Title: Chemical composition distribution of amorphous or semicrystalline polyolefins is unknown? Liquid chromatography gives answers.

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Abstract:

Note: maximum length of 400 words.

Analytical methodologies are critical to evaluate the molecular heterogeneity of materials based on polyolefins. Knowledge about the distribution of monomer units provides insight into the polymerization mechanism and enables to establish structure-property relationships. This is a highly important step for innovation and new product development.
To define these copolymers, it is important to determine their molecular heterogeneities, wherein the full Chemical Composition Distribution (CCD) is of particular interest. Therefore, whenever new catalysts and processes are designed, the CCD has become an important molecular innovation driver.

HPLC is the method of choice to investigate the molecular heterogeneity of polymers [1]. Using the modus of size-exclusion chromatography (SEC) macromolecules can be separated regarding their molar mass. In the mode of liquid adsorption chromatography (LAC), the separation is governed by their chemical composition and microstructure.

LAC of polyolefins has become possible with the discovery that polyethylene and polypropylene may be selectively adsorbed on the atomic level flat surface of porous graphite [2,3,4]. Most frequently, the chromatographic system Hypercarb™ with a solvent gradient 1-decanol→1,2,4-trichlorobenzene has been used, where polyethylene is fully adsorbed in the column at 160 °C from 1-decanol, and the stereo-variants of polypropylene are retained according to their microstructure [2,4]. The elution volume of ethylene/-1-alkene copolymers correlated linearly with the average content of 1-alkene in the copolymers. Such a linear dependence enables to calibrate the HPLC separation [2,3,4] and, thus, to characterize the chemical composition distribution (CCD). This will be illustrated on various amorphous as well as semicrystalline polyolefins.