sustainable use of recycled plastics in food packaging.

The survey demonstrates three core insights. First, questionnaire results reveal significant heterogeneity in regulatory frameworks, with many economies lacking specific authorities or clear policies, highlighting the need for more coherent and harmonized governance to reduce trade barriers and support industry adoption. Second, survey findings indicate that regulatory gaps and inconsistent authorization processes are the primary constraints on the adoption of food-grade recycled plastics, while

cost and technical challenges further limit market scalability. Third, analysis across the supply chain underscores the importance of harmonized standards, improved material sourcing systems, strengthened regulatory capacity, and enhanced technical cooperation, particularly in emerging areas such as advanced and biological recycling technologies.

These integrated findings provide a scientific and policy-relevant basis for advancing more aligned, efficient, and trustworthy frameworks for the safe use of recycled plastics in food-contact applications across APEC economies, contributing to circular economy development and the reduction of marine plastic waste.

3. Background and Objectives of the Project

The project seeks to foster an interactive discussion facilitating communication of technical knowledge and regulatory experience in recycling plastic waste and food safety risk management among APEC economies. Its primary objective is to serve as a valuable resource for APEC economies that have not yet approved the use of recycled plastics for food packaging. Meanwhile, it aims to foster coordination/consistency and sustainable development among APEC economies. The implementation of the project will contribute to the implementation of OFWG Marine Debris Roadmap and APEC Priority 2024 "Sustainable Growth for Resilient Development".



Figure 1 Floating marine litter: From food packaging waste to ocean pollution

4. Summary of Survey Findings

The survey conducted under this project collected a total of 30 questionnaires, of which 26 were valid, representing nine APEC economies, as summarized in the research report. The questionnaire design covered four stakeholder groups across the supply chain, including government authorities, resin manufacturers, packaging industries, and food companies (Table 1), providing a comprehensive basis for evaluating regulatory, technical, and market conditions for recycled plastics intended for food-contact applications.

Table 1 Design of the questionnaire series

NO.	Questionnaire Title
1	Survey on the use of recycled plastics intended to contact foods for the government authority
2	Survey on the use of recycled plastics intended to contact foods for recycled plastic resin manufacturer
3	Survey on the use of recycled plastics intended to contact foods for food packaging industry
4	Survey on the use of recycled plastics intended to contact foods for food industry

From a regulatory perspective, the survey reveals significant disparities in institutional arrangements and policy frameworks across APEC economies. As shown in Table 2, only three economies (Indonesia; Peru; and the United States) have clearly defined authorities for recycled plastics in food-contact applications, while most responding economies

lack specific regulatory bodies. The United States is the only economy with dedicated personnel, and Indonesia maintains 76 regional sub-agencies, reflecting uneven regulatory capacity. In terms of policy systems, Table 3 indicates that only a limited number of economies have established relatively advanced regulatory frameworks, while most developing economies remain at an early stage. Specific regulatory measures also vary widely, including 15% recycled content requirements in Peru and 30%–50% requirements at the state level in the United States.

Table 2 Regulatory authority for recycled plastics intended to contact foods in selected APEC economies

Economies	Authority	Responsibility	Employees	Sub-agencies
CDA	Health Canada has authority on safety of food packaging, but specific authorities on recycled plastic are in progress	N/A	N/A	N/A
PRC	No specific authority	N/A	N/A	N/A
INA	Indonesian FDA (BPOM)	Food packaging regulation for the safety requirement	No specialized personnel	BPOM has 76 regional offices
	Ministry of Industry	GMP rPET (in progress)		
MAS	Food Safety and Quality Programme, Ministry of Health	Regulations for food packages, however a dedicated standard for recycled plastic materials has yet to be established.	N/A	N/A
PE	Environmental Assessment and Enforcement Agency (OEFA), from Ministry of the Environment (MINAM)	Overseeing, monitoring, and sanctioning compliance with environmental obligations	N/A	N/A
	Ministry of Production (PRODUCE)	Overseeing, monitoring, and sanctioning the measures outlined in the technical regulations		
	No authority for food safety	N/A		
USA	U.S. Food and Drug Administration	All related activity	5	No

Note: In this table, PE stands for Peru. Viet Nam (VN), Thailand (THA) and Papua New Guinea (PNG) are not listed as they reported no relevant information.

Table 3 Policies and systems for recycled plastics intended to contact foods in selected APEC economies

Economies	Regulations, laws or policies	Deposit system	EPR	Content (%) requirement
CDA	Not applied yet	Canadian provinces and territories have deposit-return systems for beverage containers; two apply only to alcoholic beverages.	Most provinces and territories in Canada have implemented their own EPR regulations.	No requirement
PRC	Not applied yet	Not applied yet	Not applied yet	No requirement
INA	Indonesia FDA Regulation Number 20 Year 2019 concerning Food Packaging. Draft Regulation of the Minister of Industry concerning Good Manufacturing Practices for recycled PET.	Minister of Environmental and Forestry Regulation Number 14 Year 2021 concerning Waste Management at Waste Banks	Minister of Environmental and Forestry Regulation Number 75 Year 2019 concerning Roadmap for Waste Reduction by Producer	No requirement
MAS	Not applied yet	Not applied yet	Not applied yet	No requirement
PNG	NAP to end Plastic Pollution (expected before 2028)	Not applied yet	Not applied yet	No requirement
PE	Not applied yet	Not applied yet	Not applied yet	15%
THA	Notification of the Ministry of Public Health (No. 435) B.E. 2565 (2022)	Not applied yet	Not applied yet	No requirement

Economies	Regulations, laws or policies	Deposit system	EPR	Content (%) requirement
USA	Recycled plastics must comply with authorizations for food contact plastics generally. Additionally, U.S. FDA reviews voluntary submissions on recycling processes.	Local level: Oregon, Vermont, Maine, Michigan, Connecticut, Iowa, Massachusetts, New York, California, Hawaii	Local level: Oregon, Vermont, Maine, Michigan, Connecticut, Iowa, Massachusetts, New York, California, Hawaii	Local level: California (up to 50%), Washington (up to 50%), New Jersey (up to 50%), Maine (up to 30%), and Connecticut (up to 30%).
VN	No information	N/A	N/A	N/A

From an industry adoption perspective, survey data indicate very limited uptake of recycled plastics in food packaging. Among 10 responding food companies, only one company reported actual use of recycled plastics, while 80% (8 out of 10) identified regulatory gaps as a major barrier. In contrast, responses from packaging companies suggest that regulatory compliance requirements and EPR obligations act as key drivers for adoption.

From a technical and supply chain perspective, Figure 2 shows that curbside collection and in-house recycling are the dominant sources of recycled plastics. However, although domestic purchasing is widely used by industry, it is not authorized for food-contact applications in any of the nine economies, and only Canada permits imported recycled plastics. Additionally, 57% (4 out of 7) of resin manufacturers identified the reduction of trade barriers as a priority. Regarding recycling technologies, Figure 3 indicates that approximately one-third of respondents (4 out of 14) reported that biological recycling is permitted at the economy level,

although none of the surveyed companies have implemented this technology. Furthermore, 57% (4 out of 7) of resin manufacturers identified purification challenges as a key technical constraint.

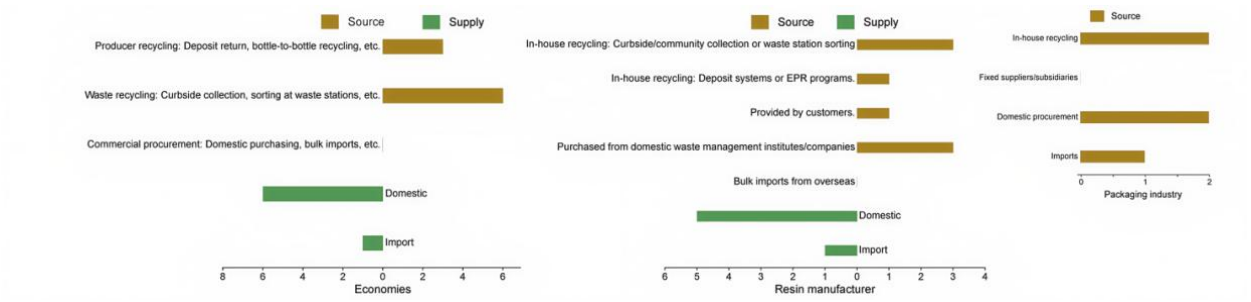


Figure 2 Material source of the recycled plastic intended to contact foods through the supply chain on the level of economies, resin manufacturer and packaging industry

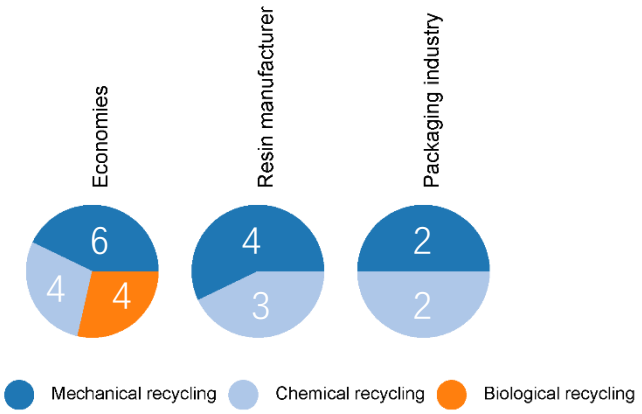


Figure 3 Technologies of the recycled plastic permitted through the supply chain on the level of economies, resin manufacturer and packaging industry

Regarding authorization processes, Table 4 shows that none of the surveyed economies require on-site inspections or periodic reviews, and authorization requirements vary significantly across economies. Approximately 50% of authorization-related responses were incomplete, indicating limited transparency and standardization. In addition, 50% (3 out of 6) of resin producers identified the complexity of authorization

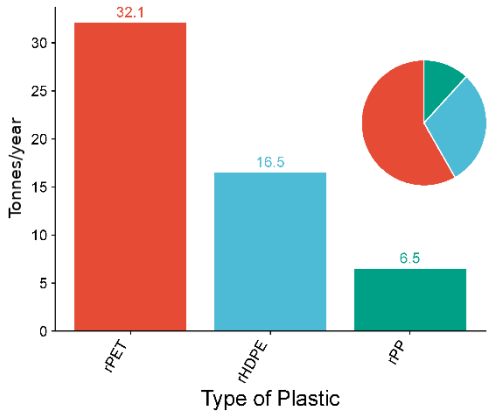
procedures as a major barrier, while 83% (5 out of 6) supported the development of harmonized evaluation standards across APEC economies.

Table 4 Authorization requirements for recycled plastics intended for food contact in selected APEC economies

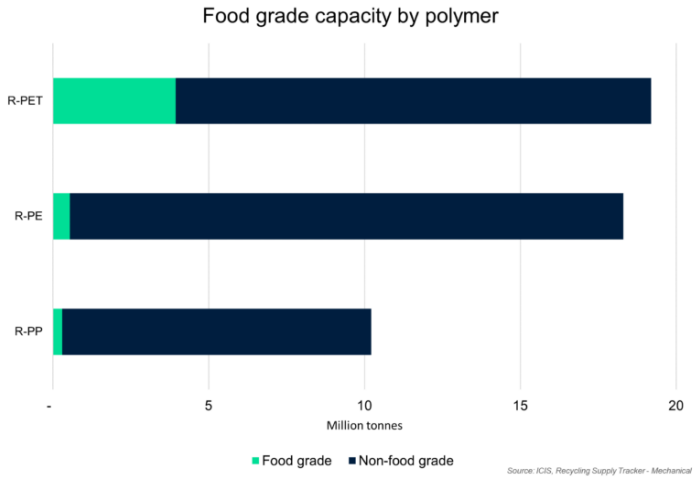
Economies	Challenge test required?	On site Inspection?	U.S. FDA or EFSA Authorization approved?	Variation on different Technologies?	Periodic reviews
CDA	Yes	No	No	Yes	No
PRC	No information	No	No information	No information	No information
INA	No information	No information	No	Yes	No information
MAS	No information	No information	No information	No information	No information
PNG	No information	No	No information	No information	No
PE	No	No	No information	No	No
THA	Yes	No	No	Yes	No
USA	No, but recommended	No	Yes, provided the material complies with applicable food contact regulations.	No	No
VN	No information	No information	No information	No information	No information

From a market perspective, Figure 4 shows that the reported capacity of food-grade recycled plastics within surveyed APEC economies is only

55.1 tonnes per year, which is significantly lower than the global capacity, where rPET alone reaches approximately 4 million tonnes annually. At the same time, Table 5 highlights inconsistencies across the supply chain: resin manufacturers can produce materials with 90%–100% recycled content, while packaging producers typically use only 10%–30%, whereas some food companies require up to 100% recycled content.



(1)



(2)

Figure 4 The capacity of food-grade plastic: (1) in APEC member economies, reported from the data collected in questionnaire; and (2) worldwide, reported by ISCC

Table 5 Percentage of recycled plastic content in the resin or packaging in

responding companies

Economies	Company	NO.	Percentage of recycled plastic content in the resin/packaging	Maximum permissible proportion of non-food contact plastics in resin
PRC	Resin manufacturer	1	90	3
		2	100	40
		3	100	5
		4	100	5
MAS	Packaging producer	1	10	--
	Food company	1	100	
USA	Resin manufacturer	1	Determined by ISCC PLUS mass	100
	Packaging producer	1	30	--

From an economic perspective, Figure 5 indicates that cost is widely recognized as a major barrier across the supply chain. Supporting market data show that recycled plastics such as rPET are priced at approximately USD 1,213 per tonne in the United States and USD 822 per tonne in China. In addition, half of resin producers expressed the need for subsidies or financial incentives to support adoption.

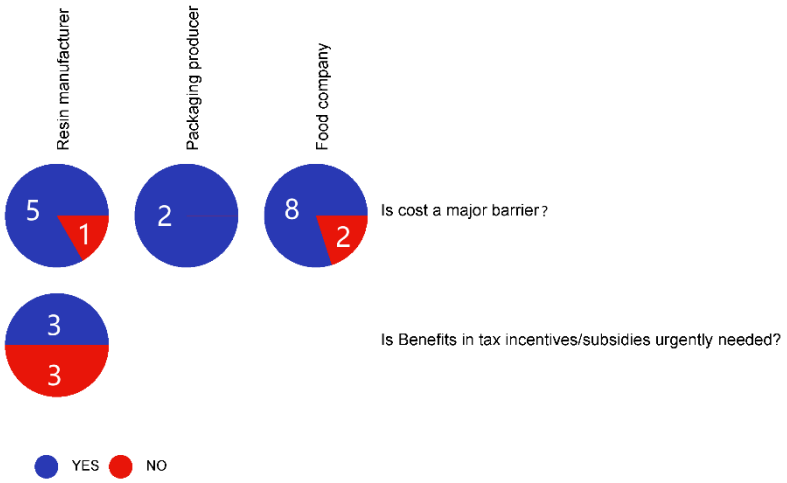


Figure 5 Financial concern of adopting recycled plastics intended to contact foods in the supply chain

From a safety perspective, Figure 6 illustrates differing perceptions among stakeholders. While packaging producers identify safety concerns as a primary barrier, 70% (7 out of 10) of food companies do not consider safety a major issue. However, 80% of food companies still identify regulatory gaps as the primary challenge.

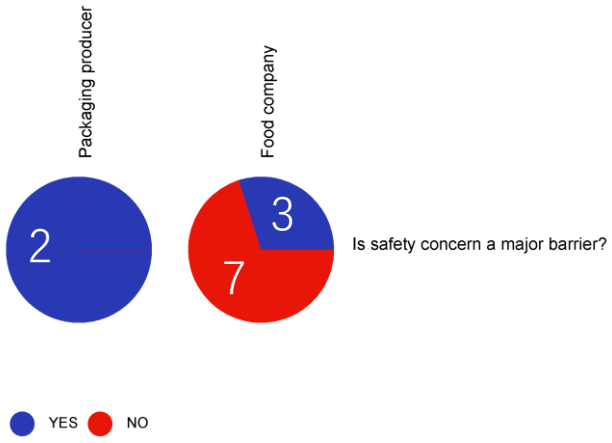


Figure 6 Safety concern of adopting recycled plastics intended to contact foods in the supply chain

Key Finding I: Regulatory frameworks exhibit significant heterogeneity. Survey results reveal considerable variation in regulatory approaches across economies, with many lacking dedicated authorities or clear policy frameworks. This fragmented landscape underscores the urgent need for more coherent and harmonized governance to reduce trade barriers and support industry adoption.

Key Finding II: Regulatory gaps and cost constraints are the primary barriers to adoption.
The findings indicate that inconsistent authorization processes and the absence of clear regulatory guidance are the main constraints limiting the use of food-grade recycled plastics. Cost pressures and technical challenges further impede market scalability, highlighting the need for streamlined procedures and targeted support mechanisms.

Key Finding III: Supply chain development requires integrated efforts across standards, systems, and technology.
A cross-chain analysis underscores the importance of harmonized standards, improved material sourcing and collection systems, strengthened regulatory capacity, and enhanced technical cooperation. Emerging areas such as advanced recycling and biological recycling technologies are identified as key priorities for future investment and collaboration.

5. Overview of Event Participation

The seminar on Policy Standards and Best Practices for Recycling of Plastic Intended to Contact with Foods among APEC Economies was organized on 16–17 July 2025. The event aimed to foster interactive dialogue and knowledge exchange among APEC economies regarding the safe use of food-contact recycled plastics, directly addressing the regulatory and technical gaps identified in the project survey. Its core objectives included:

1. Improving regulatory coherence by sharing diverse regulatory approaches and exploring alignment in risk assessment principles and authorization processes to reduce trade barriers.
2. Strengthening the enabling environment for industry adoption by discussing policy frameworks, EPR systems, and market incentives to overcome cost constraints and supply chain challenges.
3. Highlighting the critical role of harmonized standards and conformity assessment.

The event brought together a broad and diverse group of participants from multiple APEC member economies, including senior officials, technical specialists, and policy representatives from domestic food safety authorities, standardization bodies, and public health agencies. Attendees were drawn from

key institutions such as the United States Food and Drug Administration (FDA), the Ministry of Food and Drug Safety of Korea (MFDS), the State Administration for Market Regulation of China (SAMR), the China Domestic Center for Food Safety Risk Assessment (CFSA), and other government organizations responsible for food regulation, food additives management, food contact materials oversight, inspection systems, and safety evaluation. The involvement of these authorities ensured that the event was grounded in strong regulatory expertise and scientific rigor. In addition to regulatory bodies, the event also welcomed experts from research institutions and technical organizations, who contributed specialized knowledge and practical experience to enrich the technical depth of the discussions. Overall, the participant profile combined policymakers with operational and technical personnel at director, deputy director, and expert levels, reflecting a high level of professionalism and decision-making capability. With representation from economies such as China; Korea; the United States; and others, the event demonstrated a truly international and collaborative character, enabling substantive exchanges on regulatory practices, scientific assessment approaches, and emerging challenges. This diverse and well-balanced participant composition ensured that the event outcomes were comprehensive, insightful, and valuable for strengthening regional cooperation and supporting harmonized progress within the APEC region.

6. Recommendations for event discussion focus area

To enhance the effectiveness of the event, it is recommended that discussions focus on key strategic areas that address both existing challenges and future opportunities for recycled plastics intended for food-contact applications.

First, discussions should emphasize improving regulatory coherence across APEC economies. Current differences in regulatory frameworks, definitions, and authorization processes may create barriers to trade and hinder wider adoption. The event can provide a platform for sharing experiences on

regulatory approaches and exploring opportunities for greater alignment and mutual understanding, while recognizing varying levels of development.

Second, attention should be given to strengthening the enabling environment for industry adoption. The use of recycled plastics in food packaging remains limited due to cost constraints, technical challenges, and supply chain inconsistencies. Discussions may explore how policy frameworks, market incentives, and infrastructure development can support broader adoption and encourage innovation across the value chain.

Third, the role of standards and conformity assessment should be highlighted as essential tools for ensuring safety and building market confidence. Harmonized standards and consistent testing methods can facilitate trade, improve transparency, and support regulatory implementation, while helping to ensure that recycled plastics meet food safety requirements.

Finally, the importance of regional cooperation, capacity building, and knowledge sharing should be underscored. APEC provides a valuable platform for economies to exchange best practices, strengthen technical capabilities, and explore collaborative initiatives. Enhanced cooperation can support more inclusive development and contribute to the advancement of circular economy objectives across the region.

7. Event Summary

7.1 Project Survey Results

Dr. Li Qiang from the China Domestic Institute of Standardization (CNIS) presented a comprehensive report on the APEC survey regarding food-contact recycled plastics.

The findings revealed a complex and critical reality: while global rPET production capacity reached approximately 4 million tonnes in 2023, the annual production capacity for food-grade recycled plastics in some APEC economies was only 58.1 tonnes, indicating a significant gap. On the regulatory front,

although about one-third of the responding authorities permit the use of biological recycling technologies, challenges in purification have prevented resin and packaging manufacturers from adopting them. Moreover, the survey found that 75% of the responding resin manufacturers strongly support establishing a unified evaluation standard across APEC.

The report further highlighted key challenges in the supply chain: while resin manufacturers are capable of producing high-percentage recycled materials, packaging producers only incorporate 10–30% recycled plastic in their final products. Additionally, more than half of the resin manufacturers and packaging companies view cost as the primary barrier, whereas 70% of food companies do not consider it a major issue, reflecting a significant perception gap. In terms of trade, only one economy (Canada) explicitly allows the import of recycled plastics for food-contact applications, which could complicate trade.

Based on these findings, the report proposes core recommendations: urging APEC economies to bridge regulatory gaps, promote technological exchange to overcome key challenges such as biological recycling purification, encourage the development and reporting of production capacity data, and ultimately advance the establishment of a unified and mutually recognized evaluation and regulatory framework. This would accelerate the safe and economical application of food-grade recycled plastics across the region, collectively advancing toward a future of closed-loop plastic recycling.

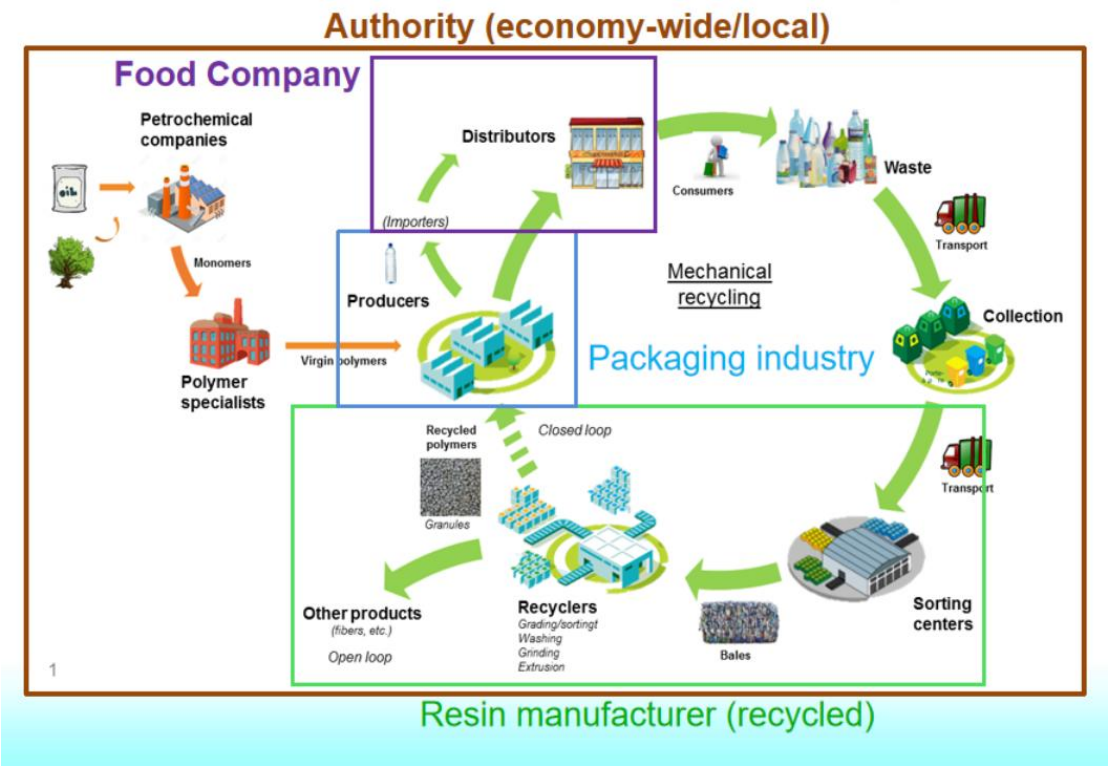


Figure 7 The flowchart illustrating the plastic recycling process in area of food industry

7.2 Progress in Risk Assessment of Recycled Plastics for Food Contact in China

Dr. Zhu Lei introduced the recent progress China has made in strengthening the scientific and regulatory foundations for the safe use of recycled plastics in food contact materials, highlighting the alignment of this work with domestic priorities such as carbon neutrality, circular economy development, and green industrial transformation. She emphasized that the growing industry demand for high-quality recycled materials and the commitment of global and domestic enterprises to reduce virgin plastic usage have made the establishment of a robust risk-assessment system essential. China has developed a coordinated regulatory structure involving food safety authorities, risk-assessment institutions, and market-supervision bodies, supported by a comprehensive standard framework covering general safety requirements, product specifications, testing methods, and good manufacturing practice for food

contact materials. Although recycled plastics were previously restricted from food-contact applications, scientific evaluations—including pilot assessments of bottle-grade rPET—demonstrate a shift toward risk-based, case-specific management. Dr. Zhu Lei presented key technical advancements such as the development of an integrated methodology combining industry surveys, contaminant identification, toxicological evaluation, migration modelling, and assessments of representative recycling processes. Dr.Zhu Lei also highlighted the establishment of a challenge-test system harmonized with EFSA and FDA principles, incorporating reference contamination levels, exposure thresholds, and acceptable residual concentrations.

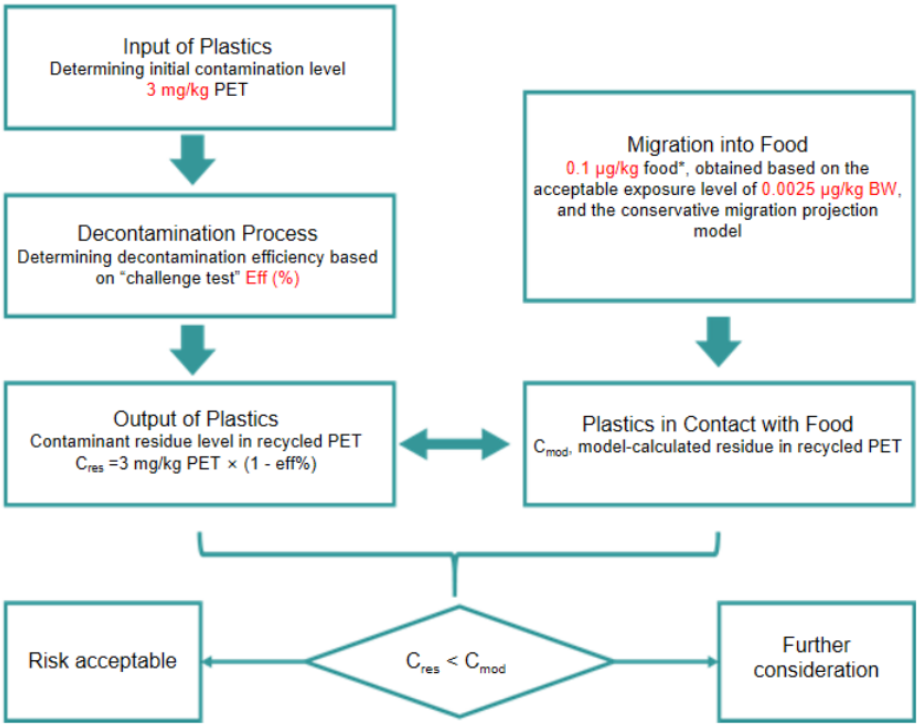


Figure 8 Procedure of rPET Challenge Test

7.3 US FDA Approach to Recycled Plastics in Food Packaging

Dr. Sarah McMullen introduced the U.S. FDA's regulatory approach to ensuring the safety of recycled plastics used in food packaging, emphasizing that recycled materials intended for food contact must meet the same safety principles applied to food additives, including prior authorization and the

requirement that a substance be of suitable purity for its intended use. She highlighted that recycling introduces new vectors for potential contamination—both from intentionally added unauthorized substances and from incidental chemicals such as household cleaners or automotive fluids—which are not encountered in controlled manufacturing environments. To address these concerns, Dr. McMullen explained that FDA evaluates recycling processes by examining feedstock source control, detailed descriptions of physical or chemical processing steps, and data demonstrating a recycling system's ability to remove incidental contaminants. A key element of FDA's assessment is the scientific basis for its contamination threshold: manufacturers must demonstrate that their process results in a dietary concentration not exceeding 0.5 parts per billion (ppb), a value FDA considers to represent negligible risk for substances lacking toxicological data, consistent with its Threshold of Regulation approach. She further elaborated on the role of surrogate contaminant testing, which intentionally contaminates clean plastic with representative chemicals to assess worst-case decontamination performance—a critical tool for validating recycling technologies. Dr. McMullen also discussed current trends, noting that FDA has seen a rapid increase in the number of recycling processes submitted for review and in No Objection Letters (NOLs) issued, reflecting both expanding legal requirements for minimum recycled content and heightened industry interest in sustainable packaging solutions. Despite this progress, she pointed out several ongoing challenges, including the diversification of polymers entering recycling streams and the need for improved data on contamination levels and non-food packaging materials. Her presentation underscored FDA's commitment to balancing safety with innovation, providing clear scientific guidance to support the safe expansion of recycled plastics in food-contact applications.

7.4 Regulatory Policies for Recycled Plastics Used in Food Contact Material in Korea

Dr. Hyung Il Kim presented Korea's current regulatory framework and scientific approach for ensuring the safety of recycled plastics used in food-contact

applications, describing how Korea has responded to the growing challenge of plastic waste and the increasing demand for recycled materials. He highlighted that food packaging accounts for the majority of Korea's plastic waste, with beverage bottles being the largest contributor, making high-quality recycling an urgent domestic priority. Korea's policy development has progressed in parallel with global trends such as mandatory recycled-content requirements and expanded recycling obligations. Dr. Kim outlined Korea's dual-track recycling landscape—including both mechanical and chemical recycling—and traced the government's ongoing legislative efforts since 2013 to establish the regulatory basis for the safe use of recycled PET in food-contact materials. He detailed key milestones such as criteria for recycled PET flakes, legal mechanisms for authorizing recycled materials, and revisions to standards governing synthetic resins used in food packaging. Under MFDS's authorization system, decontamination performance, and quality management procedures. Dr. Kim also emphasized Korea's science-based safety criteria for mechanically recycled PET, including limits on surrogate contaminant migration (≤ 0.01 mg/L), acceptable residual concentrations (≤0.22 mg/kg), and modelled safe concentrations for chemicals such as chlorobenzene, toluene, benzophenone, and methyl stearate. Safety is assessed by comparing the calculated residual concentration (C_res), derived from an assumed initial contamination level of 3 mg/kg, with the modelled migration threshold (C_mod), following international risk-assessment principles similar to those used by EFSA and FDA. He further described standardized testing protocols for contamination and migration, which simulate worst-case industrial recycling scenarios to verify actual decontamination performance. Looking forward, Korea plans to expand its regulatory framework beyond PET, including new standards for mechanically recycled polypropylene, and will continue strengthening traceability, recognition management, and global collaboration. Korea is also actively participating in Codex work on recycled food-contact materials, reflecting its commitment to advancing a safe, sustainable, and internationally harmonized recycling system in support of long-term circular-economy goals.



Figure 9 Establishment of a certification standard of mechanically recycled food contact Polypropylene（MFDS future plan）

7.5 Closing the Loop--EU's Policy Framework and Best Practice on PET Recycling

Mr. Jet Chang delivered his presentation, focusing on the closed-loop recycling of food-grade rPET in the EU and delving into its policy framework and best practices. With carbon neutrality as a long-term goal, the EU has implemented a series of initiatives, including the Green Deal, the Clean Industrial State Aid Framework (CISAF), and the Circular Economy Action Plan, to promote resource security and closed-loop recycling, positioning it as a core element of its carbon neutrality strategy. In the packaging sector, the EU has established stringent market access thresholds and specific targets for the use of recycled plastics. For example, it requires that by 2030, at least 30% of PET food and beverage packaging consist of recycled content, with gradual increases planned. In practice, beverage container deposit-return schemes and extended producer responsibility (EPR) systems have become key drivers, effectively boosting recycling rates and holding producers accountable for environmental responsibility. Meanwhile, the EU enforces rigorous safety assessments for food-contact recycled plastics, and technologies for closed-loop applications of materials like rPET and rPP have matured. In contrast, PET bottle recycling in China remains predominantly reliant on informal channels and downcycling.

However, in recent years, China has accelerated its policy efforts, including promoting EPR systems, exploring legislation to mandate the use of recycled materials, and extending its circular economy cooperation memorandum with the EU. Globally, economy like India and Korea have also introduced related measures, demonstrating that the transition to a circular economy has become an international trend.

EU mandates that all production processes for recycled plastics intended for food contact uses (excluding closed-loop recycling processes) should submit a safety assessment application to the European Food Safety Authority (EFSA)

7.6 Indonesia Plastic Packaging Recycling Landscape

This presentation, titled "Indonesia Plastic Packaging Recycling Landscape," was delivered by Hadiyan Fariz Azhar, the General Executive of the Indonesian Plastic Recycling Association (ADUPI / Asosiasi Daur Ulang Plastik Indonesia). It provides a comprehensive overview of Indonesia's efforts to build a structured circular economy for plastics. ADUPI, founded in 1989 and now a major ecosystem player with over 500 members, outlined a recycling landscape characterized by a hybrid system reliant on both formal waste management and a vast informal network of collectors. Despite possessing significant installed recycling capacity (over 3 million tonnes), utilization rates remain low at around 40-50%, and recycled plastics currently meet only 27% of total domestic demand. Key challenges include unstable supply and quality of feedstock, insufficient infrastructure, and low market demand for recycled materials. In response, Indonesia is advancing a robust policy framework centered on mandatory Extended Producer Responsibility (EPR) under MoE Regulation 75/2019, with a detailed rollout plan extending to 2045. Uniquely, the economy has established a multi-layered standard system for food-contact recycled plastics, intertwining BPOM's "Tara Pangan" food safety regulations, mandatory Halal certification governed by Islamic law, and a Domestic Standard (SNI) for materials like R-PET. Looking ahead, a new Presidential Decree on Domestic Waste Policy is in development, aiming to strengthen the EPR framework, introduce eco-modulation, and expand standardization to

boost both the quality and demand for recycled resins. In summary, the presentation illustrates Indonesia's strategic approach of leveraging top-down policy mandates and a culturally-specific regulatory matrix to steer its plastic packaging industry toward a closed-loop future.

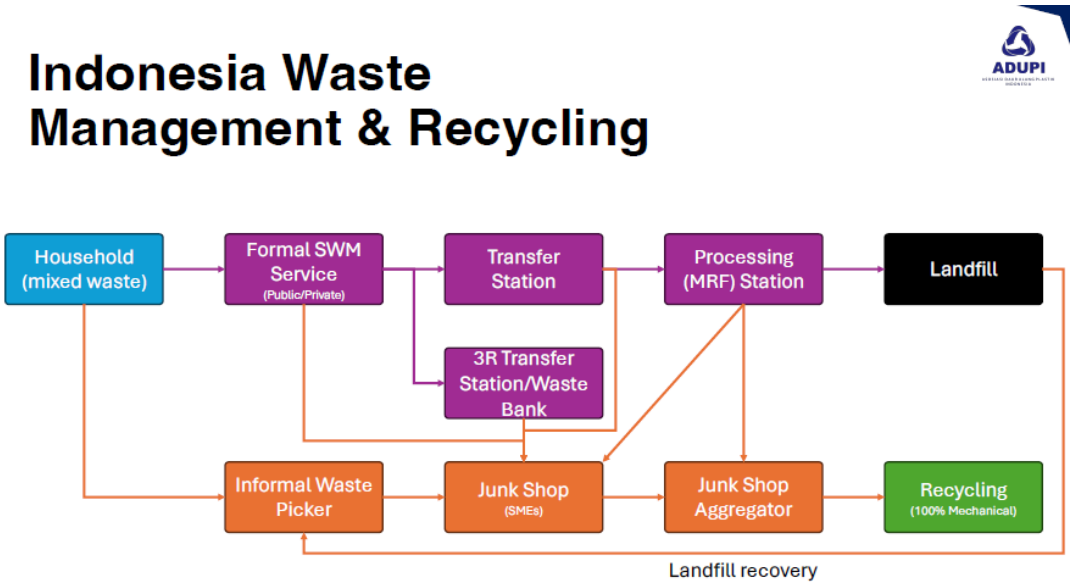


Figure 10 Indonesia Waste Management & Recycling

7.7 Three Challenges of Using Recycled Plastics in Food Contact in China: DFR, Consumer Participation, and Digital Traceability - Three Challenges of Using Recycled Plastics in Food Contact in China: DFR, Consumer Participation, and Digital Traceability

This presentation was delivered by Mr. Wang Wang of the China Plastics Recycling Association (CPRRA), providing a systematic analysis of the current status and future pathways for food-contact recycled plastics in China. Mr. Wang pointed out that the industry currently faces three core challenges: the lack of eco-design (DfR), consumer participation, and a digital traceability system.

Firstly, the presentation revealed the industry's current state through a series of exclusive data: China's plastic recycling volume has remained largely unchanged over the past 10 years, indicating that the industry has reached a development bottleneck. Specifically, in the food-contact rPET sector, according to CPRRA's 2022 survey of 145 domestic recycled PET enterprises, the total industry capacity is approximately 7.5261 million tonnes per year. However, capacity distribution is uneven, with only 12 enterprises having an annual capacity exceeding 100,000 tonnes, accounting for just 8% of the total, reflecting low industry concentration. Nevertheless, China has made significant technological progress in the food-grade recycling field. Currently, 18 recycling enterprises have obtained FDA certification, covering four materials: PET, PP, HDPE, and PS, with annual capacities of 345,000 tonnes, 142,000 tonnes, 117,000 tonnes, and 4,000 tonnes, respectively. Additionally, the capacity of enterprises passing EFSA certification has reached 165,000 tonnes per year. Leading companies such as Jiangsu Saivier, Veolia Huafei, and Wuzhou Guolong have even achieved dual certification from both FDA and EFSA.

Secondly, the presentation analyzed the methodology for plastic pollution governance from multiple dimensions. Economically, the root cause lies in the low usage and disposal costs of plastics, leading to mispricing. Philosophically, this reflects the dilemma of "technology advancing ahead of civilization." From a governance perspective, policy instruments such as extended producer responsibility are needed to correct market failures.

In summary, China's food-contact rPET industry is at a critical juncture of crossing a tipping point. Moving forward, it is essential to promote eco-design, build a closed-loop recycling system that incentives consumer participation, and establish a reliable digital traceability system to break through the bottlenecks and steer the industry toward a high-quality, sustainable, and circular future.

7.8 Testing Technology and Progress of Pollutants in Recycled Plastics

This presentation, delivered by Dr. Pan Jingjing and Dr. Zhong Huaining from the IQTC Domestic Reference Laboratory for Food Contact Materials, provides a comprehensive technical roadmap for implementing food-grade rPET in China. While life cycle assessment data confirms significant environmental benefits—with one recycling cycle reducing carbon footprint by approximately 29.65% and five cycles achieving a 61.85% reduction compared to virgin PET—the path to regulatory approval faces substantial safety challenges. Analysis of 200 batches of hot-washed rPET flakes revealed specific contamination risks: metal contaminants including Sb (avg. 172.01 mg/kg), Cr, Ni, Al, and Zn; organic compounds totaling 1,011 substances with limonene detected in 98% of samples (avg. 3.60 mg/kg) and DEHP at 1.41 mg/kg; and critically, genotoxic substances like safrole. The BPA case study showed 92% detection in pellets (median 1.7 mg/kg) with complex migration behavior influenced by processing conditions. To address these challenges, the presentation outlines a multi-pronged technical strategy: developing an expanded surrogate list of 16 substances for challenge testing (requiring ≥95% decontamination efficiency), establishing machine learning-based identification methods with >95% accuracy for distinguishing virgin/recycled PET, implementing enhanced process controls including raw material restrictions (≤5% non-food grade), and extending research to more complex materials like rHDPE which shows greater contaminant diversity. These findings provide critical scientific foundations for developing China's food-grade rPET regulatory framework while balancing environmental objectives with food safety requirements.

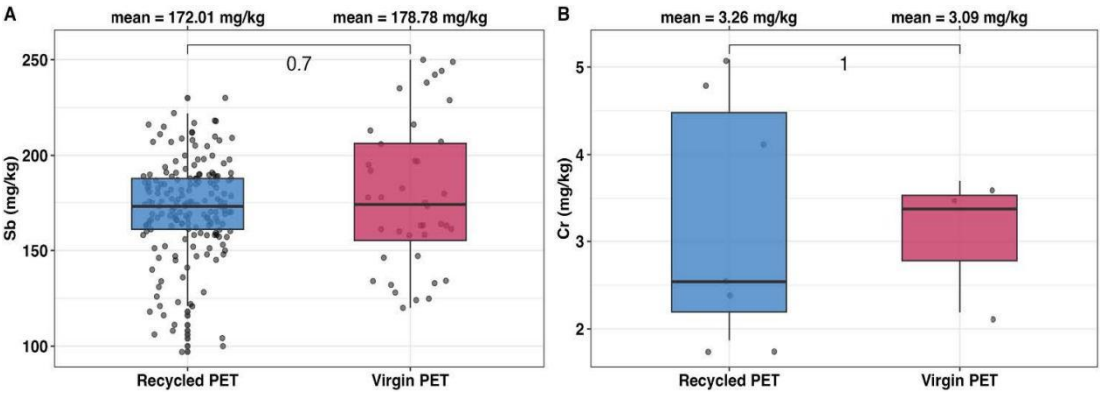


Figure 11 Comparison of antimony (A) & chromium (B) content in r-PET and v-PET.

7.9 Understanding the Risk and Safe Use of Recycled Material in Food Contact Applications

Zhang provided an overview of global practices and regulatory expectations for the safe use of recycled plastics in food-contact applications, drawing on Intertek's extensive international experience in food-contact compliance, risk assessment, and regulatory submissions. She outlined Intertek's global network, consisting of more than 1,000 laboratories and offices across over 100 economies, which supports regulatory assessments, testing programs, and government submissions related to recycled plastics. Her presentation explained the fundamental definitions used in international regulatory systems, particularly the distinction between post-consumer recycled (PCR) materials—derived from products used and discarded by consumers—and post-industrial recycled (PIR) materials generated during manufacturing. She also reviewed the different regulatory positions in major markets. In the United States, the FDA evaluates recycling processes through No Objection Letters (NOLs), focusing on whether contaminants from post-consumer feedstock might remain in recycled plastic, whether non-food-grade plastics could be unintentionally incorporated, and whether additives comply with applicable food-contact regulations. In the European Union, the European Commission authorizes recycling processes based on EFSA's scientific opinions, with specific provisions governing suitable technologies and the categorization of novel technologies that require additional oversight. Zhang further noted that several economies—including Canada; India; Japan; and Korea—have established their own regulatory systems but continue to rely heavily on FDA and EU approaches as global scientific references, while China is in the process of developing a comprehensive framework for evaluating recycled food-contact materials.

7.10 Application of Food-Grade Recycled Plastics

From an industry perspective, PepsiCo's presentation (Speaker: Ms Wang Shuang) highlighted the strategic importance of food-grade rPET in supporting

global sustainability goals and accelerating the transition toward a circular plastics economy. The presentation emphasized that sustainable packaging is essential not only for reducing plastic pollution but also for lowering greenhouse gas emissions, given that mechanically recycled rPET can reduce carbon emissions by 63% and energy consumption by 79% compared with virgin PET. PepsiCo outlined how expanding rPET use strengthens collection systems, supports waste-picker livelihoods, and creates a stable end market that stimulates higher recycling rates. The company has already launched food-grade rPET packaging in more than 60 economies, with widespread adoption across the Asia-Pacific region beginning in 2021. The presentation further detailed the mechanical recycling process—from municipal collection and material recovery to granulation, preform molding, and bottle production—demonstrating its maturity and global scalability. A major focus was PepsiCo's role within the Initiative for Sustainable Beverage Packaging (ISBP), which has developed a unified, multi-step approval system for rPET decontamination technologies. This system includes rigorous documentation reviews, detailed decontamination process descriptions, surrogate-chemical challenge testing, resin and bottle evaluations, and sensory tests, followed by multi-stage validation, consistency checks, and ongoing monitoring. PepsiCo also introduced its proprietary mathematical modeling tool, used by ISBP members to evaluate decontamination efficiency and determine whether a technology is suitable for up to 100% rPET use. The company stressed the importance of a comprehensive Food Safety Management Framework, covering standards, procedures, records, facility audits, NIAS assessments, migration testing, and heavy-metal compliance. Supplier qualification and ongoing control follow a structured CQV (Commissioning, Qualification, Verification) process, including audits, data reviews, CO_2 retention testing, product–package interaction sensory assessments, and periodic reapprovals. Additional frameworks such as change-management decision trees and standardized facility assessments help ensure that any modification in recycling technology, production lines, or intended-use conditions does not compromise food-contact safety. Overall, PepsiCo's presentation demonstrated that industry-driven systems—combining scientific risk assessment, rigorous decontamination validation, and

continuous supplier oversight—form a critical foundation for scaling safe, high-quality food-grade rPET across global markets and advancing long-term circular-economy objectives.

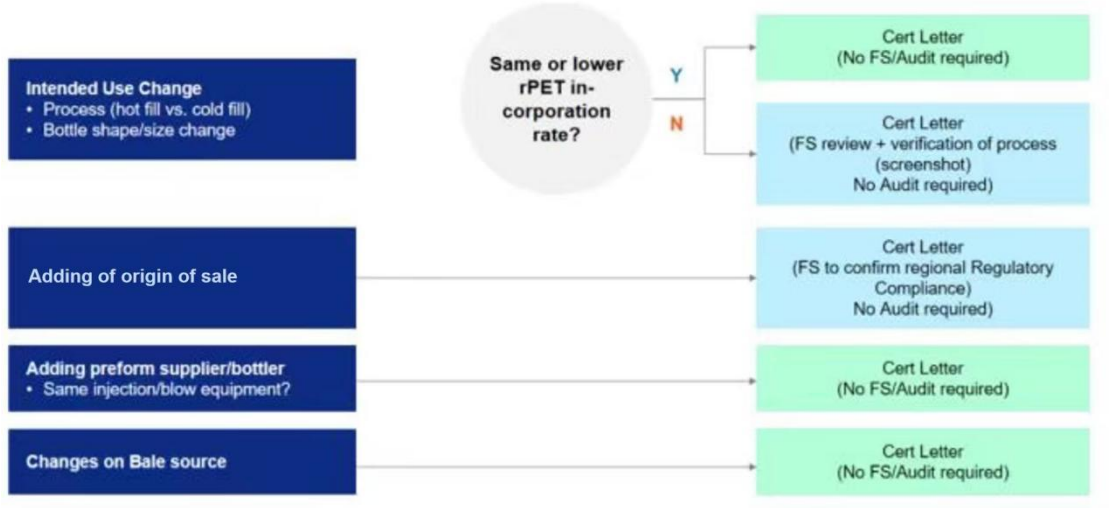


Figure 12 Cert letter process based on changes on PepsiCo application

7.11 A Comparability Analysis on the Risk Assessment Approaches to Food-Grade Recycled PET

Jim Huang provided an in-depth comparative analysis of the international risk-assessment approaches used for evaluating the safety of food-grade recycled PET, outlining the differences in regulatory structures, scientific principles, and evaluation criteria applied across various economies. He reviewed both mechanical and chemical recycling technologies, explaining how PET's chemical characteristics support multiple recycling pathways and how each jurisdiction determines the scope and rigor of its safety assessment. Jim highlighted that only two authoritative scientific reference systems (FDA & EFSA) currently serve as the global foundations for food-grade rPET evaluations, forming the basis of most economies' regulatory adaptations. His comparison demonstrated that although FDA and EFSA differ in their toxicological thresholds, exposure assumptions, and migration-modelling parameters, the overall risk-assessment outcomes and safety conclusions are

broadly consistent, confirming strong scientific alignment between the two systems. He also described how FDA and EFSA categorize recycling technologies differently, with FDA providing voluntary evaluations for both physical and chemical recycling, while EFSA requires authorization for mechanical recycling and treats chemical recycling as a “novel technology” requiring case-specific review. Jim concluded by comparing practices across regions—including the Australia; EU; Japan; Latin American economies; and U.S.—showing how jurisdictions draw upon FDA or EFSA principles, incorporate surrogate contaminant testing, or accept materials aligned with U.S. or EU authorizations. Overall, his analysis underscored that despite the absence of full regulatory harmonization, the scientific foundations guiding food-grade rPET assessments are convergent, offering a practical basis for enhancing regulatory communication and facilitating regional cooperation within APEC.

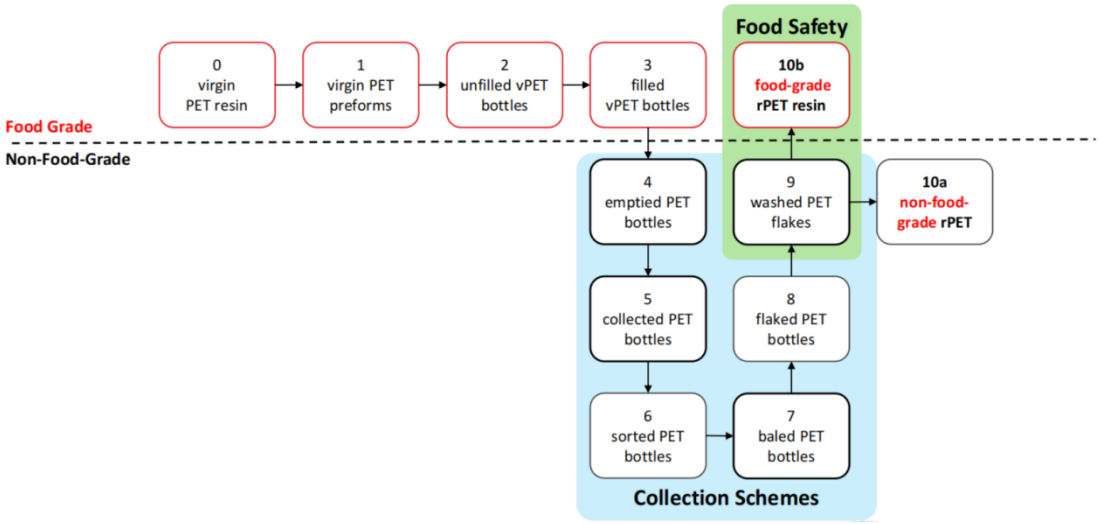


Figure 13 PET Recycling, Food Grade VS Non Food Grade

8. Analysis and Recommendations

The expert presentations collectively provide a comprehensive and multi-dimensional perspective on the regulatory, technical, and market aspects of recycled plastics intended for food-contact applications across APEC

economies. Despite differences in domestic approaches and development stages, several consistent themes and shared challenges emerge from the discussions.

The expert presentations collectively highlight a range of interrelated regulatory, technical, and market challenges in advancing the use of recycled plastics for food-contact applications across APEC economies. From a regulatory perspective, significant variations exist in policy frameworks, risk assessment approaches, and authorization procedures, reflecting different levels of institutional maturity and potentially creating barriers to trade and adoption. From a technical perspective, while progress has been made in testing technologies and process control, challenges remain in standardizing methods, validating decontamination efficiency, and addressing emerging risks associated with new recycling technologies. From a market perspective, adoption is further constrained by economic and supply chain factors, including the limited availability of high-quality feedstock, cost differences compared to virgin materials, and evolving consumer confidence. Together, these factors underscore the need for more coordinated approaches to support safe, efficient, and scalable implementation across the region.

Based on these findings, several key recommendations can be proposed：

- APEC economies are encouraged to strengthen regulatory cooperation and promote greater alignment in risk assessment principles, terminology, and authorization processes, while maintaining flexibility to accommodate different domestic contexts.
- Efforts should be made to advance the development and harmonization of standards, testing methods, and technical guidelines to support consistent safety evaluation and facilitate trade.
- Economies may consider enhancing capacity building and technical exchange, particularly to support developing economies in improving regulatory systems and technical capabilities. (d) Greater attention should be given to fostering an enabling market environment, including improving supply chain systems, encouraging innovation, and raising stakeholder awareness, to support the scalable and sustainable use of recycled plastics in food-contact

applications.

9. Conclusion

Both the Research Report and workshop indicate that：

1. The analysis of both the Research Report and expert presentations indicates that APEC economies are at different stages in regulating and implementing the use of recycled plastics intended for food-contact applications. While some economies have established relatively mature regulatory frameworks and technical systems, others are still in the process of developing relevant policies and capacities, highlighting the need for continued dialogue and experience sharing.

2. The findings suggest that ensuring safety remains the central priority in the adoption of recycled plastics for food-contact use. Although technological advancements have improved the ability to control risks, challenges persist in harmonizing testing methods, validating recycling processes, and addressing uncertainties associated with emerging technologies.

3. The broader adoption of food-grade recycled plastics is influenced not only by regulatory approval but also by market and supply chain conditions. Factors such as the availability of high-quality recycled materials, cost competitiveness, and consumer confidence play an important role in shaping market development and scalability.

10. Post Seminar Survey

The post-seminar survey was developed to assess the overall effectiveness, relevance, and impact of the event within the context of APEC's capacity-building objectives. The survey serves as an important tool for evaluating whether the seminar successfully enhanced participants' understanding of policies, standards, and best practices related to recycled plastics intended for food-contact use, as well as approaches that contribute to reducing marine plastic waste through improved recycling systems.

In addition, the survey enables the project team to identify strengths and areas requiring further improvement in terms of content design, organizational structure, and event delivery. The information collected supports evidence-based refinement of future activities and helps ensure alignment with the regulatory needs and development priorities of APEC member economies. Responses describing potential applications of seminar content—such as policy development, regulatory drafting, technical training, and strategy formulation—provide insight into the seminar's practical value and its contribution to regional cooperation.

Overall, the survey functions as a key mechanism for measuring project outcomes and informing future APEC initiatives aimed at strengthening sustainable and safe recycling practices within the food-contact sector.

Appendix A – Agenda

Seminar Programme on Policy Standards and Best Practices for Recycling of Plastic Intended to Contact with Foods among APEC Economies

Agenda

16–17 July 2025, Bei Chen Hall of Beijing Continental Grand Hotel, China

Date: July 16, 2025		
08:30-09:20am	Registration	
09:20-09:30 am	Welcome Speech I	Ms. Wang Yuhan, Director Level Officer（Grade II）, Department of International Cooperation, State Administration for Market Regulation
09:30-09:40 am	Welcome Speech II	Mr. Li Zhiping, Vice President, China Domestic Institute of Standardization
09:40-10:20 am	Group Photo＆Coffee Break	
10:20-11:00 am	Project Survey Results	Dr. Li Qiang, Researcher, China Domestic Institute of Standardization
11:00-11:40 am	Progress in Risk Assessment of Recycled Plastics for Food Contact in China	Ms. Zhu Lei, Director of Standard Division, China Domestic Center for Food Safety Risk Assessment
12:00-01:30 pm	Lunch	
01:30-02:00 pm	US FDA Approach to Recycled Plastics in Food Packaging	Dr. Mcmullen Sarah, Director, FDA China Office, United States Food and Drug Administration
02:00-02:30 pm	Regulatory Policies for Recycled Plastics Used in Food Contact	Dr. Hyung Il KIM, Deputy Director, Food Additives Standard Division, Ministry of Food and Drug Safety
02:30-03:10 pm	Closing the Loop--EU's Policy Framework and Best Practice on PET Recycling	Mr. Jet Chang, Domestic Chair, Environment Working Group，European Union Chamber of Commerce in China (EUCCC)
03:10-03:40 pm	Coffee Break	

03:40-04:20 pm	Indonesia Plastic Packaging Recycling Landscape	Mr. Hadiyan Fariz Azhar, General Executive, Indonesia Plastic Recycling Association (ADUPI)
04:20-05:00 pm	Three Challenges of Using Recycled Plastics in Food Contact in China: DFR, Consumer Participation, and Digital Traceability	Mr. Wang Wang, Executive Vice President, China Plastics Reuse and Recycling Association
05:00-05:30 pm	Discussion on Regulatory Policies of Government Departments in APEC Economies	All Attendees
Date: July 17, 2025		
09:00-09:45 pm	Testing Technology and Progress of Pollutants in Recycled Plastics	Dr. Pan Jingjing, Director of the Risk Monitoring Division, Domestic Key Laboratory of Food Contact Materials (Guangdong, IQTC)
09:45-10:20 am	Understanding the Risk and Safe Use of Recycled Material in Food Contact Applications	Dr. Xia Zhang, Regional General Manager , Intertek Assuris
10:20-10:50 am	Coffee break	
10:50-11:20 am	Application of Food-Grade Recycled Plastics	Ms. Kitty Wang, Director of Scientific and Regulatory Affairs, Greater China Region, PepsiCo
11:20-12:00 am	Good Practices and Experiences of Using Recycled Plastics in Food Packaging	Mr. Jim Huang, Senior Director, Food Contact Material, Coca-cola
12:00-01:30 pm	Lunch	
01:30-02:20 pm	Discussion of Opportunities and Challenges in Plastic Circularity	All Attendees
02:20-02:30 pm	Closing Observations and Summary	Dr. Li Qiang, Researcher, China Domestic Institute of Standardization
02:30-03:30 pm	Post-Seminar Survey	All Attendees

Appendix B – Post Seminar Survey

Policy Standards and Best Practices
for Recycling of Plastic Intended to Contact with Foods among APEC
Economies Post Seminar Survey

Thank you for participating in this seminar! To assess the event's effectiveness and continuously improve, we sincerely invite you to take a few minutes to answer the following questions.

Ranking Rules

1	2	3	4	5
Not much	A little	Somewhat	Mostly	Very

Do you feel that your understanding of the following aspects has improved through this seminar?

Topic	Question	1	2	3	4	5
Relevance	How is this project relevant to you and your economy?					
Knowledge Improvement	Policies and standards for recycled plastics in food contact					
	Best practices for recycled plastics in food contact					
	Recycling practices to reduce marine plastic waste					
Coordination and Collaboration	After the seminar, are you more willing to coordinate and collaborate with APEC economies?					

Do you have any suggestions on the content, organization, or format of the seminar?

_____

_____

How will you apply the project's content and knowledge gained at your workplace? Please provide examples (e.g. develop new policy initiatives, training, develop work plans/strategies, draft regulations, develop new procedures/tools etc.).

_____

_____

Participant information
(optional）

Name : Organization/Economy : Email:
Gender M / F

Thank you for your valuable feedback!

Please place your completed survey in the collection box at the entrance of the meeting room. Thank you for your participation!

Appendix C – Research Report

1. Executive Summary

This report, prepared by the CNIS under APEC project SCSC_205_2024A, analyzes data from 30 questionnaires (26 valid) collected from nine APEC economies. The project is organized by China and co-sponsored by Australia; Peru; Thailand; and the United States.

The questionnaire aimed at the following objectives:

- to compile regulations, standards, and best practices pertaining to recycled plastics for food-contact materials across APEC economies
- to promote an interactive dialogue that enhances the exchange of technical expertise and regulatory insights on plastic waste recycling and food safety risk management among member economies
- to provide a valuable resource for APEC economies that have not yet authorized the use of recycled plastics in food packaging

2. Background and Introduction to the Questionnaire

Plastic waste has become one of the most pressing environmental challenges of the 21st century, with its impacts stretching from land to oceans and affecting ecosystems, human health, and sustainable development. Among the various sources of plastic pollution, food-contact plastics—those used in packaging, containers, utensils, and processing equipment—represent a particularly critical category. They play an indispensable role in ensuring food safety, preserving quality, extending shelf life, and facilitating global food trade. However, the increasing consumption of single-use and non-recyclable food-contact plastics has also contributed significantly to marine plastic waste, microplastic contamination, and greenhouse gas emissions associated with their production and disposal.

Globally, international organizations such as the UNEP, the FAO, the CAC, and the ISO have emphasized the urgent need to promote sustainable food packaging solutions. At the same time, major economies and regional alliances—including the EU, ASEAN, and APEC—have launched initiatives to encourage recycling, circular economy approaches, and harmonized standards to reduce the environmental burden of plastics while safeguarding public health. For example, the EGD and CEAP promote eco-design and EPR, while ASEAN and APEC have highlighted plastic waste reduction as a shared priority for sustainable growth and blue economy cooperation. Recycling of food-contact plastics presents unique challenges. Unlike general plastics, these materials must comply with stringent safety regulations to ensure that contaminants or residues from previous use, or from the recycling process itself, do not migrate into foods. This requires clear policies, robust regulatory frameworks, scientific risk assessments, and internationally recognized standards to determine which materials and technologies are safe for reuse.

The 3R principle for plastics—Reduce, Reuse, Recycle—forms a hierarchy of actions prioritized by their environmental benefit. Reduce is the most fundamental step, focusing on prevention at the source by minimizing plastic consumption altogether, such as choosing products with minimal packaging or using reusable alternatives. The core idea is to avoid creating waste in the first place. Reuse comes next, emphasizing extension of a product's life by finding multiple uses for it in its current form, like refilling a water bottle or repurposing a container for storage. This step delays disposal and maximizes the utility of an item already in circulation. Finally, Recycle is the last-resort step of reprocessing, which involves collecting and processing discarded plastics to transform them into new materials or products. In essence, the key distinction can be concluded as: Reduce aims to eliminate the need, Reuse aims to extend the lifespan, and Recycle aims to recover the raw materials, forming a complete strategy from the most to the least desirable environmental outcome.

Economies around the world have developed different approaches: some, such as the EU and the United States, rely on pre-market authorization systems for recycled plastics; others, such as Australia; China; and Japan have introduced technical specifications, positive lists, or certification schemes. Yet disparities remain across regions in terms of definitions, testing methods, and acceptance criteria, which can create barriers to trade and limit the scaling of safe recycling technologies.

Within the Asia-Pacific region, APEC economies play a pivotal role in both plastic production and consumption, as well as in driving global trade in food and agricultural products. Many member economies have already adopted domestic strategies or roadmaps for plastic waste reduction, including bans on single-use plastics, targets for recycled content, and promotion of biodegradable alternatives. However, differences in regulatory capacity, technological development, and infrastructure mean that best practices and lessons learned are unevenly shared. For developing economies in particular, knowledge exchange and capacity building are essential to bridge the gap and enable safe, effective, and economically viable recycling systems for food-contact plastics.

Plastic pollution, especially marine litter, is a pressing global issue affecting the environment and economies. Efforts to manage plastic waste have not kept pace with production, with only 9% of over 10 billion tonnes produced globally being recycled, 12% being incinerated, while 79% end up in landfills or leaking into the environment [1]. The UN views plastic marine litter as a critical environmental crisis, primarily addressed under SDG 14 (Life Below Water) [2]. The UNEP reports that 19-23 million tonnes of plastic waste leak into aquatic ecosystems annually, projected to nearly triple by 2040 without action [3].

The APEC region, both a major contributor and a heavily impacted area of marine plastic debris, has become a focal point in the global dialogue on plastic pollution and sustainability. With its extensive coastlines, high levels of industrial production, and rapidly growing consumer markets, the region faces the dual challenge of being a significant source of plastic

leakage into the marine environment and one of the areas most vulnerable to its ecological, economic, and social impacts. This has prompted various economies within APEC to adopt targeted measures aimed at minimizing plastic waste generation, with a strong emphasis on enhancing recycling efficiency as a critical strategy for achieving long-term sustainability. Recognizing the importance of this issue, several APEC member economies—including but not limited to Canada; Japan; Korea; Thailand; and the United States—have already enacted legislation or regulatory frameworks to establish clear requirements and guidelines for the safe use of recycled plastics in food packaging. These regulations typically cover aspects such as pre-market safety assessments, testing protocols for contaminant migration, traceability systems, and certification schemes to ensure that recycled plastics meet stringent health and safety standards. By doing so, these economies are laying the foundation for domestic closed-loop plastic recycling industries that can meet consumer demand while protecting public health and supporting environmental objectives. For example, the U.S. FDA operates a pre-approval system for recycled plastics intended for food contact, while the European Union—closely linked to several APEC economies through trade—requires authorization of recycling processes under its Regulation (EC) No. 282/2008. Similarly, Japan and Korea have introduced domestic positive lists and technical standards for recycled food-contact materials, demonstrating proactive governance in this field. Despite this progress, significant challenges remain. Differences in regulatory approaches, testing methodologies, and enforcement mechanisms across APEC economies can create barriers to trade and slow the adoption of safe, harmonized recycling practices. In some economies, limited infrastructure, insufficient investment in advanced recycling technologies, and a lack of consumer awareness further hinder the development of robust closed-loop systems. Moreover, the globalized nature of plastic production and food supply chains means that no single economy can address marine plastic debris in isolation. Effective solutions require coordinated action across borders, supported by shared standards, mutual recognition of

testing results, and platforms for technical cooperation and knowledge exchange. Moving forward, APEC economies have an opportunity to strengthen regional collaboration by aligning their policies and standards, sharing best practices, and investing in innovative recycling technologies. This includes exploring harmonized guidelines for food-contact recycled plastics, supporting pilot projects that demonstrate scalable closed-loop systems, and facilitating public-private partnerships that engage industry, academia, and civil society in co-developing sustainable solutions. By enhancing coordination and building regional synergies, APEC can not only reduce marine plastic waste but also position itself as a global leader in advancing the circular economy for plastics—an approach that benefits the environment, safeguards food safety, and promotes sustainable economic development across the region.

Promoting the recycling and reuse of plastics, particularly through closed-loop systems where materials are collected, processed, and reintroduced into food packaging and other consumer products, has emerged as one of the most effective approaches to reduce plastic pollution and marine debris. Such systems not only limit the volume of plastics that escape into oceans and waterways but also contribute to resource conservation, energy savings, and the reduction of greenhouse gas emissions associated with virgin plastic production. In addition, closed-loop recycling encourages innovation in material science, eco-design, and waste management infrastructure, thereby creating new opportunities for green growth and sustainable industries.

This series of questionnaires (details shown in Table 1 **Design of the questionnaire series**) are developed under the scope of APEC project SCSC_205_2024A (Policies, standards, and best practices for recycling of plastic intended to contact with foods to reduce marine plastic waste among APEC economies), engaging key organizations across the plastic recycling industry supply chain. Through the data collected from questionnaires, the current practices, experiences, and trends in APEC economies regarding plastic recycling technologies for food packaging

are investigated, supported by practical case studies and comparative standards analysis. These efforts aim to foster sustainable, high-value recycling and effective management strategies to overcome complex technical and economic challenges in the implementation of plastic recycling across APEC economies.

3. Analysis of the Survey

Nine economies participated in the survey, contributing 30 questionnaires, with 26 deemed valid.

4. Report on the Survey findings

4.1 Authority and Policy

Significant regulatory variation exists across APEC economies. Per Table 2, only Indonesia; Peru; and the United States have defined authorities; the U.S. employs specialized personnel, and Indonesia maintains local sub-agencies. U.S. FDA oversees all food-contact recycled plastic activities, while most members (e.g., Indonesia; Peru) split manufacturing and environmental duties across agencies. Non-responding economies with advanced recycling—Japan (MHLW/MOE) and Korea (MFDS/MOE)—adopt similar bifurcated structures [4].

Strengthening regulatory functions is critical. Agencies must develop science-based rules, testing protocols, process approvals, and compliance monitoring to ensure safety and build consumer trust—addressing concerns over contaminant migration, microplastics, and chemical residues via transparent risk assessments and enforcement. Clear guidelines spur innovation (e.g., chemical recycling) and investment; fragmented frameworks deter both. Capacity-building (training, int'l cooperation, standard-setting) is vital for developing members, enabling cross-border mutual recognition and market integration.

Table 3 shows Canada; Indonesia; and the United States have relatively advanced regulations, mostly at provincial levels. Canada lacks economy-wide authority yet maintains detailed systems—proving local initiatives can drive progress. However, a U.S. recycler cited inconsistent local collection as a major barrier. The U.S. alone has traceability rules. Peru has no specific food-grade recycled plastic regulation but Law No. 30884

mandates ≥15% post-consumer recycled (PCR) content in PET beverage bottles (Article 10), subject to food safety. Other responding developing economies remain limited in policy.

Survey data confirm regulatory voids hinder adoption. Among 12 food companies (China: 5; Malaysia: 6; Peru: 1)—all lacking specific authorities/regulations—only 1 uses recycled plastics in packaging. 80% (8/10) identified regulatory gaps as the top barrier. Absent frameworks create compliance uncertainty, deter investment, and disadvantage firms versus peers in mature markets where recycled content is increasingly integrated.

Conversely, two packaging firms (Malaysia and U.S.) cited regulatory compliance and Extended Producer Responsibility (EPR) as primary adoption drivers. Where rules exist, companies treat recycled content as a legal duty and strategic opportunity—contrasting sharply with the hesitation in regulatory vacuums.

In sum, APEC urgently needs enhanced, harmonized regulations. Clear, science-based frameworks will boost confidence, incentivize infrastructure investment, safeguard food safety, and enable full industry integration of recycled plastics—advancing circular economy goals, reducing marine plastic waste, and meeting consumer expectations. Without such governance, adoption will remain fragmented, slowing regional sustainability progress.

4.2 Control and Management

4.2.1 Material Source



Figure **2 Material source of the recycled plastic intended to contact foods through the supply chain on the level of economies, resin manufacturer and packaging industry**

illustrates the sources and collection methods of recycled plastic materials, along with their variations across the supply chain, as derived from the survey of APEC economies. This chain extends from the economies level (permitted by the authority) to resin manufacturers and subsequently to the packaging industry. The data indicates that curbside

collection and in-house recycling are the predominant sources of recycled plastics at all stages. However, domestic purchasing emerges as a significant source for both resin and packaging producers, though it is not authorized for food contact use in any of the nine surveyed APEC economies, potentially leading to practical challenges. Additionally, only Canada, among the nine economies, permits the use of imported recycled plastics for food contact, which complicates trade among member economies. Notably, 57% (four of seven) of resin manufacturers surveyed consider the reduction of trade barriers for recycled plastics among member economies a critical priority to enhance their business prospects.

4.2.2 Recycling Technology

Error! Reference source not found. depicts the technologies for recycled plastics permitted across the supply chain, spanning from the authority-approved levels at the economy level to resin manufacturers and subsequently to the packaging industry, based on the survey of APEC economies. Approximately one-third (four of fourteen) of these economies authorize biological recycling for processing food-grade recycled plastics. Biological recycling is a method of plastic waste management that specifically refers to the process of using living organisms (primarily microorganisms or enzymes) to break down plastic materials and convert them into useful products. However, neither resin manufacturers nor packaging industries have yet implemented this technology. Additionally, 57% (four of seven) of resin manufacturers and both two responding packaging industries cite technical challenges in purification as a significant barrier to practical recycling. This suggests that biological recycling could emerge as a promising future trend of technology within APEC economies.

4.2.3 Authorization Process

Table 4 **Authorization requirements for recycled plastics intended for food contact in selected APEC economies**

Economies	Challenge test required?	On site Inspection?	U.S. FDA or EFSA Authorization approved?	Variation on different Technologies?	Periodic reviews
CDA	Yes	No	No	Yes	No
PRC	No information	No	No information	No information	No information
INA	No information	No information	No	Yes	No information
MAS	No information	No information	No information	No information	No information
PNG	No information	No	No information	No information	No
PE	No	No	No information	No	No
THA	Yes	No	No	Yes	No
USA	No, but recommended	No	Yes, provided the material complies with applicable food contact regulations.	No	No
VN	No information	No information	No information	No information	No information

presents the authorization requirements for recycled plastics intended for food contact across nine selected APEC economies. Notably, none of these economies mandate on-site inspections or periodic reviews, indicating a relatively lenient regulatory approach. Canada imposes the most stringent requirements, incorporating mandatory challenge tests and distinct evaluation procedures tailored to different technologies. A key observation from the authorization process is the substantial lack of information, with approximately half of the questions remaining

unanswered. This is compounded by survey findings, where half of the resin producers (three of six) identify the complexity of the regulatory approval process as a significant barrier to the application of recycled plastics intended for food contact. Surprisingly, only the United States recognizes U.S. FDA or EFSA authorization, despite the fact that advanced APEC member economies such as Japan; Korea; and Chinese Taipei, known for their sophisticated applications of food-contact recycled plastics, also acknowledge the standards of U.S. FDA or EFSA authorization based on available knowledge. Consequently, establishing harmonized evaluation standards for recycled plastics across APEC economies is advisable, a proposal supported by 83% (five of six) of the responding resin manufacturers.

4.3 Recycled Plastic Market

4.3.1 Capacity

(2)

(1) presents the food-grade recycled plastic capacity by type in selected APEC economies, as reported through the survey, totaling 55.1 tonnes per year. In contrast, (2)

(2) illustrates the global production capacity of food-grade recycled plastics reported by ISCC [5], with rPET alone accounting for approximately 4 million tonnes annually, alongside minimal capacities for rPE and rPP (each less than 1 million tonnes). Although the survey data reflects only a small fraction of the total resin production capacity in these economies, it still highlights a substantial gap between APEC and global capacities, particularly for rPET used in food-contact applications.

4.3.2 Plastic Content

Figure 4 **The capacity of food-grade plastic: (1) in APEC member economies, reported from the data collected in questionnaire; and (2) worldwide, reported by**

ISCC

Table 5 Percentage of recycled plastic content in the resin or packaging in responding companies presents the percentage of recycled plastic content in the supply chain, spanning resin producers, packaging producers, and food companies in responding APEC economies. Results indicate that food companies, such as the one in Malaysia, demand 100% recycled plastic content in their packaging, reflecting stringent sustainability requirements. Resin manufacturers also demonstrate the capability to produce polymers with high recycled content (90%-100%) alongside. However, packaging producers incorporate significantly lower recycled content (10%-30%), which creates inconsistencies in the supply chain, hindering the adoption of food-grade recycled plastics. The data based on the questionnaire reveals significant disparities in recycled content usage across these stages, highlighting challenges in achieving a consistent and sustainable supply chain for food-grade recycled plastics.

4.4 Motivation and Concern

4.4.1 Financial

Food-grade recycled plastic, such as rPET, is often more expensive than virgin plastic due to the costs of collection, sorting, and ensuring food safety compliance. In early 2025, rPET prices in the U.S. were around USD 1,213 per tonne in March, while in China, they were lower at USD 822 per tonne [6]. Virgin PET prices are generally lower in Southeast Asia than in North America, suggesting a price gap that varies by region and market dynamics. From the data collected in the survey, most companies in the supply chain view cost as a major barrier to adopting recycled plastics for food contact, with half of the resin producers urgently advocating for tax incentives or subsidies, shown in **Error! Reference source not found.** Addressing these economic challenges through targeted financial support, recycling system improvement and regulatory

harmonization is crucial to enhance the adoption of food-grade recycled plastics, supporting sustainability goals across APEC economies.

4.4.2 Safety

Safety is a critical focus when utilizing recycled plastics for food-contact applications, with differing viewpoints across the supply chain. According to **Error! Reference source not found.** both two packaging producers who responded to the survey identify safety concerns as a primary obstacle, largely due to risk assessments conducted during production. In contrast, food companies, as the ultimate consumers of packaging with recycled plastic content, hold a differing perspective, with 70% (seven out of ten) not considering safety a significant barrier. This difference is further highlighted by survey data showing that 80% of food companies view regulatory gaps as a major challenge to adopting food-grade recycled plastics, suggesting that while end users and the public are increasingly open to such packaging, governments and regulatory bodies across APEC member economies tend to be more conservative on this subject.

5. Recommendation

The survey has studied regulations, standards and best practices related to recycling plastics for food contact materials among APEC economies. Here are the recommendations based on the information collected from questionnaires:

1) Regulatory gaps have emerged as the most significant barrier to the adoption of recycled plastics for food-contact applications, a concern unanimously raised by all members of the supply chain. Developed economies, such as Canada and the United States, have implemented advanced regulations, as well as deposit systems and EPR requirements, primarily at the local level. However, this decentralized approach can pose challenges in current practical, which is not ideal for developing economies, making such systems may be impractical.

A more effective solution would be the establishment of economy-wide regulations for those economies who have not yet authorized the use of recycled plastics in food packaging or, ideally, a unified APEC-wide regulatory framework to address these disparities.

2) The limitation on material sources for recycled plastics intended for food-contact applications represents another significant gap. Data indicates that both resin producers and the packaging industry consider domestic purchasing a vital source of recycled plastic; however, this practice is not permitted by any of the nine surveyed APEC economies. Additionally, the high cost of raw material collection is widely recognized as a key factor driving the elevated price of recycled plastics, such as rPET. To address these issues, it is recommended to permit domestic purchasing and facilitate bulk imports, while considering appropriate adjustments to tariff rates, to reduce trade barriers among member economies, thereby enhancing the availability and affordability of recycled materials.

3) The absence of a standardized authorization process is identified as the third major gap in the adoption of recycled plastics intended for food-contact applications. The U.S. FDA and EFSA authorizations, widely regarded as two of the most reputable evaluation systems, are recognized only by the United States in the nine responding economies, which is contrary to expectations. To address this discrepancy, it is recommended to develop harmonized evaluation standards for recycled plastics across APEC member economies, a proposal strongly supported by the majority of surveyed resin producers.

4) Biological recycling is embraced by one-third of the surveyed APEC economies; however, none of the responding resin producers or packaging industries have implemented this technology. Therefore, it is recommended to promote enhanced technical exchange among member economies.

5) It is recommended that governments and regulatory bodies across APEC member economies adopt a more open stance toward food packaging containing recycled plastic content, provided it is supported by thorough risk assessments. This shift is warranted given that the public and end users exhibit greater acceptance of safety concerns than initially anticipated.

6. Conclusion

The project seeks to advance closed-loop plastic recycling, with a particular focus on food-contact packaging, to reduce plastic debris pollution in marine environments. Analysis of the questionnaire data highlights regulatory gaps, restrictions on material sources, and the absence of a standardized authorization process as primary obstacles to the adoption of recycled plastics in food packaging applications. Additionally, enhancing technical communication, boosting capacity development, and raising public awareness are recommended strategies. Moving forward, the project plans to organize forums and seminars to further advance these initiatives.

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