

Kováts E sz. Gas-chromatographische Charakterisierung organischer Verbindungen. Teil 1: Retentionsindices aliphatischer Halogenide, Alkohole, Aldehyde und Ketone. (Characterization of organic compounds by gas chromatography. Part 1. Retention indices of aliphatic halides, alcohols, aldehydes and ketones.) *Helv. Chim. Acta* **41**:1915-32, 1958. [Organisch-Chemisches Laboratorium, Eidg. Technischen Hochschule, Zurich, Switzerland]

In gas chromatography, peak maxima of the members of the simplest homologous series, the n-paraffins, provide fixed points on a special 'tape measure' which change with experimental conditions. Using regularity of retention data for these homologues (linearity of the logarithms with carbon number) the distance between two maxima can be subdivided into 100 parts giving a scale on which the 'retention index' of any other substance can be read. At the peak maximum of the n-paraffin, x-ane, the scale is 100 x. [The *SCJ*[®] indicates that this paper has been cited in over 660 publications since 1961.]

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"The birth of the present paper came from necessity. I was engaged by Leopold Ruzicka, shortly before his retreat into the organic chemistry laboratory of the Swiss Federal Institute of Technology, to 'apply physicochemical methods to the study of essential oils.' At the same time, I was an appointed co-worker of Firmenich & Cie in Geneva. With a laboratory assistant, Ernst Baumann, and my first doctoral student, Adolph Wehrli, I began to study the adaptation of chromatographic and distillation methods to the separation of the components of natural oils and that of spectroscopic methods for the determination of the structure of the isolated compounds.

"Very soon, we had prepared a first outline for an analytical procedure. First, the oil was separated by liquid displacement chromatography into groups containing nonpolar, medium polar, and highly polar compounds. The three groups were then distilled and the fractions characterized by gas chromatography. The final step was the isolation of the components by preparative gas chromatography. Soon, a second doctoral student, Ernst Kugler, began to analyze mandarin orange peel oil. Soon we had an immense number of chromatographs of different distillation fractions and we were unable to cross identify peaks.

"It was well known at that time that the peak position in a chromatogram is characteristic for the substance under strictly reproducible conditions. I tried to make a special scale which itself changes with the gas chromatographic conditions but on which the measured peak position is always the same. From this it followed that the measuring scale must be produced by a standard chromatogram run under the same conditions as those in which peak positions had to be characterized.

"After having tried to work out different systems, one evening I read over the paper by Anthony T. James and Archer J.P. Martin' in which they reported that retention volumes of members of homologous series give linear plots as a function of the carbon number. I realized that the logarithmic distance of the peak maxima of the homologues gives marks on the chromatograph similar to those on tape measures used by tailors. In reevaluating all my data, the simplest homologous series, that of the nparaffins, was chosen as a base. The fixed points, the peak maxima, were defined as 100 times the carbon number, 500 at the peak of pentane, 600 at that of hexane, and so on. The retention indices of other compounds were found by linear interpolation.

"In the new system, everything became much simpler. Wehrli completed his measurements and simple rules appeared for the prediction of chromatographic behaviour of unknown substances.² Kugler began the analysis of mandarin orange peel oil and completed it in a short time also using the brandnew nuclear magnetic resonance spectroscopy.^{3,4}

"Why has this paper been highly cited? I think that a paper must appear at the right time. Second, the basic idea must be simple. Third, it must simplify the work of others. I would like to express my gratitude to the late Ruzicka who made the obstacles encountered in research and publication disappear, and also to Emil Cherbuliez, former editor of *Helvetica Chimica Acta*, who was always ready to help young people.

"Honours I have received include the Tsvett Chromatography Medal of the International Symposium in 1978 and the 1979 Tsvett Commemorative Medal of the Academy of Sciences of the USSR."

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3. Kugler E & Kováts E sz. Zur Kenntnis 'atherischer Öle. 1. Mitteilung. Zur Kenntnis des Mandarinenschalen-Öls (*Citrus reticulata* Blanco, bzw. *Citrus nobilis* var. *deliciosa* Swingle "Mandarin"). *Helv. Chim. Acta* **46**:1480-513, 1963.
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