Update on the Plastic Aerosols … where are we?

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Definition of Aerosols

- GHS - Chapter 2.3
  Aerosols, this means aerosol dispensers, are any non-refillable receptacles made of metal, glass or plastics and containing a gas compressed , liquefied or dissolved under pressure with or without a liquid, paste or powder, and fitted with release device allowing the contents to be ejected as solid or liquid particles in suspension, in a gas, as a foam, paste or powder in a liquid state or in a gaseous state. (this includes the current definition in ADR)

- Any synthetic material is possible?
  Limits for plastic aerosols?

Plastic Aerosols – History

- 1951-1955: First non-metallic aerosols made of uncoated glass

  Initially same ‘criteria’ for metal and plastic
  – restrictions came later related to glass, e.g. 4 fl.oz. =118 ml in US, 100 ml in Japan, 150 ml/220ml in Europe etc. - additionally pressure limits

- 1956: 19 ml (bakelite)
- 1958-1980: different types of opaque plastics in small sizes (Nylon, PP etc.)
- 1975: European Aerosol Dispensers Directive with rules for plastic containers
- 1980-1990: transparent and opacified PET cans developed
- 1991: British Standard on Plastic Aerosols
- 1997: Cans made of PEN and PET/PEN developed
- 1999-today: Efforts to change/amend regulations concerning plastic aerosols
  Target: equal brimful volumes (and pressure limits) for all can material types

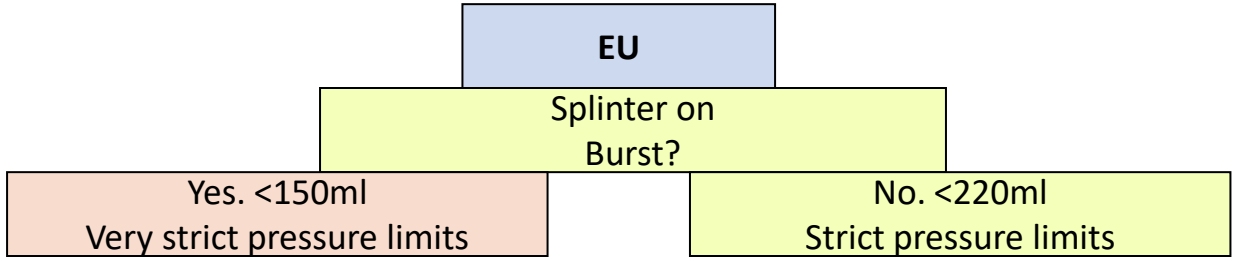
Legal Considerations

- British Standard BS 5597:1991
  - In the past several exemptions in US and Canada based on BS 5597:1991
  - Key message:
    Plastic aerosol cans fulfilling the same requirements (and some more) can have the same maximum brimful volume as metal cans (1000 ml) and can be filled the same way as metal cans (maximum pressures of 13.5 bar at 55°C, adapted in US 160 psig at 130°F and Canada 1105 kPa =11.03 bar at 55°C)
- Basic reference for all amendments of standards in the US, Canada over the years
- In EU, however, everything is different!

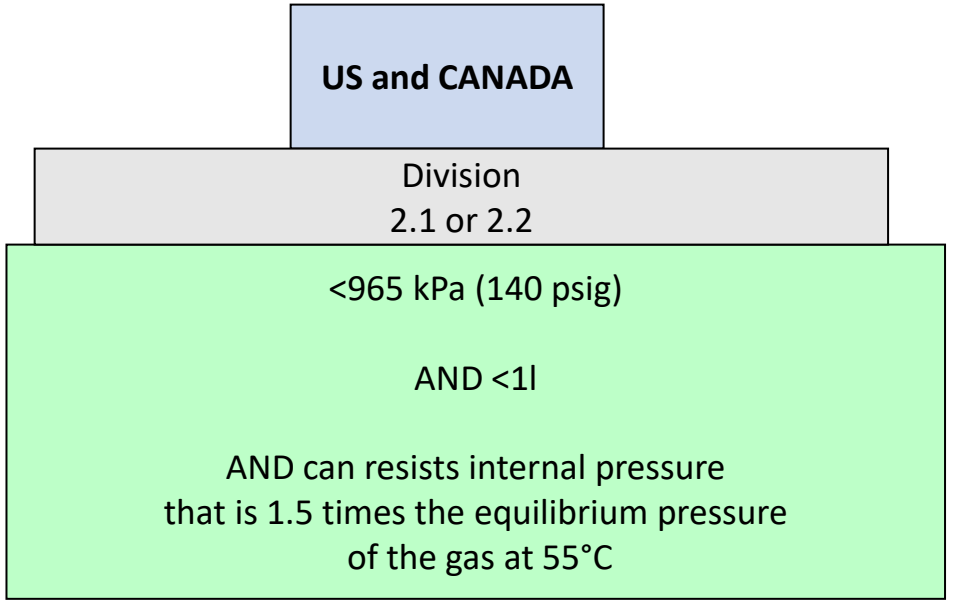
Legal Considerations

- Restricted to selected synthetic materials?
  - ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road)
    - Plastic aerosol cans can be made of any plastic/synthetic material
    - Brimful volume up to 500 ml
    - Max. pressure 1.32 MPa at 50°C
    - *Other references*
      - *International Maritime Dangerous Goods Code (IMDG Code)*
      - *Regulations concerning the International Carriage of Dangerous Goods by Rail* (RID)
    - Full acceptance of EU-Aersol Dispensers Directive
  - ICAO (International Civil Aviation Organization)
    - Plastic is only PET, PEN, Nylon and/or EVOR (combinations)
    - More detailed and specific requirements, including ageing aspects and drop test
    - Brimful volume up to 500 ml, but only for non-flammable, non-toxic gas and contents; otherwise 120 ml only
    - Max. pressure 974 kPa at 55°C

Plastic Aerosols – The Problem



More or less
NO exemption possible
(Exemption
only for containers < 50 ml)



DOT 2S

EXEMPTION

Plastic Aerosols – The Problem

- While international transport permits plastic aerosol containers up to 500 ml brimful volume
  - DOT permits in brimful volumes up to the same size as metal cans
  - Similar in other regions/countries, e.g. Canada, Latin America
  - Europe as a big Aerosol Region limits the brimful volume to 220 ml and the maximum pressure!

- Net: Is there a problem?
  - Plastic Aerosol Containers are permitted globally
  - Innovation might change legal position … however …

Plastic Aerosols – The Problem

- Plastic Cans can only be used for specific products, however they can be used for products where metal cans would fail - always remember that aluminum cans need a „plastic“ coating to avoid corrosion
- Inexpensive Plastic Cans primarily for non-flammable ingredients
- Other product types require provisions concerning compatibility, permeability etc. => COST
- ENVIRONMENTAL ASPECTS are imperative, especially mid- to longterm, which reveals the biggest disadvantage of Plastic Aerosols made of currently common plastic materials!
  Life Cycle analysis is the key to a better establishment in the market
- Size limitation vs. Metal cans is a never ending story!

Technical Considerations

- Material shall not splinter on burst
- Temperature resistance
  - Waterbath testing is difficult for plastic cans, especially drying with hot air afterwards

    => Alternative test methods to hot water bath apply and are recommended
  - Additional high temperature test, e.g. at 60 - 65°C

    This test is not included in legal proposals (to maintain alignment of legal requirements with those for metal cans)

    However, it reflects the expected temperature resistance during production and in the hands of consumers
- Long term stability against environmental impact

  => stability test on each individual aerosol product

Technical Considerations

- Resistance against propellants
  - PET best with Isobutane
  - PE/PP would work with DME
  - Plastics work with compressed gases – however permeation rates are high!
- Resistance against ingredients depends … especially when there are Perfume Components = small molecules that can easily penetrate
- Resistance against Ozone and UV rays
- New to consider: Resistance against bacteria (and other bugs)
  - PET vs. Ideonella sakaiensis (reported 2016)
  - Furthermore consider:
    - Nylon vs. Flavobacterium (reported 1975)
    - PE via Bacteria that can be found in moths (reported 2014)
    - Polystyrol via Enzymes in a mealworm Zophobas morio (reported 2022)

=> Some day there will be bugs that consume any type of plastic

https://www.chemie.de/news/1176474/superwuermer-die-sich-durch-plastikmuell-fressen.html?utm_source=newsletter&utm_medium=email&utm_campaign=chemde&WT.mc_id=ca0259

Plastic Aerosol – Most Recent Steps

- Evaluation of the Aerosols Dispensers Directive 75/324/EC – Final report from March 24, 2017

  => EC did not consider to change

- Reasons
  - 43% of stakeholders consider the limitations in size concerning plastic dispensers as inappropriate
  - Only 24% did consider a change in EC legislation as appropriate
  - Recycling had been seen as difficult
  - Plastic aerosol containers are made primarily of PET preforms and blow moulding process.
    => The quality of PET the handling of the preform and the blow moulding process can have an impact on the long-term stability of the can.
- Other considerations
  - Predicted shift from Aluminum to Plastic for small receptacles did not happen
  - Outside Europe bigger plastic aerosol dispensers are allowed (e.g. 2S in US and Latin America), net there is experience.
    But … a limit in size protects the European market.

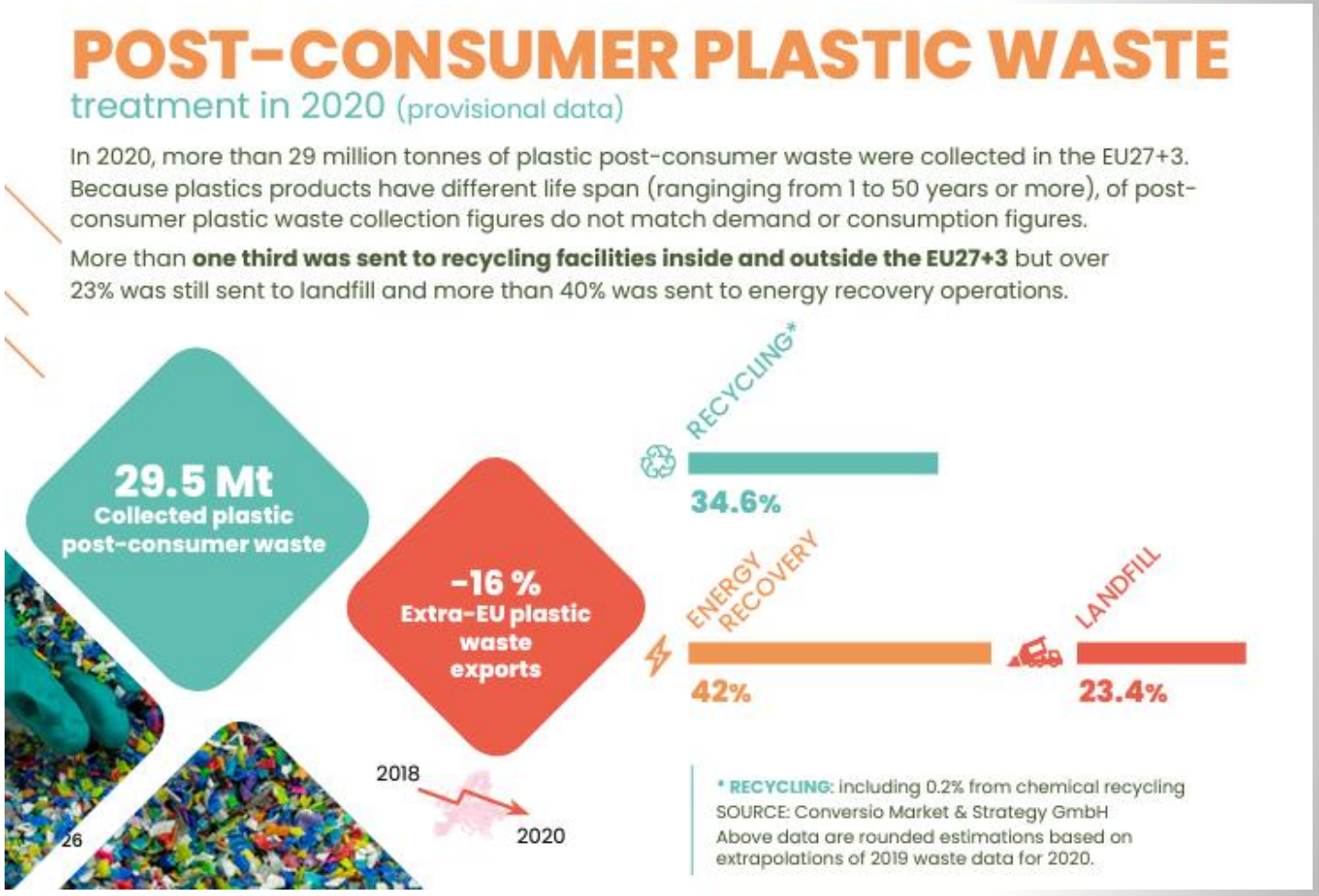
Spotlight: Plastic Waste Treatment

- In 2014, the EU generated about 25 million tonnes of post-consumer plastic waste

  only 30% was recycled
  = about 8 Million tonnes

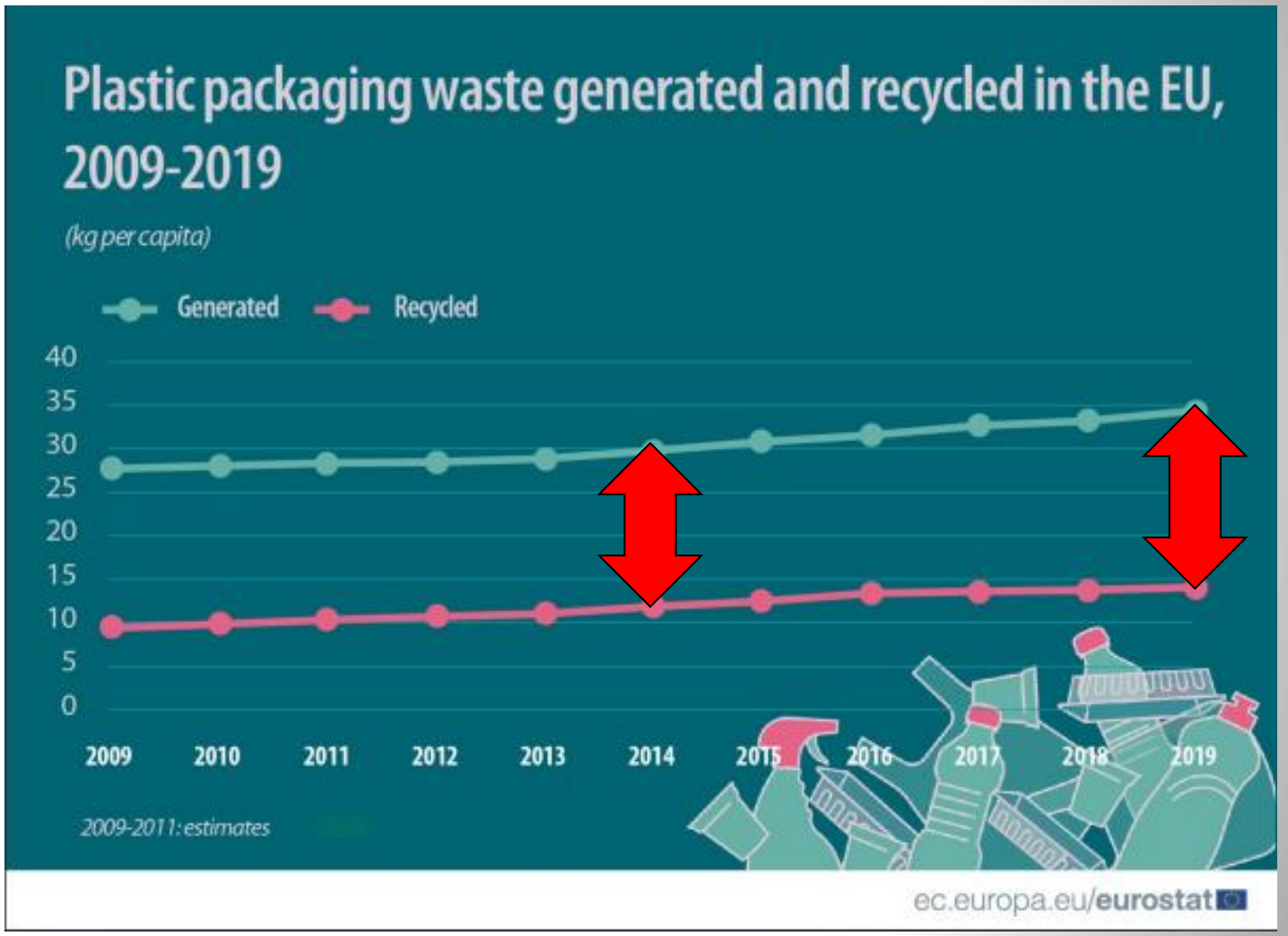
- In 2020 about 29 million tonnes collected

  34.6% recycled
  = 10.2 million tonnes



Spotlight: Plastic Waste Treatment

- Are we on the right track?



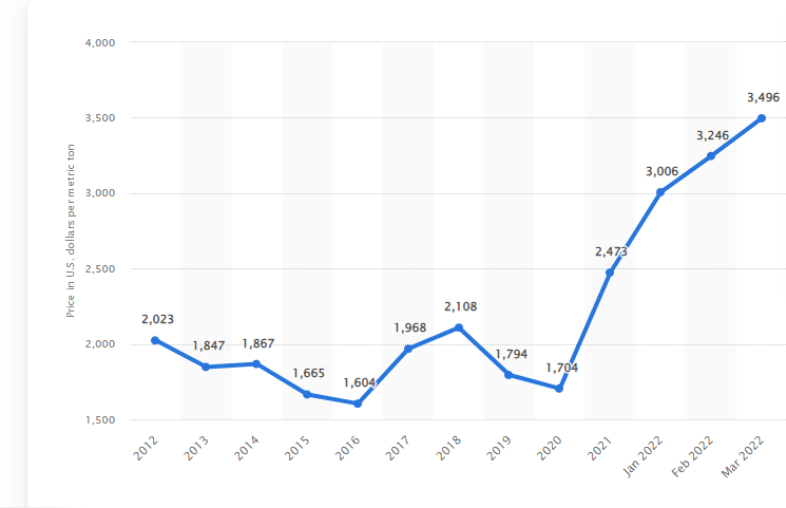
Activities to change the game

- Recycling is a major concern – PETCORE AEROSOL RECYCLING SPECIAL INDUSTRY WORKING GROUP https://www.petcore-europe.org/working-groups/134-plastic-aerosol-recycling-special-industry-group.html
- Task Forces in Europe supported by FEA

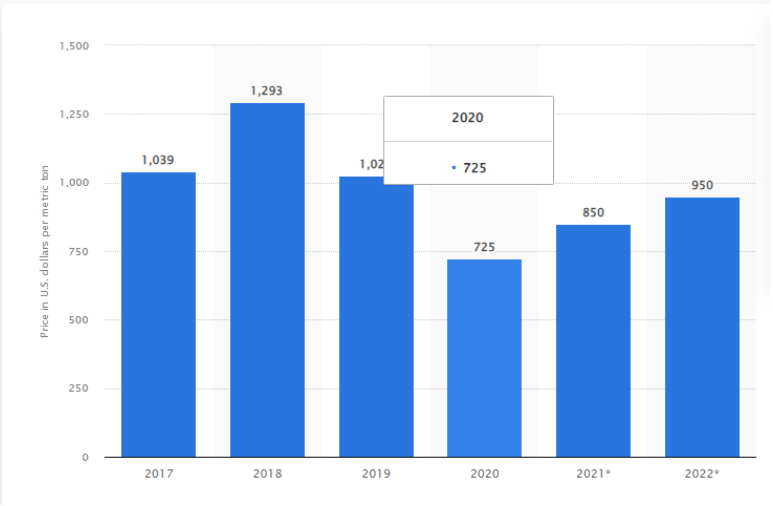
- Most important:
  Ongoing developments and launches

Spotlight: Why PET?

Average Aluminum price in US Dollars per metric ton
Rising above 3000 US Dollars per metric ton



Average PET price in US Dollars per metric ton
At about 1000 US Dollars per metric ton
=> Inexpensive
And easy to mold



Compared to average PP price is about 1100-1250 US Dollars per metric ton PET is even less expensive

Spotlight: Innovation

- Plastipak cans (Deft, Febreze), Coster, Airopak, VCAN are still successful concepts
  Aeropak system consumes 42% less energy and emits 74% less CO2.
- More concepts available (Alpla, Graham, Appe etc.)
- Even biomass cans are available (Farrag)
- Coster, Lindal, Precision, Summit, Aptar provide valves for plastic cans

Spotlight: Innovation

- Innovations around plastic cans are about shape
- Very good examples of an innovative award winning product concepts in 2020

  - L‘Oreal Ushuaia

  - Deft

https://www.plastipak.com/de/aerosol/

https://www.feaglobalevents.org/fea-global-aerosol-awards-2020-2/

=> However, it did not change the landscape yet

Spotlight: Innovation

- New launch by Sidel in 2022 (again PET)

https://packagingeurope.com/news/pet-aerosol-container-launched-by-sidel/8123.article

Conclusion

- Last evaluation of European ADD in 2014-2017 => No changes for plastic Europe is still limited to 220ml brimful volume = 150 ml liquid filling
- Changes in Latin america for plastic dispensers are a step forward
- If we could change the European ADD we could change the World for Plastic Aerosol Dispensers

- Big Questions:
  - Constant dripping wears away the stone?
  - Are bigger sizes >220 ml in plastic really essential?
  - Is there really another synthetic material other than PET? (remember the biomass aerosol container)

PET has a lot of advantages

Thank You!

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