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Retention of tetrahydroquinoline derivatives on hypercross-linked polystyrene under conditions of liquid chromatography from weakly polar eluents

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Abstract

The paper presents the results of study of the retention regularities of 1,2,3,4-tetrahydroquinoline derivatives under conditions of quasi-normal-phase high performance liquid chromatography. A feature of this chromatographic mode is the predominant contribution of specific interactions with the sorbent – hypercrosslinked polystyrene in our case – to the retention. The choice of sorbent due to its widespread use as an adsorbent in liquid chromatography, as well as its ability to participate in π-interactions.

It was found, that the nature of the non-polar eluent modifier has a significant effect on retention: it increases in the range dichloromethane – tetrahydrofuran – isopropanol. The difference in the elution strength of the solvents is explained by the difference in their ability to specific interactions with both sorbate molecules and the surface of hypercrosslinked polystyrene.

When the content of the modifier changes, the sorption characteristics decrease with increasing polarity of the resulted eluent due to increasing of the specific sorbate – eluent interactions contribution, and decreasing of the role of sorbate – sorbent n-π interactions. The decrease in the contribution of specific interactions to sorption leads, particularly, to the fact that the retention factor values of different compounds noticeably come closer.

The dependences of retention on physicochemical parameters of the sorbates turn out to be inverse with respect to the regularities characteristic of the reversed-phase mode. Reversed-phase retention usually increases with increasing volume, polarizability and lipophilicity of sorbate molecules due to enhanced dispersion interactions with the sorbent and solvophobic – with the polar eluent, while in the quasi-normal-phase conditions retention decreasing is observed with increasing of these characteristics. The most probable reason for this is the enhancement of dispersion interactions with the non-polar mobile phase and the absence of solvophobic effects in the latter case.

Comparison of the retention factors of sorbates containing different functional groups showed that compounds containing phenyl fragments have not characterized by the highest retention factor values, as might be expected based on their ability to π-π-interactions with the surface of hypercrosslinked polystyrene. This can be explained by the non-planar orientation of the phenyl substituents, which, in the absence of the "pressing" action of the mobile phase, does not allow for the realization of all possible π-π interactions with the sorbent. Specific interactions of hypercrosslinked polystyrene with tetrahydroquinoline derivative molecules are carried out mainly due to π- and n-π-interactions with oxo-groups of sorbates, which is manifested in a greater retention of compounds containing an oxo-group in position 2 compared to similar derivatives with methyl radical in this position.

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