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ANALYTICAL CHALLENGE

"Never odd or even" challenge

Reinhard Meusinger[1]

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We would like to invite you to participate in the Analytical Challenge, a series of puzzles to entertain and challenge our readers. This special feature of "Analytical and Bioanalytical Chemistry" has established itself as a truly unique quiz series, with a new scientific puzzle published every three months. Readers can access the complete collection of published problems with their solutions on the ABC homepage at http://www.springer.com/abc. *Test your knowledge and tease your wits in diverse areas of analytical and bioanalytical chemistry by viewing this collection.*

In the present challenge, palindromes are the topic. And please note that there is a prize to be won (a Springer book of your choice up to a value of €100). Please read on...

Meet the challenge

Before we start with this challenge, please read the "never odd or even" backwards by ignoring the word boundaries. Such a sequence of characters which reads backward the same as forward is called a palindrome. Palindromes may appear as a word ("racecar"), a phrase ("Was it a car or a cat I saw?"), a number ("1001"), or a date. And entirely by chance this manuscript was submitted on the 12th February 2021, or 12-02-2021. By the way, the world's longest palindromic word in everyday use is the Finnish 19-letter word *saippuakivikauppias* for soapstone vendor [1]. Linguists are not the only ones fascinated by palindromes: Joseph Haydn's Symphony No. 47 is nicknamed "The Palindrome" because, for example, the second half of its minuet is the same as the first but backwards. In chemical structural analysis, the term palindrome is unusual. We can consider all molecules with C_2 symmetry properties as palindromic. Thus, molecules such as water, diethylether, or *n*-alkanes can be considered palindromes by their structure, but not by their name. This is opposite in case of the compound we are looking for in this challenge. Their structure is not a palindrome because their chain ends are not identical. However, a palindromic phenomenon occurs here by comparing the IUPAC convention with the physiological counting method preferred by nutritionists. Coincidentally, the structural group in the middle of the molecule receives the same number on both notations, regardless of which side you start counting from. The substance we are looking for is widespread in flora and fauna, where it occurs in a chemically bound form as a mixture with similar compounds. Therefore, it is not surprising that an older and much more frequently used trivial name exists for it, which shares the same roots as the name of a popular fruit from which the substance is mainly obtained.

The challenge

For structural analysis purposes, the electron impact mass spectrum (Fig. 1), infrared spectrum (Fig. 2), ^{1}H-NMR

✉ Reinhard Meusinger
meusi@nmr.chemie.tu-darmstadt.de

[1] Institute of Organic Chemistry and Biochemistry, University of Technology Darmstadt, Alarich-Weiss-Str. 4, 64287 Darmstadt, Germany

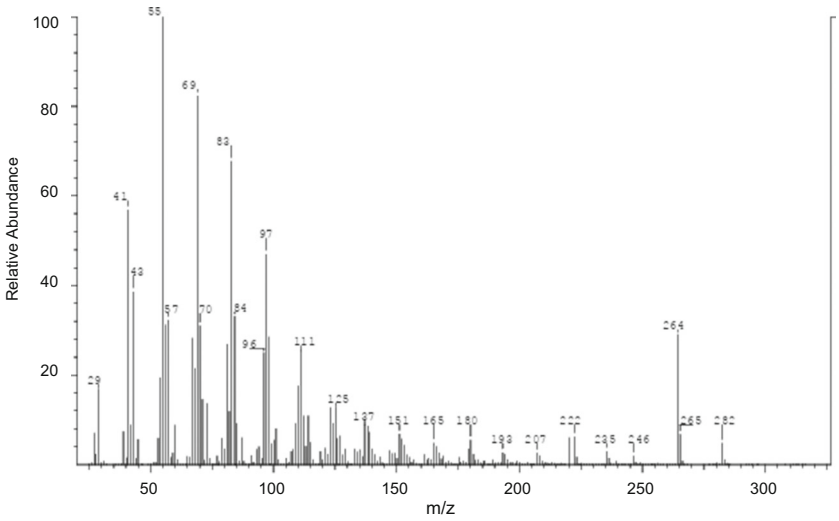

Fig. 1 Electron impact mass spectrum of the pure compound

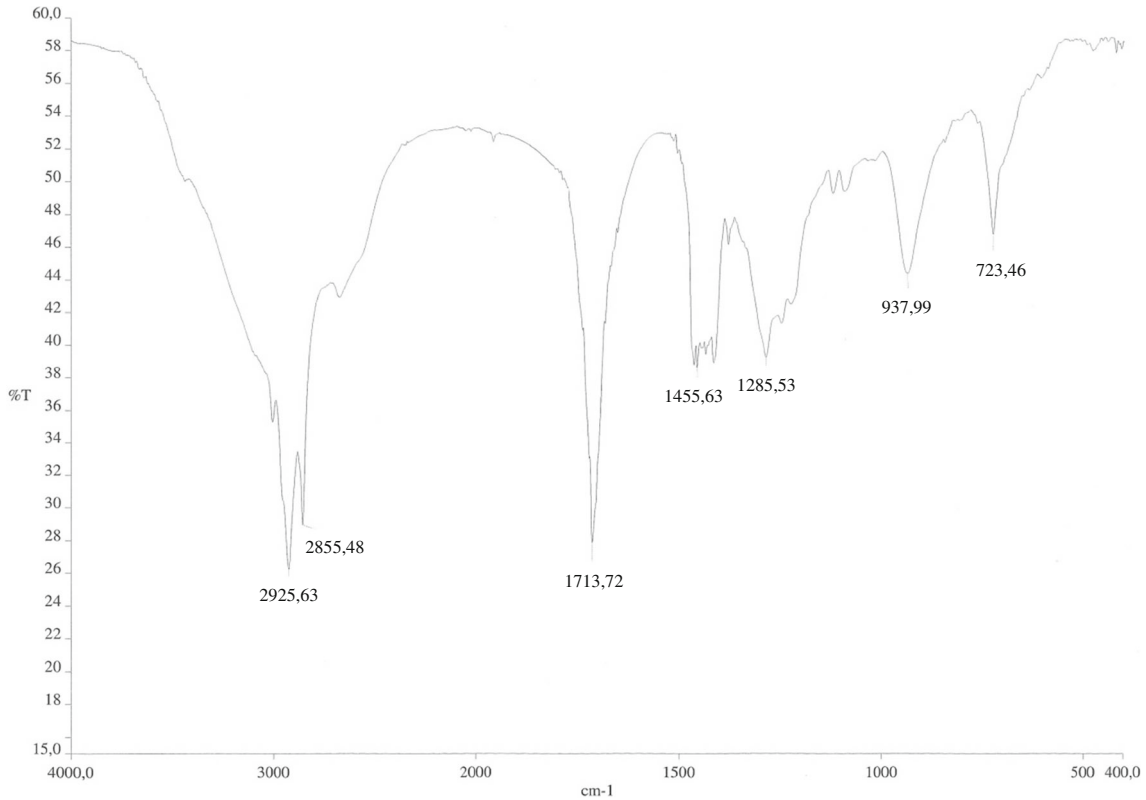

Fig. 2 Infrared spectrum of the pure compound (KBr pressed disc)

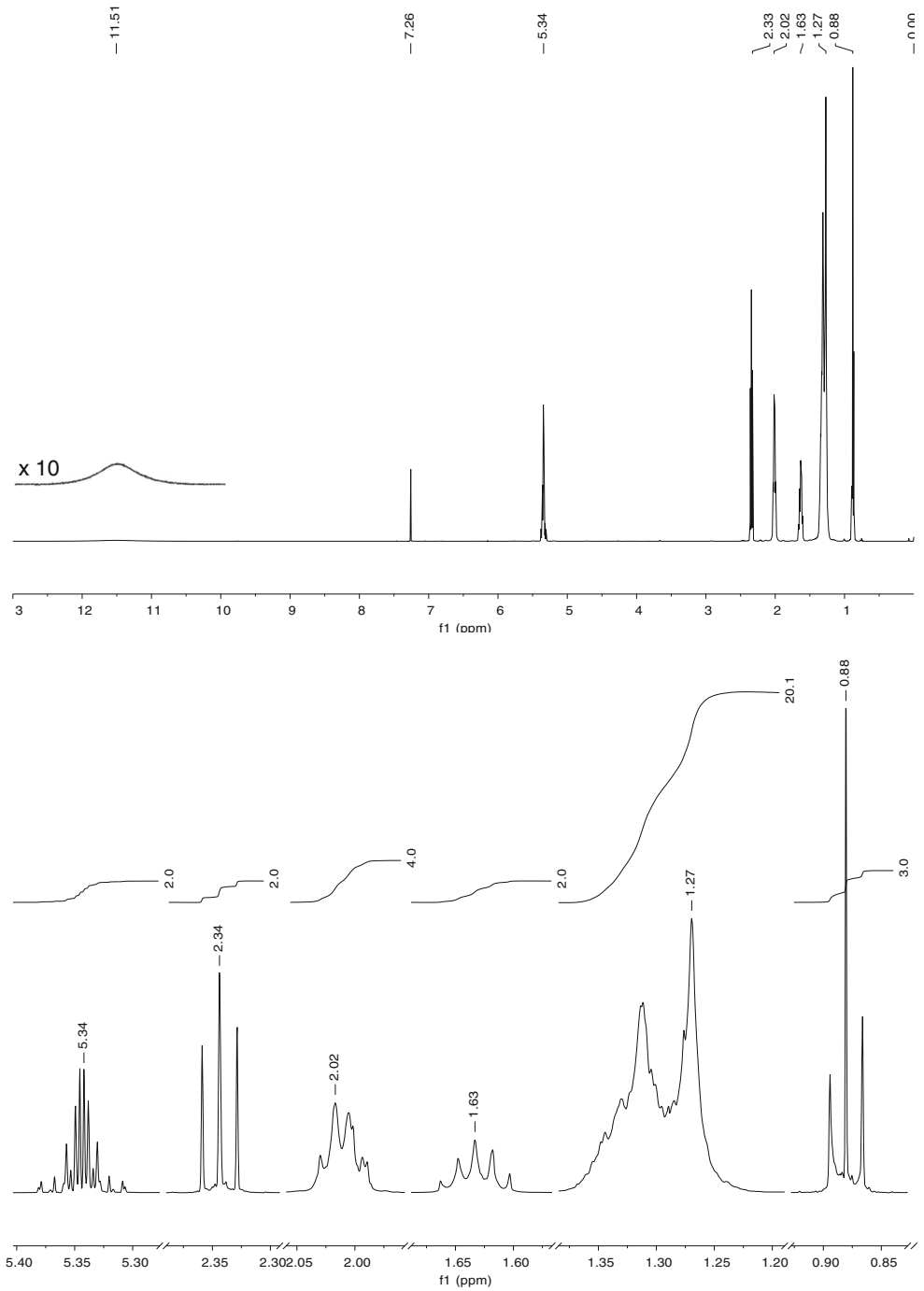

Fig. 3 500 MHz ^{1}H-NMR spectrum of a solution in $CDCl_3$ with respect to tetramethylsilane (0.0 ppm). The broadened low-field shifted signal is heightened. The signal at 7.26 ppm resulted from residual protons in deuterated solvent. The integral value of the most high-field shifted signal at 0.88 ppm was set to 3.0 for a methyl group. The spreads of the multiplet signals are given after apodization of the FID with exponential and Gaussian functions

spectrum (Fig. 3), and ^{13}C-NMR spectra (Fig. 4) are provided for this well-known compound. In MS spectrum, the relative small parent peak at *m/z* 282 is conspicuous. All NMR spectra were obtained in $CDCl_3$ as solvent.

Can you identify this substance?

Declarations

Conflict of interest The author declares no competing interests.

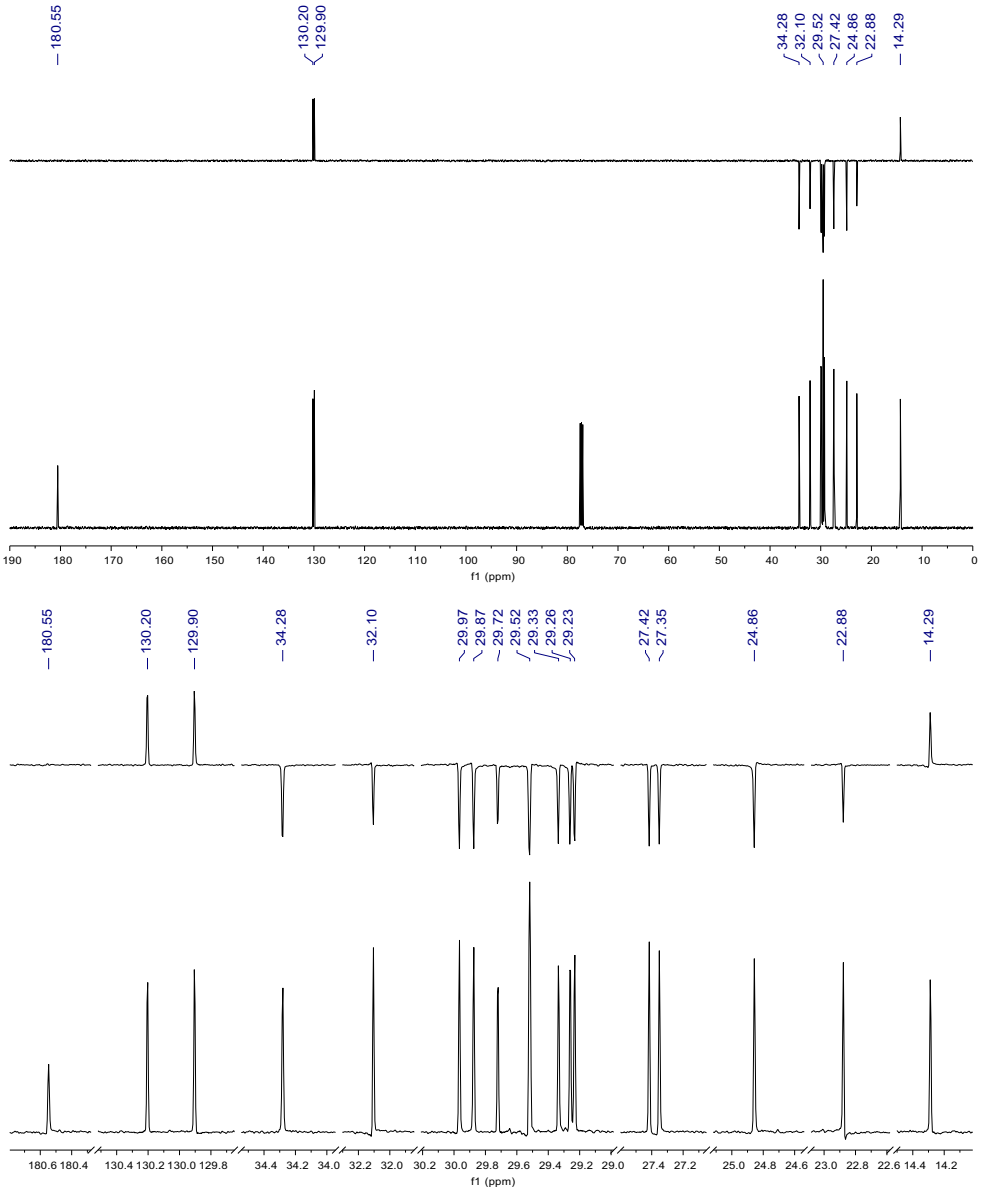

Fig. 4 125 MHz ^{13}C-NMR (bottom) and the distortionless enhanced polarization transfer DEPT-135 (top) spectra with respect to $CDCl_3$ at 77.2 ppm. In the lower part of the figure, the spreads of all signals are given. Almost all signals are resolved here. Only the signal at 29.52 ppm shows double intensity. Note also the shift difference of 0.3 ppm between the two signals at around 130 ppm

Reference

1. https://www.guinnessworldrecords.com/world-records/longest-palindromic-word

We invite our readers to participate in the Analytical Challenge by solving the puzzle above. Please send the correct solution to abc-challenge@springer.com *by July 1, 2021. Make sure you enter "Never odd or even challenge" in the subject line of your e-mail. The winner will be notified by e-mail and their name will be published on the "Analytical and Bioanalytical Chemistry" homepage at* http://www.springer.com/abc *and in the journal (volume 413/issue 24) where readers will find the solution and a short explanation.*

The next Analytical Challenge will be published in 413/16 July 2021. If you have enjoyed solving this Analytical Challenge, you are invited to try the previous puzzles on the ABC homepage.