Characterization of Polyolefins using High-Temperature Size Exclusion Chromatography Coupled with an Infrared Detector (HT-SEC-IR5)

Hamza M. Aboelanin[1,2], Subrajeet Deshmukh[3], Tibor Macko[3], Jan-Hendrik Arndt[3], Stepan Podzimek[1], Robert Brüll[3]

(1) Institute of Chemistry and Technology of Macromolecular Materials, Faculty of Chemical Technology, University of Pardubice, Studentska 573, 53210 Pardubice, Czech Republic

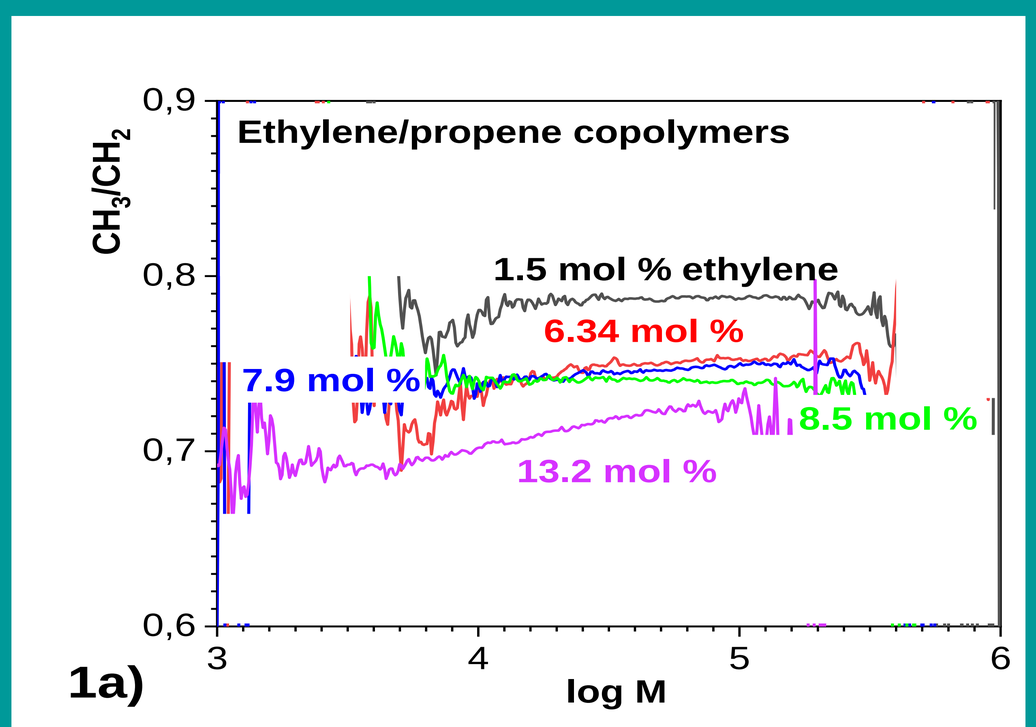
(2) Department of Chemistry, Faculty of Science, Al-Azhar University, 11884 Cairo, Egypt

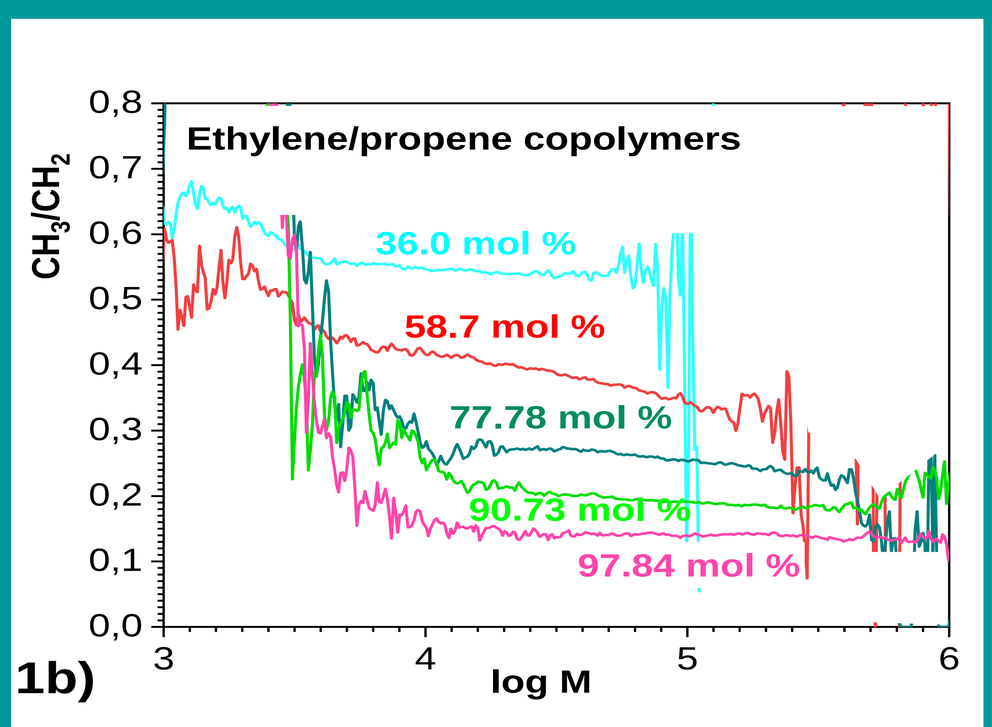
(3) Fraunhofer Institute for Structural Durability and System Reliability, Division Plastics, Group Material Analysis, Schlossgartenstrasse 6, 64289 Darmstadt, Germany

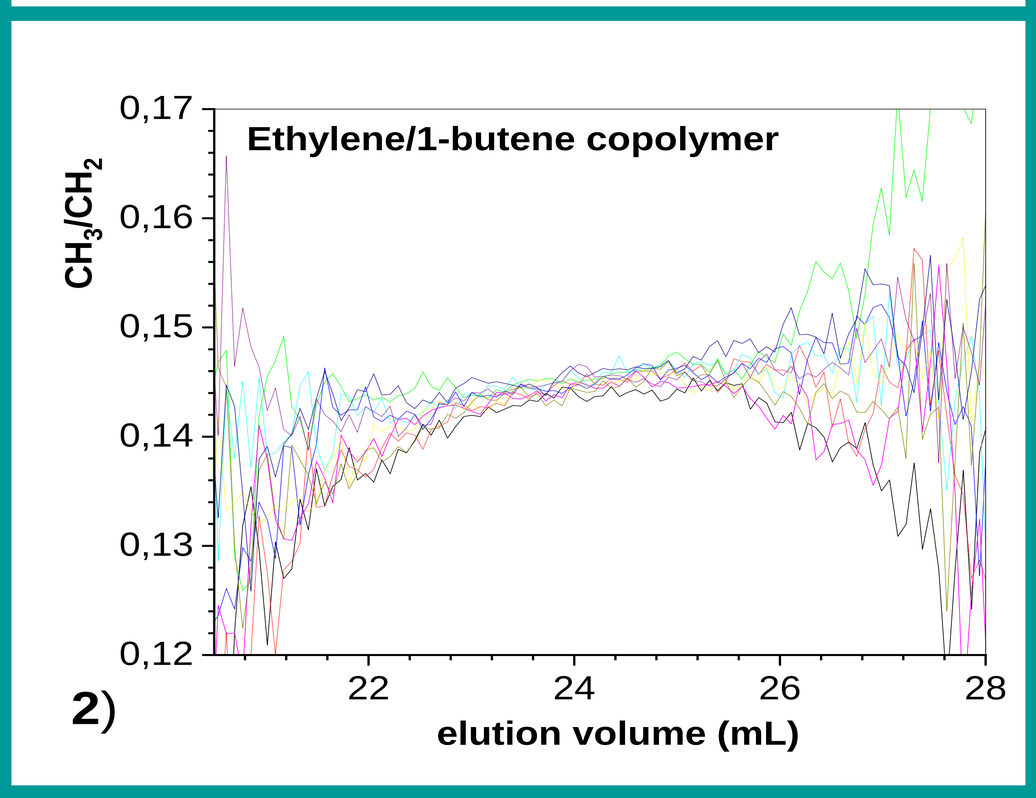
Introduction

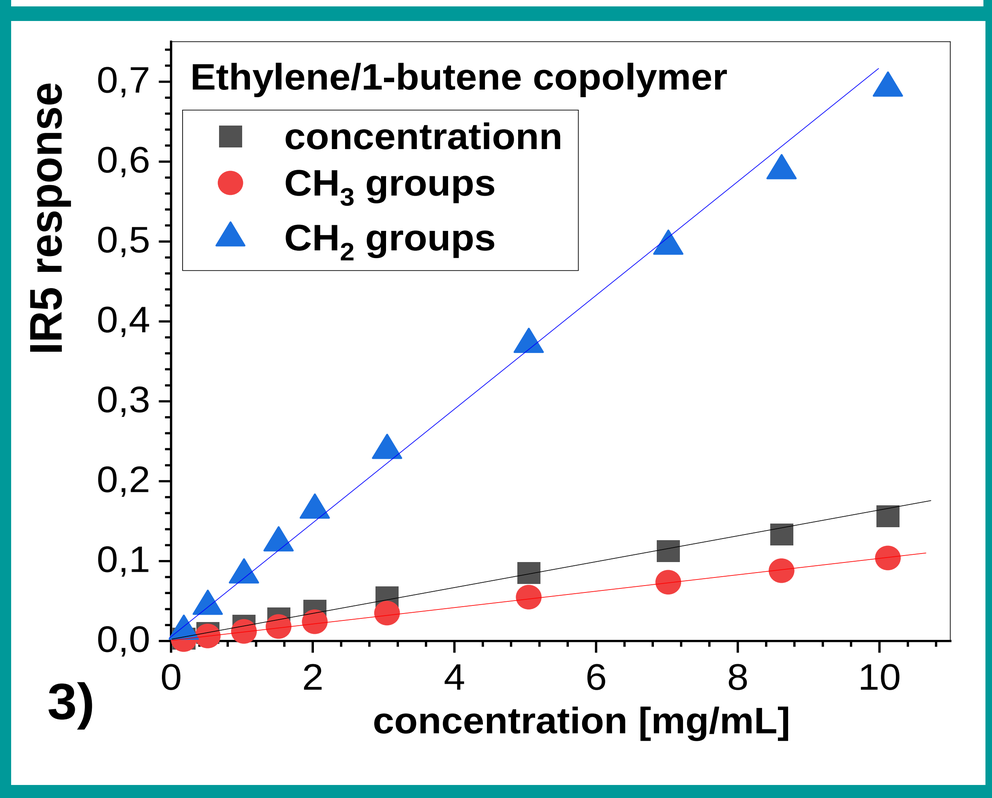
The molecular structure of polyolefins copolymers is important for the research and development of polyolefins. The chemical composition distribution of polyolefins copolymers synthesized by different catalytic systems and varying comonomer types was studied using high-temperature size exclusion chromatography (HT-SEC) coupled with a new model of an infrared detector (model IR5, PolymerChar, Valencia, Spain) [1]. The IR5 detector enables monitoring of the IR response of methyl (- CH_3) and methylene groups (- CH_2-) in macromolecules with high sensitivity [1]. We have investigated the dependence of the CH_3/CH_2 ratio along the molar mass axis for the series of ethylene/1-alkene copolymers.

Results









Conclusion

- It was found that the ratio of CH_3/CH_2 may increase, be constant, decrease or change irregularly along the molar mass axis, depending on the sample under investigation (ethylene/propylene copolymers, Figure 1). Because the CH_3/CH_2 profiles may be very different even for a given series of copolymers synthesized with the same catalyst (Figure 1), it is supposed that one or more experimental parameters, which were not strictly controlled throughout synthesis, are responsible for these substantial differences in the chemical composition along the molar mass axis [2].
- The repeatability and limit of detection of the IR5 detector were tested using 10 solutions of an ethylene/1-butene sample (Figure 2). The standard deviation of ~ 0.00063 corresponds to the mean CH_3/CH_2 ratio (~ 0.14483).
- The lR5 response depends linearly on the concentration of a polymer (Figure 3, $R^2 = 0.997$).
- Coupling of size exclusion chromatography with the advanced IR5-detector enables the convenient and reliable characterization of the chemical composition distribution (CCD) of many polyolefin materials along their molar mass axis [2].

Acknowledgment

Hamza M. Aboelanin thanks for the possibility to participate in the ERASMUS+ program. His study was organized in cooperation between the University of Pardubice and the Fraunhofer Institute for Structural Durability and System Reliability (LBF), Darmstadt..

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