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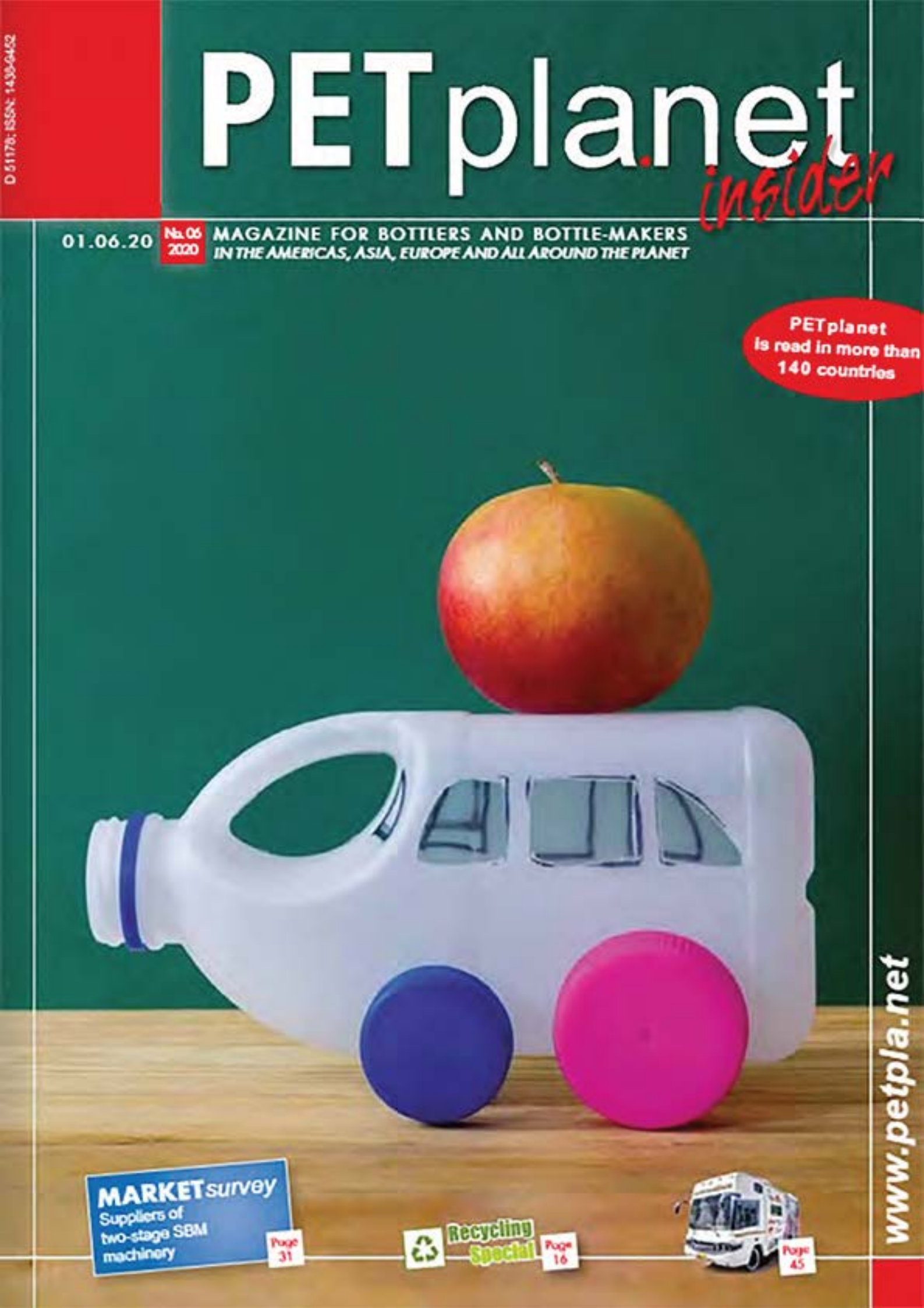

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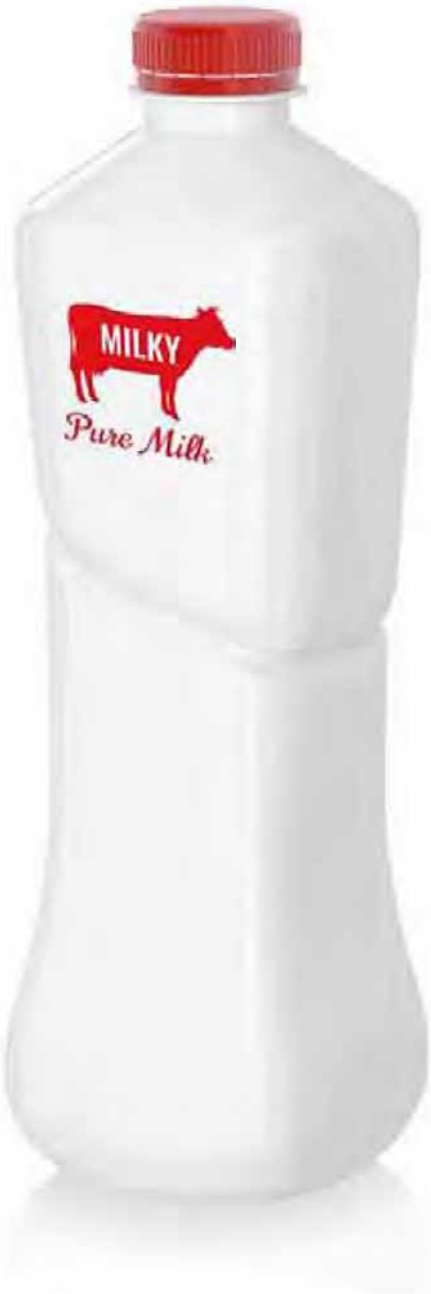
New masterbatch offers "circular economy" design and zero TiO_2

High opacity, low TiO_2

In early 2018, white opaque PET bottles for milk narrowly escaped being banned in France, on the basis that they were "non-recyclable". The issue attracted a lot of negative media coverage and became a high-profile political topic. Ultimately, the bottles were allowed to remain on the French market, conditional on the industry driving a drastic reduction of TiO_2 (titanium dioxide) content. The following year, Penn Color introduced pennaholt, a white masterbatch containing 50% less TiO_2. The company says that it enabled the design of white PET bottles with very low TiO_2 but, at the same time, maintaining the highest levels of opacity and whiteness for maximum shelf-life and shelf appeal.



The original pennholt enabled typical 8% TiO_2 content in a PET bottle for long life white milk to be cut to below 4% in monolayer PET bottles and below 2% in multilayer packages. This helped to improve white opaque PET's compatibility with the non-clear recycled PET stream, where high content of TiO_2 had previously been identified as hindering both the recycling process and the manufacture of end-products using non-clear rPET content.

A changed approach to reduce TiO_2

Opacity drives consumer's experience of the quality and safety of the product, as light blocking protects organoleptic properties and nutrients. High opacity (>99.5% at 550nm) and premium whiteness (>87L) are required to package longlife white milk. Whiteness, with its implications of cleanliness, freshness, purity and safety, sends a message that plays a critical role in the success of the product.

Conventional white masterbatch technologies exploit the light scattering property of TiO_2, dispersed in a plain package wall, to provide opacity and whiteness. Pennaholt uses a different mechanism. Its patent-pending technology generates micro-structured interfaces within the PET bottle wall, using high reflective characteristics to create a barrier to light. High opacity and premium whiteness result from a synergistic effect between the micro-structured wall and the light scattering effect of inert particles.

Compliance with new legislation

TiO_2 now faces another critical challenge. In February 2020, the EU CLP (classification, labelling and packaging of chemical substances) classified it as a suspected carcinogen (level 2), by inhalation of powders or dust. The effective date of restriction is confirmed as October 2021. As the classification is "by inhalation", it does not apply to packages, where TiO_2 is "locked" in the polymer.

Packagers should, however, be aware that it is the combination between the CLP and the EU waste directive that is a concern. Any waste containing more than one per cent of a carcinogenic substance is considered hazardous. The waste directive applies regardless of the form of the substance so it means any recycled PET bottle with more than 1% TiO_2 is hazardous waste. The EU has recently published its "new circular economy plan" with even stricter regulations on the presence of hazardous substances in the recycling streams.

White opaque PET will face a challenging situation from October 2021, additional to its technical compatibility with the recycling stream and the Single Use Plastic directive.

Penn Color says that it can help customers with its technological development of pennaholt. Its latest variants are now available with only one per cent or even zero TiO_2 but

with the same opacity and whiteness. Depending on the target application, it could even be formulated with no minerals.

The synergy between microstructured wall and light scattering is still at the core of pennaholt masterbatch. Its mechanism is created by a composition of inert particles and a highly engineered organic polymer, with high molecular weight and high thermal stability, that is FDA approved and REACH compliant.

On the recycling side, Penn Color says that pennaholt meets the APR and EPBP guidelines on elutriation, extrusion, solid stating and material IV, with 50% rPET blend. When taken through multiple cycles of bottle-to-bottle closed-loop recycling, PET bottles with the latest version exhibit no difference to clear PET bottles in terms of IV loss, either.

Supporting the 'circular economy'

The industry only puts on the market packages that are fully compliant with Health and Safety regulations. That requires the strict control of Non Intentionally Added Substances (NIAS) in the package. However, higher content of recycled material in packages and more recycling closed loops could risk NIAS build-up in the circular economy streams. Penn Color says that pennaholt is specifically formulated to reduce NIAS, with substances of higher level of purity and thermostability than found in conventional masterbatches. In a specific scenario of three closed loops of manufacturing, recycling and re-using with 100% rPET, analytical tests found 50% fewer NIAS with pennaholt than with a conventional TiO_2 based masterbatch.

Penn Color asserts that, as a platform technology, pennaholt allows the creation of bespoke formulations, for both monolayer and multilayer packages, to not just support but actually get ahead of global circularity and regulatory trends.

www.penncolor.com