

Report of Expert Committee

To examine “*whether any further regulatory provisions are required on the subject of restrictions on the packaging by use of plastic material, after the steps already taken and if so to what extent*”

(constituted as per NGT Order passed in O.A. No. 15/2014 dated 31/5/19)

Submitted to

Hon’ble National Green Tribunal

Date: 30th August, 2019

REPORT OF THE EXPERT COMMITTEE ON NGT ORDER IN HIMJAGRITI CASE

Background

1. Vide order number O.A. No. 15/2014 dated 31.05.2019 in the “*Himjagriti Uttaranchal Welfare Society*” case, Hon’ble National Green Tribunal (NGT) constituted an Expert Committee (hereafter called EC) to examine “*whether any further regulatory provisions are required on the subject of restrictions on the packaging by use of plastic material, after the steps already taken and if so to what extent*”. As per the order, the EC would comprise of the representatives of Bureau of Indian Standards (BIS), Central Pollution Control Board (CPCB) and Directorate General of Health Services (DGHS) with Food Safety & Standards Authority of India (FSSAI) as the nodal agency for coordination.

Meeting and consultations

2. Taking the lead, FSSAI organized a series of meetings, inviting other stakeholders technical institutes, prominent NGOs working in the field of environment and plastics, other government bodies, businesses and companies involved in manufacturing and use of plastics in packaging of foods, beverages and other items. Meetings and discussions were held as under -

- 1) Expert committee meeting on 28th June, 2019.
- 2) Expert committee meeting with industry associations on 28th June, 2019.
- 3) Consultation with NGOs and other Social Groups on 12th July, 2019.
- 4) Consultation with Indian Beverage Association on 8th August, 2019.
- 5) Expert committee meeting with technical institutes and experts on 20th August, 2019.
- 6) Expert committee meeting with co-opted members on 21st August, 2019.

List of participants in each meeting is at Annex-1.

3. During its deliberation, the EC noted that food and beverages, drugs and cosmetics and textiles are major items of mass consumption that use plastic packaging. The EC considered the following laws, rules and regulations currently in force on the issue of use of plastics, in addition to scientific literatures available on the subject:

- 1) Food Safety and Standards (Packaging) Regulations, 2018

- 2) Plastic Waste Management Rules, 2016.
- 3) BIS Standard; IS: 14534 Guidelines for Recycling of Plastics and IS: 12252 Polyalkylene Terephthalates (PET and PBT), Their Copolymers and List of Constituents in Raw Materials and End Products for their Safe Use in Contact with Foodstuffs and Pharmaceuticals (First Revision)
- 4) Legal Metrology (Packaged Commodities) Rules 2011.

Key Areas of Concern

4. The EC in its deliberation was of the firm opinion that excessive use of plastics, especially in the packaging of non-essential products is a matter of concern. The main focus of EC was to identify areas where the use of plastics may be reduced or other environment friendly packaging could be used. In order to make its recommendations on regulatory provisions, the EC decided to look at the entire gamut of issues and concerns related to plastic use in packaging and possible actions that various stakeholders could take. Seven major areas of concern as under were identified:

- 1) Continued use of multi polymer plastic (MPP) or multi layered plastic (MLP) with associated difficulties in its recycling.
- 2) Increasing use of small packages such as bottles used for beverages, sachets, pouches which are not viable to collect and recycle.
- 3) High capital cost involved in the presently available techniques in recycling plastics.
- 4) Inadequate reach of Extended Producer Responsibility (EPR).
- 5) Non availability of economically viable substitutes to the plastics.
- 6) Lack of consumer awareness for proper disposal of plastics and litter management.
- 7) Absence of joint regulatory mechanism with respect to plastic waste management.

Systematic Plan of Action

5. In order to address the above concerns, the EC proposes the following systematic plan of action with 12 specific points by different stakeholders.

(A) Manufacturer / User Industries of Plastic Packaging Materials

(1) *Institute concept of 'plastic footprint':* What gets measured is managed. Therefore, in order to encourage businesses to reduce use of plastics through innovation and redesigning of their packaging, a system of quantifying the use of plastics per unit of final product (say kg of plastic used in 1000 kg/kiloliter of final product) may be put in place. A deflator or inflator may be used for use of recyclable plastics, biodegradable/compostable plastics or multilayered plastic as the case may be. A system of periodic assessments of plastic footprint for each product category may be done. In food and beverages, these categories could include confectionery and bakery products (biscuits, ice-creams, bakery products and chewing gum), namkeens (chips, namkeen, nuts/peanuts), instant noodles and cereals, beverages (cold drinks, juices, energy drinks and hot drinks) and dairy products (milk, paneer, yoghurt and flavoured milk). Plastic footprint for each category may be benchmarked with the market average of use of plastic. This would encourage companies to adopt packaging reduction strategies that may include reducing weight of packaging, eliminating unnecessary packaging, using lightweight packaging materials, optimizing packaging size and use of recyclable (compostable) and reusable packaging material. Through a system of recognition, rewards and perhaps eventually penalties, it is hoped that the companies would work towards continuous reduction of plastics, product by product and enable businesses to demonstrate their commitment to safer environment.

(2) *Discourage small pack sizes:* Lighter, portable, and cost-effective nature of single serve sachets/pouches/bottles continues to make them an attractive proposition for the low-income consumers as well as young and active millennials. Smaller pack sizes/single serve packaging also have brought better quality and premium products affordable to all the sections of the society. But on the other hand it constitutes to the major plastic waste and litter, as their collection is economically non-viable. Hence, in consultation with Legal Metrology Dept. the small pack sizes such as small water bottles, pouches, cups which constitute a considerable amount of plastic waste may not be allowed.

(3) *Reducing plastic content in multi-layered plastic (MLP):* Ideal packaging materials had been tailored by combining different material with customized functionality

to sufficiently protect sensitive food products and thus obtain extended shelf life. Latest feasible techniques and technologies may be employed to cut down the use of multiple polymers/plastics. More research in this area is required to be done by scientific institutions. Use of Single polymer/layer recyclable packaging materials shall be encouraged in this case.

(4) *Encourage alternatives to plastics:* Bio-plastics and biodegradable plastics like Poly Lactic Acid (PLA) made from fermented plant starch etc. can be a sustainable alternative to conventional plastics. However there are limitations with the availability of resources for such material. More research in the area to reduce the cost of PLA is required to be done. There is also need to create awareness on biodegradable, compostable or bio-based plastics since their degradation requires conditions like appropriate temperature, light, hydration and/or microbial presence. Hence these have to be separately marked and disaggregated. In case, the biodegradable & compostable or bio-based plastics remain unsegregated and go in landfills just like that, it is unlikely to meet these conditions and serves no purpose. Existing packaging systems of paper based cartons with minimal plastics as coatings, composite and reusable containers made up of glass, tin, metal and paper maybe promoted as replacements. A list of alternatives to plastic packaging materials as suggested by Centre for Science and Environment (CSE) is at Annexure-2.

(5) *Effective Extended Producer's Responsibility (EPR) framework:* The current Plastic Waste Management Rules mandate the "producer of packaging products and branded consumer goods to dispose plastic packaging waste generated due to their business activities". Even though the policy framed under these rules is fairly good but it has been confined to selected few big businesses. It is understood that National Framework on EPR for plastic waste management is being finalized. The framework may consider a system of monitoring as well as penalty provision for its non-compliance may be explored. The companies may be encouraged to use their downstream supply chain of distribution and retail for collection and aggregation of plastics for recycling. This may be quite easy in direct selling entities that use multi-layered marketing, distribution networks.

(B) Final consumers/Users of plastic packaged articles and food stuff

Establishments, agencies, institutions, organizations including government/non-government, food/non-food operators such as roadways, railways, airlines, schools, colleges and university campuses, E-commerce groups, corporate campuses, hotels, marriage, banquet and community halls under this head shall take-up responsibilities on the following;

- (6) *Eliminate/Ban single use plastics*: should eliminate and prohibit the usage of single serve/use plastics within their ecosystems. Recent ban by the Parliament and Indian railways are worth emulating.
- (7) *Alternatives to plastics*: They shall encourage the use of reusable and recyclable environment friendly alternatives such as jute and cloth bags, bamboo and wooden cutlery, leaf based plates, glass and metal containers etc.
- (8) *Improved Litter Management*: They should take up the responsibility of collecting all the waste in their campuses, sorting out dry and wet waste. They could also encourage their staff, teachers and students to bring such plastic waste from homes and help in collection and aggregation of such waste by tying up with businesses in plastic recycling. Dry waste can be segregated into recyclable and non-recyclable and accordingly processed. Wet waste may be sent to composting, which can be done in-house. This activity could be made a part of the social responsibility system.
- (9) *Better Plastic Disposal*: Initiatives are to be taken up, to dispose plastic waste by forming groups/clusters to set up/identify energy recovering systems such as incineration and pyrolysis. Getting adequate quantities of suitable plastics waste is seen as most important factor in success of such units. More organized efforts and encouragement is required for this proper disposal.

(C) Municipal bodies/other organizations promoting circular economy

- (10) All municipal bodies must be made responsible for development and setting up of infrastructure for segregation, collection, storage, transportation, processing and disposal of the plastic waste either on its own or by engaging agencies or producers as mentioned in the Plastic Waste Management Rules.

(D) Citizens and consumers

- (11) Citizens, especially the socially engaged ones living in urban areas with wide access to information, have adopted more environmentally conscious consumption habits oriented toward recycling, reusing and composting the waste that derives from their domestic consumption. This segment of socially discerned consumers, appreciate brands that demonstrate a commitment to environmental sustainability. A more intensive public campaign, however, is needed to mainstream this kind of behavioral change to a wider public segment. Further approach of incentivising the customers can also be explored to encourage them for plastic waste management.

(E) Science and Research Institution

- (12) Science and research institutions must be encouraged for working in the direction of developing environmental friendly packaging materials and plastic waste management systems which can be used on commercial basis. Start-ups may also be encouraged to work in this area. For the food and beverages sector, FSSAI may create a group of institutions and experts to coordinate new work in this area with leading institutions like the Indian Institute of Packaging, CIPET, IIT Delhi, IIT Guwahati, Indian Institute of Toxicological Research (IITR), National Chemical Laboratory, Pune and others.

Regulatory Action

6. In the backdrop of the action points for different stakeholders listed above, the EC noted that issues of packaging are more critical in food, beverages and medicines. There are not only environmental issues but also public health issues. There are concerns about increasing shelf-life and reducing food waste by providing more effective packaging solutions for food and beverages. In this regard, FSSAI has recently initiated several steps to reduce the use of plastics in packaging of food and beverages and make it safer. These are as under:

- (1) FSSAI has decided to permit use of liquid nitrogen dosing in PET bottles during the packaging of drinking water. This would help in strengthening the bottle thereby facilitating the manufacture with the use of bottles with lower wall thickness.

- (2) FSSAI has initiated the process of removing the restriction on the use of returnable bottles for packaging of artificially sweetened beverages.
- (3) FSSAI is promoting the use of bamboo as an alternative to plastics such as straws, plates, bowls, cutlery etc.
- (4) Allow and enable hotels to keep in-house packed glass bottles in place of plastic bottles in hotel rooms.

7. As its commitment towards food safety and better environment, the FSSAI is establishing a separate '*Scientific Panel on Packaging and Food Contact Materials*'. In the context of ban on single use plastics, the Expert committee noted that many state governments have imposed a ban on single use plastic. There are however differences in approach and definition. It is understood that the Department of Chemicals and Petrochemicals has formed a Committee to define single use plastic. This committee is expected to submit its report soon and same could be implemented nation-wide. Finally, the Experts Committee made the following four specific recommendations on regulatory aspects on use of plastics.

- (1) Food Safety and Standards (Packaging) Regulations, 2018: To review the limits of heavy metals in PET and fix the limits of specific migration limits of Antimony and DEHP (Diethylhexyl-phthalate). In addition to this also explore the possibility of setting limits for Cadmium and chromium.
- (2) Food Safety and Standards (Packaging) Regulations, 2018 and IS 14543 (Packaged Drinking water): To remove the restriction on the use non-transparent bottle for drinking water to enable businesses to explore the possibilities of use of alternatives other than the PET currently in use.
- (3) Food Safety and Standards (Packaging) Regulations, 2018; IS 14534 (Guidelines for Recycling of Plastics); and Plastic Waste Management Rules, 2016: The European Food Safety Authority (EFSA) permits the use of recycled PET in food packaging under certain set protocols. EC recommends to explore the possibilities for removal of ban on use of recycled plastic in food packaging after a scientifically validated method of pre-cleaning of plastic waste is developed to ensure that the final product using recycled material does not pose any health risk.
- (4) Legal Metrology (Packaged Commodities) Rules 2011: To explore the possibilities of restricting small packs of commodities such as water, shampoo, sauce, pickle etc.

Review and Monitoring

8. The Expert Committee noted that while regulatory provisions for restrictions on the packaging by use of plastic material are mostly in place, there is lack of coordinated approach and implementation of these provisions is poor. It suggested putting in place sector-specific mechanisms to review and monitor the use of plastics in packaging and commitment of businesses under '*Extended Producer Responsibility (EPR)*' framework, managing plastic footprints, and related issues. In this, sector-specific regulators such as FSSAI (for food and beverage packaging), CDSCO (for drugs and cosmetics packaging), Ministry of Textile (for textile packaging) etc. and the Central Pollution Control Board (CPCB) could work together to ensure better coordination. Related ministries and the Ministry of Housing and Urban Affairs and Department of Drinking Water and Sanitation could also be associated for better coordination with Swachh Bharat Mission.

Annexure 1: List of Participants

I. Expert Committee meeting on 28.06.2019

1. Sh. Pawan Agarwal, CEO, FSSAI
2. Sh. V K Diundi, Scientist-F & Head(PCD), Bureau of Indian Standards (BIS)
3. Sh. Vijay Kumar Gupta, Scientist-C(PCD), Bureau of Indian Standards (BIS)
4. Dr. Pradeep Saxena, Addl DDG (PS), Director General of Health Services (DGHS)
5. Sh. Pankaj Agarwal, Scientist-E, Central Pollution Control Board (CPCB)
6. Professor Alok Dhawan, Director, CSIR-IITR
7. Dr. N. Bhaskar, Advisor(QA),FSSAI
8. Dr. A. C. Mishra, Joint Director(Standards), FSSAI
9. Ms. Manpreet Kour, Technical Officer(Standards), FSSAI

II. Expert Committee meeting with Industry stakeholders held on 28.06.2019

Expert Committee Members:

1. Sh. Pawan Agarwal, CEO, FSSAI- Chair
2. Sh. Shri V K Diundi, Scientist-F & Head(PCD), Bureau of Indian Standards (BIS)
3. Sh. Vijay Kumar Gupta, Scientist-C(PCD), Bureau of Indian Standards (BIS)
4. Dr. Pradeep Saxena, Addl DDG (PS), Director General of Health Services (DGHS)
5. Sh. Pankaj Agarwal, Scientist-E, Central Pollution Control Board (CPCB)
6. Professor Alok Dhawan, Director, CSIR-IITR

FSSAI Secretariat:

1. Dr. N. Bhaskar, Advisor(QA)
2. Dr. A. C. Mishra, Joint Director(Standards)
3. Ms. Manpreet Kour, Technical Officer(Standards)

Industry Representatives:

1. Ms. Parna Dasgupta- Kellogg's
2. Ms. Garima Singh- Mondelez
3. Ms. Monika Rawat, Zydus Wellness Products Limited
4. Ms. Tulika Shukla- Nestle India
5. Ms. Sangeeta Chadha- HUL
6. Ms. Priyanka Gupta- FICCI
7. Sh. D. V. Malhan, AIFPA
8. Sh. Satansh Kumar, AIFPA
9. Ms. Neha Agarwal,CII
10. Sh. Virender Landge, CII-FACE
11. Sh. Kalyan Vadlamani, CII
12. Ms. Priyanka Yadav, CII
13. Sh. Kumar Kalpam, Mother Dairy
14. Ms. Kajal Debnath, Mother Dairy
15. Dr. P. Jose David, Tata Global Beverages Ltd.
16. Sh. K. KalyanaRaman, Tata Global Beverages Ltd.

17. Dr. Aman Gupta, Yum Foods
18. Ms. Trapta Rastogi, Jubilant Food Works Ltd.
19. Sh. Sumit Chugh, Tata Starbucks Pvt. Ltd.
20. Sh. R. Boobalan, ITC Limited
21. Sh. R. Varadharajan, ITC Limited
22. Dr. M. Chakraborty, ITC Limited
23. Sh. Kalyan Chatterjee, ITC Limited
24. Sh. Adip Roy, Amway India Enterprises
25. Ms. Minakshi, Abbott
26. Ms. Manisha Singh, Abbott
27. Sh. Pratim Bralmelin, Flipkart
28. Sh. Kaushik Saha, Pepsico
29. Sh. Ramesh Ramachandran, Pepsico
30. Ms. Antara Kapoor, Pepsico
31. Sh. Himanshu Gupta, PCMA
32. Sh. R K Gera, PCMA
33. Dr. Vijay Habbu, PACE
34. Sh. Bharat B Mehta ,PACE
35. Sh. Prabhakar Mishra, Prefetti Van Melle India Pvt Ltd
36. Sh. Abhinav Srivastava, Amway India Enterprises

III. Consultation with NGOs and other Social Groups on 12.07.2019

Stakeholders:

1. Dr. Praveen Aggarwal, Action Alliance for Recycling Beverage Cartons
2. Sh. Maanik Bagai, Action Alliance for Recycling Beverage Cartons
3. Sh. Amit Khurana, Centre for Science & Environment
4. Ms. Swati Singh Sambyal, Centre for Science & Environment
5. Ms. Sharon Mathew, Him Jagriti Uttaranchal Welfare Society
6. Dr. R.K. Singh, Him Jagriti Uttaranchal Welfare Society
7. Mr. Akshaya Dhaundiyal, Him Jagriti Uttaranchal Welfare Society
8. Ms. Sonia Garga, Saahas
9. Ms. Nimisha Jha, Saahas

FSSAI Secretariat:

1. Sh. Pawan Agarwal, CEO
2. Sh. Kumar Anil, Advisor (Standards)
3. Dr. A. C. Mishra, Joint Director (Standards)
4. Ms. Manpreet Kour, Technical Officer (Standards)
5. Ms. Dilmeet Kaur, Intern
6. Ms. Akanksha Jain, Intern

IV. Consultation with Indian Beverage Association on 08.08.2019

IBA Representatives:

1. Sh. Arvind Verma
2. Sh. Chandramohan Gupta

3. Sh. Ish Kumar Bhatia
4. Sh. Jaideep Gokhale
5. Sh. Sharad Sharma
6. Sh. Hitesh Gangrade
7. Sh. Byas Anand
8. Sh. Priyank Arya
9. Ms. Juhi Gupta
10. Sh. Bharat B Mehta
11. Dr. V G Habbu
12. Sh. Pankaj Uppal

FSSAI Secretariat:

1. Sh. Pawan Agarwal, CEO, FSSAI- Chair
2. Sh. Kumar Anil, Advisor (Standards)
3. Dr. A. C. Mishra, Joint Director (Standards)
4. Sh. Harish R K, Assistant Director(Standards)
5. Ms. Manpreet Kour, Technical Officer (Standards)

V. Expert Committee meeting with technical institutes and experts on 20.08.2019

Expert Committee Members:

1. Sh. Pawan Agarwal, CEO, FSSAI- Chair
2. Sh. Shri V K Diundi, Scientist-F & Head(PCD), Bureau of Indian Standards (BIS)
3. Sh. Vijay Kumar Gupta, Scientist-C(PCD), Bureau of Indian Standards (BIS)
4. Dr. Pradeep Saxena, Addl DDG (PS), Director General of Health Services (DGHS)

Stakeholders:

1. Dr. Aswani Kumar Mohapatra, CIPET
2. Prof. Vimal Katiyar, IIT Guwahati
3. Sh. M Chakraborty, IIP
4. Dr. Surendra Pratap, Petroleum Conservation Research Association
5. Sh. Pradeep Tyle, Pradeep Tyle & Associates
6. Sh. Girish Behal, Ester Industries Limited
7. Sh. Jaideep Gokhale, TetraPak
8. Sh. Navdeep Mehram, TetraPak
9. Sh. Bobby Johnson, TetraPak

VI. Expert Committee meeting with co-opted members on 21.08.2019

Expert Committee Members:

1. Sh. Pawan Agarwal, CEO, FSSAI
2. Sh. Vijay Kumar Gupta, Scientist-C(PCD), Bureau of Indian Standards (BIS)
3. Dr. Pradeep Saxena, Addl DDG (PS), Director General of Health Services (DGHS)
4. Sh. Pankaj Agarwal, Scientist-E, Central Pollution Control Board (CPCB)
5. Prof. Alok Dhawan, Director, CSIR-IITR
6. Sh. Anand Kishor, Assistant Professor, NIFTEM, Ministry of Food Processing Industries

7. Sh. Avnish Tomar, Assistant Director (Packaging), CIB & RC in Directorate of Plant Protection Quarantine & Storage, Ministry of Agriculture & Farmers Welfare
8. Sh. Sanjeev Kumar, DDC(I), CDSCO
9. Dr. Aswini Kumar Mohapatra, CIPET

FSSAI Secretariat:

6. Sh. Kumar Anil, Advisor (Standards)
7. Dr. A. C. Mishra, Joint Director (Standards)
8. Sh. Harish R K, Assistant Director(Standards)
9. Ms. Manpreet Kour, Technical Officer (Standards)

Annexure 2: Alternatives to Plastic Food Packaging

Alternatives/Case Studies	Composition	Usage
<p>Plant-based plastics – Bioplastics</p> <p>A firm called <u>Innocent</u> (London) is making bottles from 15per cent PLA which is used for food packaging.</p> <p>Source:https://bit.ly/2yRpSsO; https://bit.ly/32ryC3m; https://bit.ly/2XYKY3N</p> <p><i>Indian Initiatives:</i></p> <ul style="list-style-type: none"> • <u>Bakeys Foods Pvt. Ltd.</u>, a firm that has been manufacturing spoons made from rice, millet and wheat since 2011. <p>Source:https://bit.ly/2xUDyzE https://bit.ly/2JTsYyK</p> <ul style="list-style-type: none"> • <u>PAPPCO</u>: is a start-up based in Mumbai which uses plant materials to manufacture disposable cutlery. The PAPPCO greenware is mainly sold through retail stores such as Star Bazaar, Reliance, and Nature’s Basket all over India, and through restaurant chains. <p>Source: https://www.pappcoindia.com/</p> <ul style="list-style-type: none"> • <u>Evirocor Packaging India Pvt. Ltd.</u> <p>Source: https://bit.ly/2O3H1a3</p> <ul style="list-style-type: none"> • <u>Cosmos Eco Friends</u> • Source:http://cosmosecofriends.com/ 	<p>Waste products like corn, rice; sugar feed stocks; cassava; potato etc., which is broken down into biodegradable component called Polylactic Acid (PLA).</p> <p>Rice / Millet / Wheat</p> <p>Sugarcane + Bamboo + Wheat Straw</p>	<p>PLA are used to make drinks bottles; various food grade containers; films</p> <p>Edible Spoons</p> <p>Disposable Cutleries, paper straws, dim-sum baskets, cones</p> <p>Pizza Boxes, Meal Boxes, Packaging Cups, Curry Boxes, Divider Packaging Box, Container Packaging Box</p> <p>Plates, bowls, lunch trays, food containers, clam shells, cutlery, hot/cold cups</p>

<p>PLA films with different plasticizing agents (glycerol; tributyl citrate; epoxized palm etc.) with corona treatment to PLA</p> <p>Source:https://bit.ly/2XYhkYo; https://bit.ly/2JKau3r</p>	<p>PLA + Plasticizing Agents</p>	<p>Flexible films for food packaging; bottled water and juices; extruded packages; cups; lunch boxes</p>
<p>PLA with biopolymer (viz., PLA + Poly (butylene succinate-co-adipate) PBSA has high tensile strength).</p> <p>Source:https://bit.ly/2XYhkYo; https://bit.ly/2JKau3r</p>	<p>PLA + Cellulose Nanocrystals + 15 per cent Acetyl (tributylcitrate)</p>	<p>Flexible films for food packaging; bottled water and juices; extruded packages; cups; lunch boxes</p>
<p>Stone paper packaging</p> <p>Source:https://bit.ly/2xMF3Qj</p>	<p>Calcium Carbonate</p>	<p>Takeaway food cartons; beverage pouches; greaseproof paper wraps; food grade packaging</p>
<p>Palm leaves</p> <p>A Berlin start-up 'Arekapak' is presently using it for food packaging purposes.</p> <p>Source: https://arekapak.de/</p> <p><u>Indian Initiatives:</u></p> <ul style="list-style-type: none"> • <i>Kamla Natural Plates (Assam)</i> Source:https://bit.ly/2SoilaS • <i>Somani(Hyderabad)</i> Source:https://bit.ly/2Y94Tgm 	<p>Natural waste product of the areca palm leaves</p>	<p>Packaging for food such as fresh fruit, vegetables and nuts</p>
<p>Edible six-pack ring (E6PR)</p> <p>An American brewery store - Saltwater – is the first store to develop and use this product in Florida</p> <p>Source: https://bit.ly/30yhVkX; https://bit.ly/2XLSGim</p>	<p>Barley and Wheat remnants</p>	<p>Brewery cans</p>
<p>Seaweed water bubbles</p> <p>UK startup 'Ooho' has conceptualized and are presently using this product. The process produces 5x less CO₂ and uses 9x less Energy vs PET production.</p> <p>Source: https://bit.ly/2Y5Ma5i</p>	<p>Seaweeds + Plants</p>	<p>Flexible packaging for beverages and sauces for on the go consumption</p>

<p><u>Indian Initiatives:</u></p> <p>Workbench Projects: a Bengaluru-based startup together with ‘Ooho’ are making edible sachets to replace plastic bottles.</p> <p>Source:https://bit.ly/2Vi9FaU</p>		
<p>Microbial polyesters (PHAs) viz., Polyhydroxy Alkanoates (PHA) and copolymer Polyhydroxy (butyrate-co-valerate) - P(HB-co-HV) - and fibers (wheat straws/brewing grains/olive pomace etc.)</p> <p>Source: https://bit.ly/2YQGPMi; https://bit.ly/30DNA4r;</p>	<p>Microbial polyesters + PH-co-HV + Fibers</p>	<p>Lids; disposable food containers; plates and cups food delivery and food services; vegetable storage</p>
<p>PLA mixed with P(HB-co-HV) (3-hydroxybutyrate-co-3-hydroxyvalerate)</p> <p>Source:https://bit.ly/30DNA4r</p>	<p>P(HB-HV) + PLA</p>	<p>Lids; disposable food containers; plates and cups food delivery and food services</p>
<p>Bioplastic made from Prickly Pear Cactus</p> <p>Source:https://bit.ly/2XT8ATl; https://bbc.in/2It2xix</p>	<p>Cactus Juice + Non-toxic Additives</p>	<p>Disposable food boxes, containers; cups and cutlery</p>
<p>Milk Plastic made from milk protein (casein). ‘Lactips’ a French based company uses biosourced material (milk protein) as a packaging material for food & beverage industries.</p> <p>Source:https://bit.ly/2JPHAkI</p>	<p>Milk Protein + Clay + Reactive Molecule (glyceraldehyde)</p>	<p>Bioplastic films; cups and cutlery</p>
<p>Wood Pulp Cellophane is made from wood pulp and is FSC (Forest Stewardship Council) certified. NatureFlex, a California based start-up, uses films that are made from cellulose.</p> <p>Source:https://bit.ly/2JMja9F https://bit.ly/2XPqhaX</p>	<p>Wood Pulp</p>	<p>Cellophane can be used in chocolate and confectionery; fresh produce and dairy; and barrier for bakery, snacks, coffee, tea, chocolate as well as home and personal care items</p>