

1. Summary

Recycled Poly(ethylene terephthalate) for Direct Food Contact Application

Petitioner:

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Starlinger iV+ Technology

The company ITD with seat in Saedinenie (Bulgaria) is running a super-clean recycling process with a capacity of 1500-1800 t per year. This super-clean recycling line is using the Starlinger (Austria) super-clean recycling technology (Starlinger iV+) for the production of PET recyclates for direct food contact from conventionally recycled post-consumer PET materials.

Since 2005, Starlinger/ITD and the Fraunhofer-Institute for Process Engineering and Packaging (Freising, Germany) have been working together on the evaluation of the cleaning efficiency of their super-clean recycling process. The cleaning efficiencies were examined by carrying out a challenge test according to the principles recommended by European Guidelines and US FDA in order to investigate whether the output material is suitable for being re-used in packaging materials for direct food contact.

The ITD super-clean recycling process uses re-collected post-consumer poly(ethylene terephthalate (PET) containers of original food grade quality as input material. During the process this material is washed, processed and cleaned up in such a way that the output material, the recycled PET pellets, can be used again for the production of new articles for direct contact with foodstuffs.

The ITD recycling process technology includes basically the following steps:

- Step 1: Grinding of re-collected post-consumer PET containers into flakes followed by an intensive wash process and drying
- Step 2: Drying of the flake material from step 1 under air using high temperature
- Step 3: Re-extrusion of dried flakes from step 2 including high temperature and a vacuum degassing system. The pellets are subsequently crystallized
- Step 4: Deep-cleansing of the pellets from step 3 in a continuous running solid state polycondensation process using high temperature and vacuum

The ITD recyclate will be used together with virgin PET to produce new single use PET food contact articles with up to about 100% recyclate. However, ITD as the recycler has not in every case the full information about the bottle manufacturing process. Therefore it is assumed within the evaluation process of this petition that the packaging materials contain up to 100% super-clean recyclate.

Typical food contact applications for the ITD recyclate will be bottles for mineral, still and carbonated water, soft drinks, juices, and beer. This may include for some products hot fill conditions and in all cases storage conditions at room temperature of several weeks and months. ITD is also a packaging manufacturer of bottles which are used for all kinds of foodstuffs under cold fill and hot fill processes and in all cases storage conditions at room temperature of several weeks and months. Therefore it is assumed within the evaluation process of this petition, that the bottles can be used for all kinds of foodstuffs including hot fill processes. Typical food contact conditions include also long term storage (several months) at room temperature.

The crucial parameters of the recycling process are the initial concentration of potential contaminants in the washed flakes before super-clean recycling. In addition residence times of the decontamination reaction, decontamination temperatures as well as the applied vacuum are important for the decontamination process.

The control of possible contamination in the input feedstream and the decontamination during the process includes several steps:

- The first important step is achieved with the recollection system and the characterisation of the input material
- The four key steps of the recycling process technology which are essential for the decontamination efficiency of the recycling process technology follow. In step 1 efficient surface washing occurs followed by volatilisation effects due to the applied drying conditions.
- Under the temperature and under vacuum conditions during the decontamination (step 2: re-extrusion, step 3: SSP reaction) potential contaminants are efficiently removed as long as they are volatile enough. The volatility of potential contaminants corresponds in general with the molecular size. For PET, this leads to an advantageous situation, because PET has a very low diffusivity. Potential contaminants exactly those contaminants which have a potential to enter the PET matrix can be removed again.
- The applied residence times, temperatures and vacuum conditions are essential for the cleaning efficiency. Therefore these parameters are controlled and locked by a data locking system. In the case of failure, the recyclates are not used for direct food contact applications.
- The final recycle may be used at 100% to make PET bottles, trays and other containers for direct food contact. However, typically the recycle content of bottles and trays will be below 50%. Therefore during the challenge test and the evaluation it is assumed, that the recycle is used 100% for packaging materials.
- Finally, the increase in the intrinsic viscosity correlates with the decontamination efficiency. The final recyclates would be able to be processed into new containers. The level of intrinsic viscosity needed, is depend of the design, and the end use of the food container. Therefore final recyclates would not meet the technically needed intrinsic viscosity (iV) and would not be suitable for being processed into new containers. Remark: a correlation between the cleaning efficiency and the intrinsic viscosity during a challenge test is, in principle, not possible because high concentrations of the surrogates influence the intrinsic viscosity of challenge test samples. A proper determined of the intrinsic viscosity is therefore only possible for non-contaminated samples. A literature study shows the general correlation between the temperature, the catalyst concentration and the heating time.

From the data provided in this dossier we come to the following conclusions:

- The investigated super-clean recycling process is in compliance with the EFSA criteria to be used for safety evaluation of a mechanical recycling process to produce recycled PET intended to be used for manufacture of materials and articles in contact with food (EFSA Journal 2011;9(7):2184)
- The investigated super-clean recycling process is in a position to produce recyclates which are in compliance with Article 3 of the EU Framework Regulation 1935/2004.
- The produced PET recyclate will fulfil the requirements for overall migration and specific migration of PET monomers according to EU Regulation 10/2011.
- The produced PET recyclate fulfils the requirements of Article 4 of the EU Regulation 282/2008.
- Referring to the attached description of the petitioners quality assurance system (QAS) we conclude also that the investigated super-clean recycling process is in a position to fulfil the requirements of the GMP Regulation (EC) 2023/2006.