

Polypropylene

Borealis' position on phthalates in PP catalysts

The role of Phthalates in the polymerisation process of propylene

Throughout their more than fifty years of history almost all types of polypropylene have been produced with the help of a Ziegler-Natta-catalyst (ZN-catalyst).

The vast majority of the current 4th Generation PP ZN catalysts are prepared starting from a Pre-catalyst (proCAT) mixture, containing, besides magnesium- and titanium (IV) chloride, an internal donor, which is very often a phthalate such as Dibutyl phthalate (DBP), Diisobutyl phthalate (DIBP) or Bis(2-ethylhexyl) phthalate (DEHP). The internal donor is essential for the control of the stereoregularity (isotacticity) of the final polymer and therefore has a major impact on the mechanical properties of the final material.

Before, or during, the polymerisation process the proCAT is added to the reactor, where - together with an aluminium alkyl and an external donor, which is usually silane-based - the activated catalyst forms in situ.

The activated catalyst polymerises propylene and its co-monomers into the various types of polypropylenes and thus is consumed or rapidly decomposed. The remaining trace degradation products are either removed in the process or end up as catalyst residues in the polypropylene.

If completely surviving the polymerisation process, the used phthalates could theoretically be present in concentrations of about 1 mg/kg in the final pellets. However, test results have shown phthalate values not exceeding 0.15 mg/kg PP and often even below the threshold of the analytical method of 0.01 mg/kg PP.

Legal framework

Regulation (EC) 1907/2006 (REACH - Registration, Evaluation, Authorisation and Restriction of Chemicals) addresses the production and use of chemical substances and their potential impacts on both human health and the environment.

Annex XIV of REACH, the Authorisation List, comprises substances which must not be used anymore in concentrations above defined concentration limits without an authorisation after a defined "sunset date".

According to REACH, article 2-8-b transported isolated intermediates shall be exempted from Title VII (Authorisation).

Dibutyl phthalate (DBP), Diisobutyl phthalate (DIBP), and Bis(2-ethylhexyl) phthalate (DEHP) are listed on REACH Annex XIV, which has recently been up-dated by Regulation (EU) 2021/2045 from 23 November 2021 adding the endocrine disrupting properties to the already existing entries of the three phthalates. That means that the concentration limit for those three substances requiring an authorisation has been lowered from 0.3 wt% (3,000 mg/kg), which is the default threshold for reprotoxic Cat 1B sub-stances, to 0.1 wt% (1,000 mg/kg). The new sunset date applicable for mixtures that contain the phthalates between 0.1 and 0.3 wt% was 14 December 2024.

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Key messages

Polyolefins such as PP and PE generally do not require any plasticisers like phthalates or any other comparable substances.

The potential residual traces of phthalates in polypropylenes are far below the limits defined by REACH (0.1 wt%), thus no commercial polypropylene is subject to any restriction or ban in that respect.

As part of the proCA_t mixture the Phthalates DBP, DIBP or DEHP are transported isolated intermediates which are exempted from Authorisation under REACH.

The sunset date for these phthalates, which came into force in February 2015, does not prohibit continuing the import or use of any products containing them in concentrations below 0.3 wt%. With the sunset date in December 2024 for the additional endocrine disrupting properties this threshold was lowered to 0.1 wt%.

Although the described applications are still legally compliant and safe, Borealis, as a Responsible Care company, driven by customer and consumer expectations, has transferred its product portfolio to non-phthalate based catalysts, where technically and economically feasible.

Please be assured that, in any case, Borealis is committed to continuously maintaining the high quality and properties of our products.

ISSUER

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