

POSITION PAPIER ON THE PCR GRANULATE OF FA. BIFFA

AS OF 3rd June 2024

POST-CONSUMER RECYCLATES AS A BUILDING BLOCK OF SUSTAINABLE PRODUCT DEVELOPMENT

In terms of sustainability, the use of recycled materials is an important cornerstone. Recycling and environmental protection are taken into account from the very beginning of the development of new LINHARDT products.

With this position paper we would like to give you a brief overview of our PCR granulate and inform you about special properties of recycled materials.

GENERAL PROPERTIES OF THE BIFFA RECYCLATE

The recyclate is produced from packaging materials already used by the end consumer. Special processing generates a raw material that is suitable for reuse in a plastic tube. Currently, mainly milk bottles are used as raw material.

However, in pilot phases, the use of other resources will also be tested and developed further.

During production of the PCR material, the crushed milk bottles are cleaned in a complex process and filtered by means of camera systems and centrifuges. The flakes are then extruded into new granulate in a regranulation process. However, the granulate is given certain properties, which we would like to explain in more detail below:

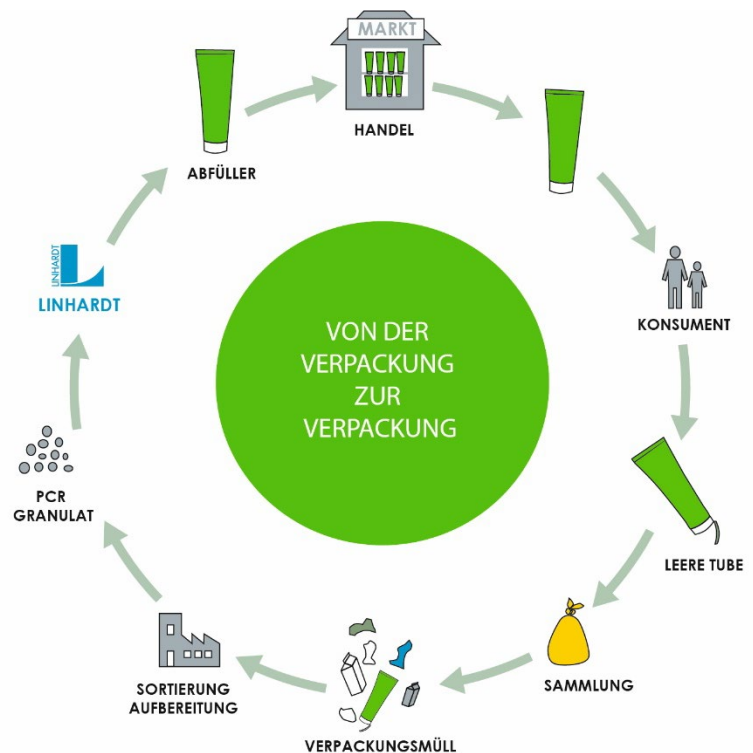


Figure 1: PCR circuit

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Material type: HDPE

Granulate colour: light green - reddish, depending on the amount of red and green caps processed (fat content in the milk)

Odour: slightly acidic (milk), noticeable when opening the carton, odour should diminish after airing. Effects on the sensory properties of the filling material to be determined by stability tests carried out by the customer.

Shelf life: similar to all other materials – 12 months

Storage temperature: +10°C to +35°C at 40-60% relative humidity

Approval: 1935/2004/EG regulation on materials and objects intended to come into contact with foodstuffs



Figure 2: Milk bottle as starting material

POSSIBLE CONSEQUENCES OF PCR USE: PARTICLE AND MATERIAL INCLUSIONS

Despite elaborate processing and filtration, contamination of the recyclate by closures, labels, films, etc. cannot be completely avoided, so that a maximum of 3% impurities may be contained in the PCR granulate.

Due to this production-related contamination, inclusions in the tube casing cannot be completely avoided. These inclusions are particularly visible on the inside of the tube, but may also show up in the form of scratches and surface irregularities (indentations & elevations):

Tube interior:

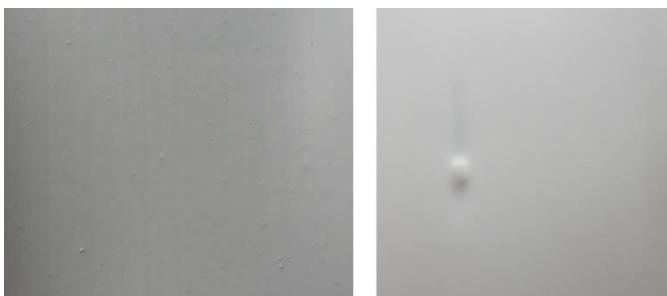


Figure 3: Particle and material inclusions on the inside of the tube

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Tube outside (decoration):

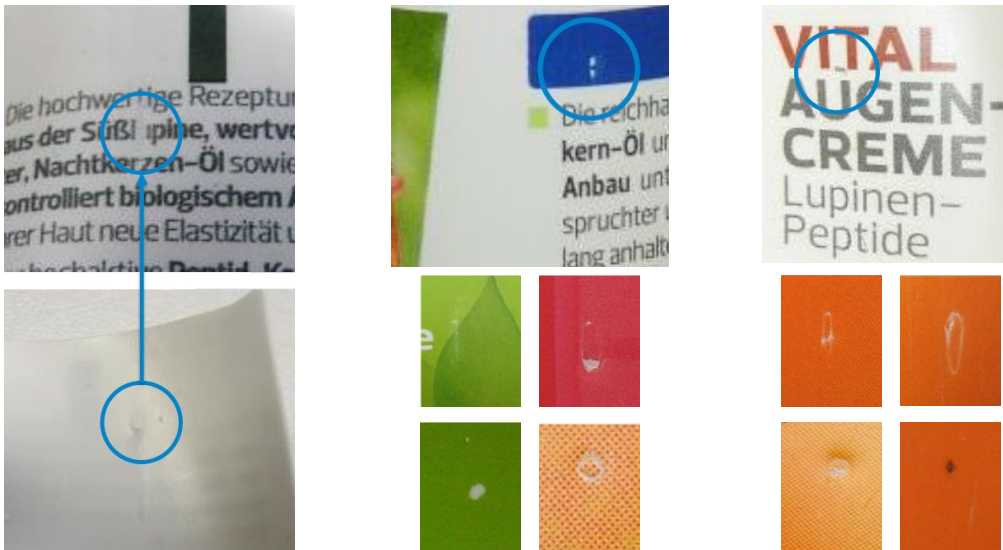


Figure 4: Particle and material inclusions as interfering factors for the decoration on the outside of the tube

The particles pressed through on the inside can lead to partial artefact formation on the outside printing. In the area of existing particles, the tube no longer lies flat on the underlying stainless steel mandrel, so that the plate pressure is partially increased and more ink is applied in this area, which can manifest itself as a dark spot. We would like to point out that the wall thickness can have a significant influence here. With a thinner wall thickness $< 350 \mu\text{m}$, this effect will be stronger compared to the conventional $500 \mu\text{m}$. The material mix also has an influence. The harder the mixture, the better this effect can be compensated for.

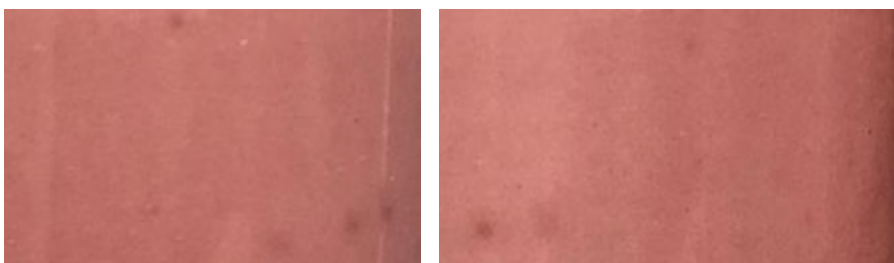


Figure 5: Particle and material inclusions lead to partially stronger printed areas

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POSSIBLE CONSEQUENCES OF PCR USE: DEPOSITS AND SCRATCHES DURING EXTRUSION

During extrusion, deposits increasingly occur when PCR granules are used. This means that burns may form in the hot extrusion tool, which "scratch" the viscous plastic flowing past. There is also a risk that such scratches may not be covered by printing ink or varnish. With a coloured tube and matt lacquer, these scratches may be more prominent.

In addition, certain components of the plastic evaporate after exiting the extruder and may precipitate as hydrophobic deposits. These are comparable to waxes and cannot be printed in the subsequent process steps, so that the basic colour of the plastic remains visible:



Figure 6: Scratching during extrusion

Die The effects described above result from the material properties and are therefore not subject to complaint. Accordingly, special attention must be paid to raising awareness of the specifics of recyclates among all stakeholders.

We will be happy to provide you with a PCR property chart on request, which shows the properties and effects using practical examples.

LINHARDT demands continuous qualitative development from their suppliers. Therefore, we collaborate with our raw material suppliers on various projects, but also involve the machine suppliers to optimise the processing as well.

If you have any questions or need support, please feel free to contact us at any time.