Abstract:
Thermal treatment of aqueous solutions of xylose, rhamnose, and l-alanine led to a rapid development of a bitter taste of the reaction mixture. To characterize the key compounds causing this bitter taste, the recently developed taste dilution analysis (TDA), which is based on the determination of the taste threshold of reaction products in serial dilutions of HPLC fractions, was performed to locate the most intense taste compounds in the complex mixture of Maillard reaction products. By application of this TDA, 26 fractions were obtained, among which seven fractions were evaluated with a high taste impact. LC/MS and NMR spectroscopy as well as synthetic experiments revealed the 1-oxo-2,3-dihydro-1H-indolizinium-6-olates 1-5 as the key compounds contributing the most to the intense bitter taste of the Maillard mixture. Calculation of the taste impact of these compounds based on a dose/activity relationship indicated that these five compounds already accounted for 56.8% of the overall bitterness of the Maillard mixture, thus demonstrating this class of 1-oxo-2,3-dihydro-1H-indolizinium-6-olates as the key bitter compounds. First synthetic studies on the relationship between the chemical structure and the human psychobiological activity of 1-oxo-2,3-dihydro-1H-indolizinium-6-olates revealed that substitution of the furan rings of 1 by 5-methylfuryl moieties (compounds 3-5) or by
5-(hydroxymethyl)furyl groups (compound 6) led to a significant increase of the bitter threshold. In contrast, the substitution of the oxygen atoms in the furan rings of 1 by sulfur atoms induced a significant decrease of the detection threshold of the 1-oxo-2,3-dihydro-1H-indolizinium -6-olate; for example, the thiophene derivative 7 showed the extraordinarily low bitter detection threshold of $6.3 \times 10^{-5}$ mmol/kg (water).