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## Safety assessment of the process LOGIFRUIT, used to recycle high-density polyethylene and polypropylene crates for use as food contact materials

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### Abstract

The EFSA Panel on Food Contact Materials, Enzymes and Processing Aids (CEP) assessed the safety of the recycling process LOGIFRUIT (EU register number RECYC260). The input consists of pre-washed high-density polyethylene (HDPE) or polypropylene (PP) crates from closed and controlled food distribution loops. The process separates crates by material type. Crates are ground to flakes, possibly extruded to pellets and used by companies approved to be in the loop to manufacture new crates. The Panel considered that the quality management system (QAS) put in place to ensure compliance of the origin of the input with Commission Regulation (EC) No 282/2008 and to provide full traceability is critical. The Panel concluded that, when run under the conditions described, the input of the process LOGIFRUIT exclusively originates from product loops which are in closed and controlled chains. The process is designed to ensure that only crates intended for food contact are used and that contamination other than by food can be ruled out. Therefore, the recycling process LOGIFRUIT to produce HDPE and PP crates to be used in contact with fruits and vegetables, and packed meat and fish, dairy, bakery and pastry products is not of safety concern.

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† Deceased.

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## 1. Introduction

### 1.1. Background

Recycled plastic materials and articles shall only be placed on the market if they contain recycled plastic obtained from an authorised recycling process. Before a recycling process is authorised, EFSA's opinion on its safety is required. This procedure has been established in Article 5 of Regulation (EC) No 282/2008<sup>1</sup> of the Commission of 27 March 2008 on recycled plastic materials intended to come into contact with foods and Articles 8 and 9 of Regulation (EC) No 1935/2004<sup>2</sup> of the European Parliament and of the Council of 27 October 2004 on materials and articles intended to come into contact with food.

According to this procedure, the industry submits applications to the Member States Competent Authorities, which transmit the applications to the European Food Safety Authority (EFSA) for evaluation.

In this case, EFSA received an application, from the Spanish Agency for Food Safety and Nutrition (AESAN), for evaluation of the recycling process LOGIFRUIT, European Union (EU) register No RECYC260. The request has been registered in EFSA's register of received questions under the number Q-2021-00336. The dossier was submitted on behalf of LOGIFRUIT S.L., Spain.

### 1.2. Terms of Reference

The Spanish Agency for Food Safety and Nutrition (AESAN) requested the safety evaluation of the recycling process LOGIFRUIT, in compliance with Article 5 of Regulation (EC) No 282/2008.

### 1.3. Interpretation of the Terms of Reference

According to Article 5 of Regulation (EC) No 282/2008 on recycled plastic materials intended to come into contact with foods, EFSA is required to carry out risk assessments on the risks originating from the migration of substances from recycled food contact plastic materials and articles into food and deliver a scientific opinion on the recycling process examined.

According to Article 4 of Regulation (EC) No 282/2008, EFSA will evaluate whether it has been demonstrated that the plastic input of the recycling process originates from a product loop which is in a closed and controlled chain ensuring that only materials and articles which have been intended for food contact are used and any contamination can be ruled out.

## 2. Data and methodologies

### 2.1. Data

The applicant has submitted a confidential and a non-confidential version of a dossier following the 'EFSA guidelines for the submission of an application for the safety evaluation of a recycling process to produce recycled plastics intended to be used for the manufacture of materials and articles in contact with food, prior to its authorisation' (EFSA, 2008) and the 'Administrative guidance for the preparation of applications on recycling processes to produce recycled plastics intended to be used for manufacture of materials and articles in contact with food' (EFSA, 2021). In accordance with Article 38 of the Commission Regulation (EC) No 178/2002<sup>3</sup> and taking into account the protection of confidential information and of personal data in accordance with Articles 39 to 39e of the same Regulation and of the Decision of EFSA's Executive Director laying down practical arrangements

<sup>1</sup> Regulation (EC) No 282/2008 of the European parliament and of the council of 27 March 2008 on recycled plastic materials and articles intended to come into contact with foods and amending Regulation (EC) No 2023/2006. OJ L 86, 28.3.2008, p. 9–18.

<sup>2</sup> Regulation (EC) No 1935/2004 of the European parliament and of the council of 27 October 2004 on materials and articles intended to come into contact with food and repealing Directives 80/590/EEC and 89/109/EEC. OJ L 338, 13.11.2004, p. 4–17.

<sup>3</sup> Regulation (EC) No 178/2002 of the European Parliament and of the Council of 28 January 2002 laying down the general principles and requirements of food law, establishing the European Food Safety Authority and laying down procedures in matters of food safety. OJ L 31, 1.2.2002, p. 1–48.

concerning transparency and confidentiality,<sup>4</sup> the non-confidential version of the dossier was published on Open.EFSA.<sup>5</sup>

According to Article 32c(2) of Regulation (EC) No 178/2002 and to the Decision of EFSA's Executive Director laying down the practical arrangements on pre-submission phase and public consultations,<sup>4</sup> EFSA carried out a public consultation on the non-confidential version of the application from 1 June to 22 June 2022. No comments were received.

The following information on the recycling process was provided by the applicant and used for the evaluation:

- General information:
  - general description.
- Specific information:
  - recycling process,
  - characterisation of the input,
  - characterisation of the recycled plastic,
  - intended application in contact with food,
  - compliance with the relevant provisions on food contact materials and articles,
  - process analysis and evaluation,
  - operating parameters,
  - quality assurance system (QAS).

Additional information was sought from the applicant during the assessment process in response to a request from EFSA sent on 3 February 2022 and was subsequently provided (see '[Documentation provided to EFSA](#)').

## 2.2. Methodologies

The risks associated with the use of recycled plastic materials and articles in contact with food come from the possible migration of chemicals into the food in amounts that would endanger human health. The assessment was conducted in line with the principles described in the guidelines on recycling plastics (EFSA, 2008), in the EFSA Guidance on transparency in the scientific aspects of risk assessment (EFSA, 2009) and considering the relevant guidance from the EFSA Scientific Committee.

## 3. Assessment

### 3.1. General information<sup>6</sup>

According to the applicant, the recycling process LOGIFRUIT is intended to recycle pre-cleaned damaged crates of food grade high-density polyethylene (HDPE) and polypropylene (PP) to flakes. This recyclate may be blended with virgin HDPE or PP, or used at 100%, to manufacture new crates for repeated use in the same loops as they originated from, for up to long-term storage of fruits and vegetables, packed meat and fish, dairy products, bakery and pastry products at room temperature or below.

### 3.2. Description of the process

#### 3.2.1. General description<sup>6</sup>

LOGIFRUIT S.L. is a pooling company with the main activity in renting out, conserving (including washing, classification, storage, manipulation and distribution) and warehousing reusable plastic packages, such as crates and pallets. Its clients are food manufacturers or packers, with supermarket chains as final users. These chains perform their own internal loops and are responsible for the collection of the empty crates from their shops and the return to LOGIFRUIT S.L. Grinding of crates to be recycled, possibly extrusion, and injection moulding to manufacture new crates occurs by

<sup>4</sup> Decision available online <https://www.efsa.europa.eu/en/corporate-pubs/transparency-regulation-practical-arrangements>

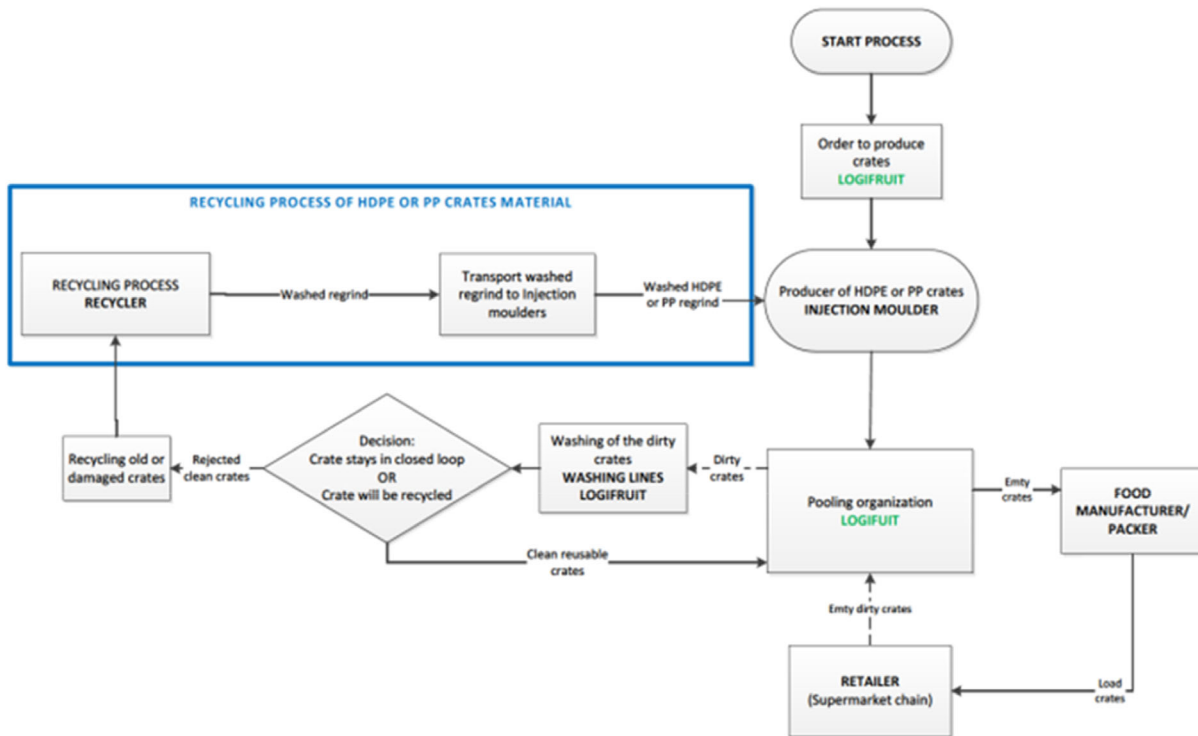
<sup>5</sup> The non-confidential version of the dossier following EFSA's assessment of the applicant's confidentiality requests is published on Open.EFSA and is available at the following link: <https://open.efsa.europa.eu/dossier/FCM-2021-0583>

<sup>6</sup> Technical dossier, section 'Recycling process'.

companies that are part of the loop, approved according to the LOGIFRUIT Quality Assurance System (QAS). LOGIFRUIT S.L. is the owner of the crates.

Damaged HDPE and PP crates, pre-cleaned by LOGIFRUIT S.L. (input), are checked for the origin and visually inspected to sort out contaminated ones. The HDPE and PP crates are ground separately. The flakes are further washed with water in order to remove potential adhering contamination, such as paper and dust. The dry regrind is packed in [redacted], then used to manufacture new crates by injection moulding, with or without blending with virgin HDPE or PP.

According to the applicant, the LOGIFRUIT loop involves the steps shown in Figure 1.



**Figure 1:** Flow chart for the recycling process LOGIFRUIT (provided by the applicant)

### 3.2.2. Characterisation of the input<sup>7</sup>

According to the applicant, the input material for the recycling process LOGIFRUIT consists of damaged or no longer used pre-washed HDPE or PP crates after use in contact with food in closed loops of distributors and retailers for transport and storage of fruits and vegetables and packed meat, fish, dairy products, bakery and pastry products.

The crates are collected by LOGIFRUIT S.L. and brought to washing lines. For the washing, water and detergents are applied. The crates are cleaned according to hygienic standards of the food industry to be re-used. Damaged crates or crates for which there is no use are recycled.

According to the applicant, the crates are made of HDPE or PP originally produced in compliance with the Commission Regulation (EU) No 10/2011 relating to plastic materials and articles intended to come into contact with foodstuffs.

According to the applicant, the existing internal quality assurance system ensures that the input originates exclusively from closed and controlled loops and provides full traceability of the material processed within its premises. Clients sign contracts in which they commit themselves to rule out the utilisation of the crates for purposes other than food packaging. Traceability is ensured and mixing in of other crates ruled out by the embossed LOGIFRUIT logo, engraved manufacturing date, typical green colour and the dimensions fitting into the LOGIFRUIT’s machinery.

<sup>7</sup> Technical dossier, section 'Characterisation of the input'.

### 3.2.3. Characterisation of the output<sup>8</sup>

The following technical specifications for the HDPE and PP flakes have been established by the applicant: melt flow index, density and rheological properties.

Up to 100% recycled HDPE and PP flakes may be used by manufacturers of new HDPE or PP crates. According to the applicant, no re-additivation occurs. Given the low rate of broken crates per year (4% estimated by the applicant) as well as the long lifetime of the crates (estimated at 120 uses or more), the number of reprocessing cycles is low.

### 3.3. Comparative testing of virgin and recycled material<sup>9</sup>

Material of HDPE crates made of flakes recycled after use in a distribution loop was compared to new ones. The following parameters were tested:

- Overall migration into 3% acetic acid, ethanol 95%, 10% ethanol (all 10 days at 40°C) and isooctane (2 days at 20°C).
- Specific migration into 3% acetic acid, ethanol 95%, 10% ethanol (all 10 days at 60°C) and isooctane (10 days at 20°C) of substances (monomers and additives) with a specific migration limit (SML) in Commission Regulation (EU) No 10/2011. Worst case simulants were selected for each substance.

Screening methods were applied to investigate differences between virgin and recycled HDPE material:

- Volatile and semi-volatile content by gas chromatography coupled to time of flight mass spectrometry (GC-TOF-MS).
- Fraction with a molar mass lower than 1,000 Da by size exclusion chromatography (SEC) coupled to various detectors.
- Non-volatile degradation substances by ultra-high-performance liquid chromatography coupled to quadruple time of flight mass spectrometry (UHPLC-QTOF-MS).

There was no significant difference in the overall migrations from virgin and recycled material. No new volatile compounds were detected. The semi-volatile substances that were slightly increased have been identified as far as possible and consisted of degradation products of the polymer, such as long-chain hydrocarbons and an alkanic acid. There was no significant difference in the fraction with a molar mass lower than 1,000 Da.

Certain non-volatile substances were identified and semi-quantified in 10% ethanol, 3% acetic acid, 95% ethanol and isooctane. The migration of those with an SML was well below their SML values. Also taking into account that potential migration from the crates would almost exclusively occur through the gas phase, the Panel considered that the migration of the non-volatile substances is anyway negligible.

### 3.4. Compliance with the relevant provisions on food contact materials and articles<sup>10</sup>

According to the applicant, the pre-washed reusable HDPE and PP crates used as input material for the recycling process are made of plastic that complies with Commission Regulation (EU) No 10/2011. Comparative tests indicated only minor differences between new and recycled HDPE material.

### 3.5. Process analysis and evaluation by the applicant<sup>11</sup>

The applicant presented a process analysis showing that the recycling process is managed by a QAS in which continuous control is performed, ensuring that contamination and the involved risks are ruled out.

### 3.6. Discussion

The data presented by the applicant allow characterising the process, its input, output and the intended uses of the crates. Based on the description of the process, the input being supplied by a

<sup>8</sup> Technical dossier, section 'Characterisation of the recycled plastic'.

<sup>9</sup> Annex 5 'Comparison of virgin and recycled material'.

<sup>10</sup> Technical dossier, section 'Compliance with the relevant provisions on food contact materials and articles'.

<sup>11</sup> Technical dossier, section 'Process analysis and evaluation'.



pooling organisation belonging to a closed and controlled chain, the Panel considered that this process is within the scope of Art. 4 c(i) of the Regulation (EC) No 282/2008.

Within the loop, the crates are used for up to long-term storage of fruits and vegetables, and packed meat, fish, dairy products, bakery and pastry products, at room temperature or below. At the end of their service life (e.g. because of damages), pre-cleaned crates are recycled (input). The crates are ground into flakes, which are subsequently washed and dried. These flakes can be used at up to 100% to manufacture new recycled crates by injection moulding.

Considering the high temperatures used in the injection moulding to produce new crates, the possibility of contamination by microorganisms can be discounted. Therefore, this evaluation focuses on the chemical safety of the final product.

The Panel considered the management of the process as critical, i.e. that the whole process (collection, sorting, recycling, distribution) is operated under a QAS that includes the use of specific identifiers ensuring traceability and control of the input. The traceability system of the LOGIFRUIT process uses identifiers for the crates, i.e. the embossed LOGIFRUIT's logo, engraved manufacturing date, typical green colour, the dimensions fitting into the LOGIFRUIT's machinery and the identity of the suppliers. Reference and batch numbers are used for the grinding and washing steps.

The grinding of the crates, the washing of the flakes, the extrusion and the injection moulding under the conditions described by the applicant are not considered of safety concern. By the comparison of the migration from recycled and virgin HDPE material it has been demonstrated that the use and recycling have no significant effect on the formation and migration of degradation products, additives, monomers and oligomers.

The recycled HDPE and PP flakes are characterised by technical specifications, mainly related to the required mechanical properties of the material.

## 4. Conclusions

The Panel concluded that the process LOGIFRUIT ensures that only materials and articles intended for food contact are used and that contamination by other than food can be ruled out, since the inputs originate from product loops that are in closed and controlled chain. The recycling process LOGIFRUIT is, therefore, suitable for manufacturing new HDPE and PP crates to be used in long-term contact with fruits and vegetables, and packed meat, fish, dairy products, bakery and pastry products, at room temperature or below.

## 5. Recommendations

As part of the good manufacturing practice (GMP) in the meaning of the Regulation (EC) No 2023/2006, the Panel recommends periodical verification that the input originates from crates that have been manufactured in accordance with the EU legislation on food contact materials and articles (Regulation (EC) No 282/2008, Art. 4b). Specifications for input (cleaned crates from closed and controlled loops) and separate processing of the material intended for food contact should be kept under control. Supporting documentation recording the control should be available.

## 6. Documentation provided to EFSA

- 1) Dossier 'LOGIFRUIT'. November 2021. Submitted on behalf of LOGIFRUIT S.L., Spain.
- 2) Additional information, May 2022. Submitted on behalf of LOGIFRUIT S.L., Spain.

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## Abbreviations

CEF Panel	Panel on Food Contact Materials, Enzymes, Flavourings and Processing Aids
CEP Panel	Panel on Food Contact Materials, Enzymes and Processing Aids
Da	Dalton
GC–TOF-MS	gas chromatography coupled to time of flight mass spectrometry
HDPE	high-density polyethylene
HPLC	high-performance liquid chromatography
PET	poly(ethylene terephthalate)
PP	polypropylene
QAS	quality assurance system
SML	specific migration limit
UHPLC–QTOF-MS	ultra-high-pressure liquid chromatography-quadruple time-of-flight mass spectrometry