

## Mass Spectra of Capsaicinoids

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Besides molecular ion, the three characteristic peaks at  $m/z = 137$  (base peak),  $m/z = 151$ , and  $m/z = 195$  are found in mass spectra in all capsaicinoids (**1a-f**).

### INTRODUCTION

Capsaicin and capsaicinoids are pungent components in the plants of the *Capsicum* family.<sup>1</sup> They also possess attractive biological activities: antinociceptive activity,<sup>2</sup> analgesic activity,<sup>3</sup> antiinflammatory activity,<sup>4</sup> transdermal activity,<sup>5</sup> and animal repellent activity.<sup>6</sup> We were prompted to develop a practical synthesis of capsaicinoids (**1a-f**)<sup>7</sup> for transdermal and antiinflammatory studies and investigated the mass spectral data for structural determinations along the way. We observed the molecular ion peak as well as characteristic peaks  $m/z = 137$  (base peak);  $m/z = 151$ ; and  $m/z = 195$  in (**1a-f**). Some mass spectra of capsaicinoid have already been reported,<sup>8</sup> but detailed interpretation is lacking. Herein we report the gc-mass data of capsaicinoid (**1a-f**) that we synthesized. This result is expected to be a useful information for future identification of capsaicinoids.

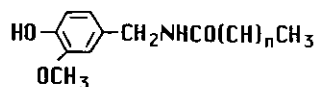
### EXPERIMENTAL SECTION

The capsaicinoids (**1a-f**) for mass spectral study were prepared by the following sequences: (i) protecting the phe-

nolic OH of vanillin with the benzyl group, (ii) conversion of the formyl group of protected vanillin into an oxime, (iii) transform this oxime into nitrile by the treatment of  $\text{Ac}_2\text{O}$ , (iv) reduction of the nitrile with  $\text{LiAlH}_4$  to give (4-benzyloxy-3-methoxybenzyl)amine, (v) coupling of this amine with some corresponding acyl chlorides in the presence of triethylamine to afford protected capsaicinoids, and (vi) deprotection to provide capsaicinoids (**1a-f**).<sup>7</sup> Except **1a** and **1b**, pure capsaicinoids (**1c-f**) were obtained by passing the crude product through silica-gel column using  $\text{CHCl}_3$  as eluent and recrystallized from  $\text{Et}_2\text{O}$ -hexane (1:1). Compounds **1a** and **1b** were purified with Kugelrohr distillation under vacuum.

Mass data were recorded on a Hewlett Packard mass spectrometer connected to a Hewlett Packard series II model gas-liquid chromatograph. It was equipped with a 12 m  $\times$  0.2 mm (I.D.) HP-1 (crosslinked methyl silicone gum) column, supplied by the Hewlett Packard Company, with a helium flow rate of 1 mL/min. The column temperature was programmed from 70 °C to 220 °C at 30 °C/min. Electron ionizing energy was 70 eV and ion source temperature was 300 °C. Data were acquired and processed on a Data Analysis program in the MS ChemStation software, supplied by

Table 1.



**1a-f**

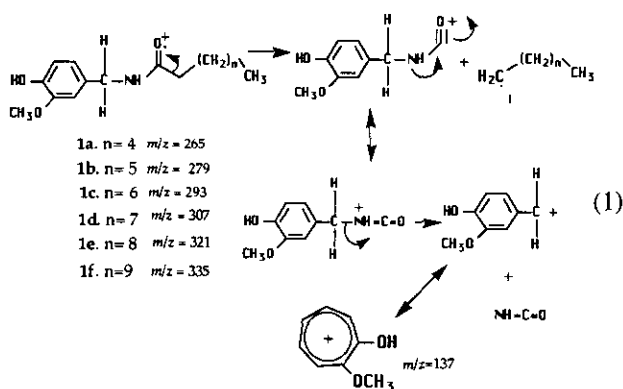
Comps	n	retention time (min.)	$m/z$ (relative intensity)			$[M]^+$
<b>1a</b>	5	15.86	137 (100)	151 (16.91)	195 (8.98)	265 (11.12)
<b>1b</b>	6	16.46	137 (100)	151 (14.03)	195 (4.64)	279 (6.04)
<b>1c</b>	7	17.40	137 (100)	151 (17.51)	195 (6.85)	293 (2.72)
<b>1d</b>	8	18.49	137 (100)	151 (17.14)	195 (10.46)	307 (3.80)
<b>1e</b>	9	19.10	137 (100)	151 (17.45)	195 (6.02)	321 (0.18)
<b>1f</b>	10	20.80	137 (100)	151 (18.65)	195 (8.06)	335 (1.20)

Hewlett Packard. **1a** and **1b** which are liquid, but **1c-f** are solid at room temperature (25 °C) were dissolved in ethanol (sample size: 25 mg-50 mg per mL) and injected into gc-mass instrument.

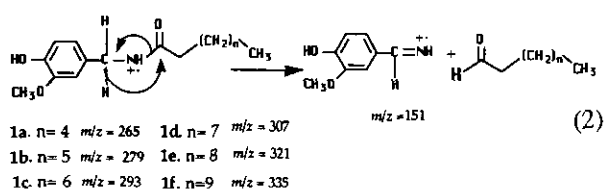
## RESULTS AND DISCUSSION

In gas chromatography, the regular increase in retention time of each capsaicinoids (**1a-f**) was observed about 0.6-1.7 minutes per carbon. All the capsaicinoids (**1a-f**) show three identical peaks;  $m/z = 137$  (base peak);  $m/z = 151$ ; and  $m/z = 195$ . The retention time of gas chromatography and characteristic peaks ( $m/z$ ) of mass spectra of capsaicinoids (**1a-f**) are given in Table 1.

In the homologous capsaicinoid series (**1a-f**), each molecular ion has  $m/z = 14$  increment. The fragment,  $m/z = 137$ , the base peak in capsaicin and all other capsaicinoids, can easily assigned to the substituted tropylium ion formed by benzylic cleavage. From the molecular ion an  $\alpha$ -cleavage with loss of an alkyl radical,  $\text{CH}_3(\text{CH}_2)_n\text{CH}_2\cdot$ , followed by benzylic cleavage and loss of a neutral isocyanate gives the stable substituted tropylium ion,  $m/z = 137$  (eq. 1).

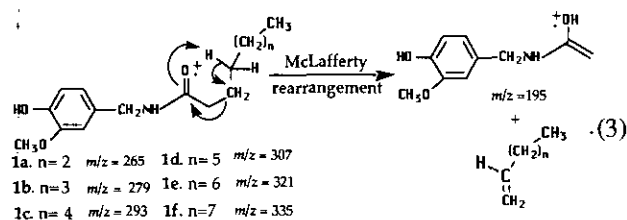


The fragment of  $m/z = 151$  which was formed from the molecular ion by a hydrogen rearrangement and simultaneous cleavage of a neutral aldehyde leads to the stable iminium ion,  $m/z = 151$  (eq. 2).



The fragment of  $m/z = 195$  can be derived from a typical McLafferty rearrangement to give the ion at  $m/z = 195$

and neutral olefins as shown in eq. 3.



## ACKNOWLEDGMENT

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## Key Words

Capsaicinoids; Mass spectra.

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