

# Supporting Information

for

## **Use of costic acid, a natural extract from *Dittrichia viscosa*, for the control of *Varroa destructor*, a parasite of the European honey bee**

Kalliopi Sofou<sup>1</sup>, Demosthenis Isaakidis<sup>1</sup>, Apostolos Spyros<sup>1</sup>, Anita Büttner<sup>2,3</sup>, Athanassios Giannis\*<sup>2</sup> and Haralambos E. Katerinopoulos\*<sup>1</sup>

Address: <sup>1</sup>Department of Chemistry, University of Crete, Voutes, Heraklion, 71003, Crete, Greece,

<sup>2</sup>Institut für Organische Chemie, Universität Leipzig, Johannisallee 29, 04103 Leipzig, Germany and

<sup>3</sup>recent address: Department of Chemistry and Food Chemistry, TU Dresden, 01062, Dresden, Germany

Email: Athanassios Giannis\* - giannis@uni-leipzig.de; Haralambos E. Katerinopoulos\* - kater@chemistry.uoc.gr

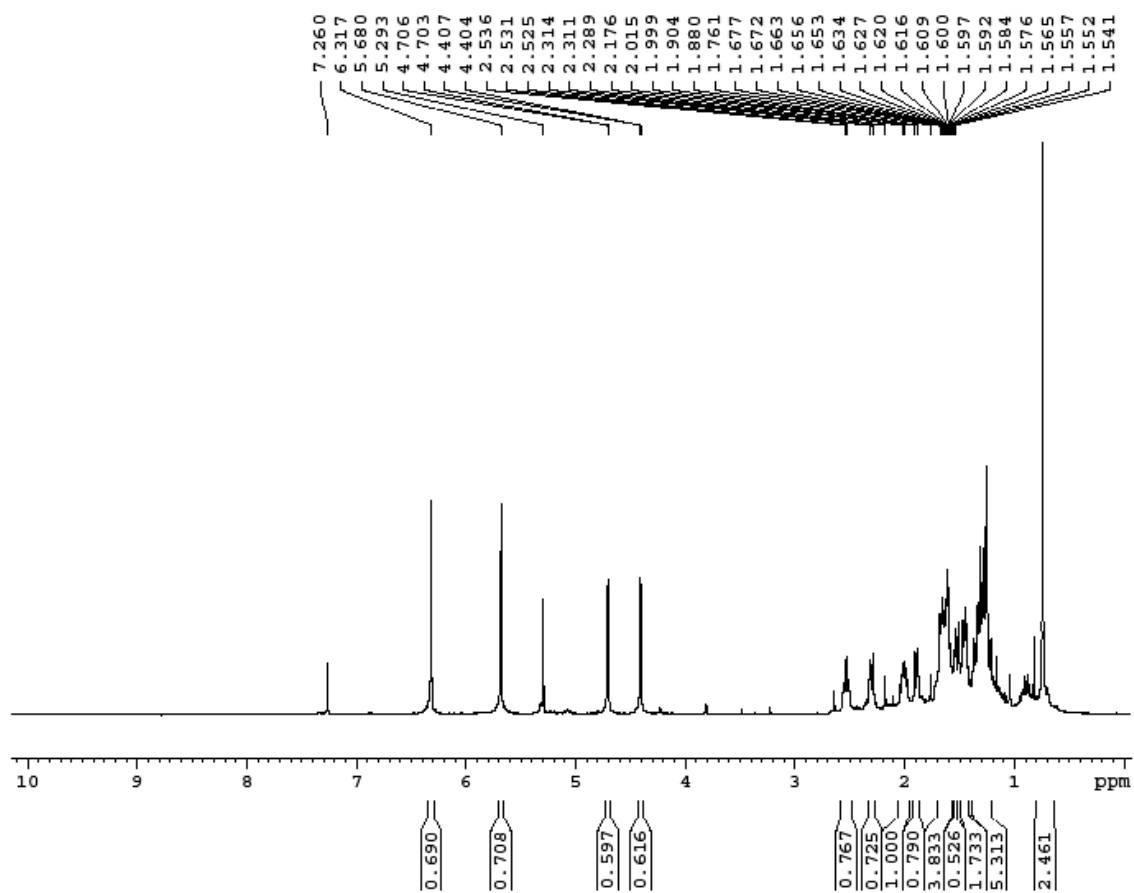
\* Corresponding author

### **NMR, IR and MS spectra of costic acid**

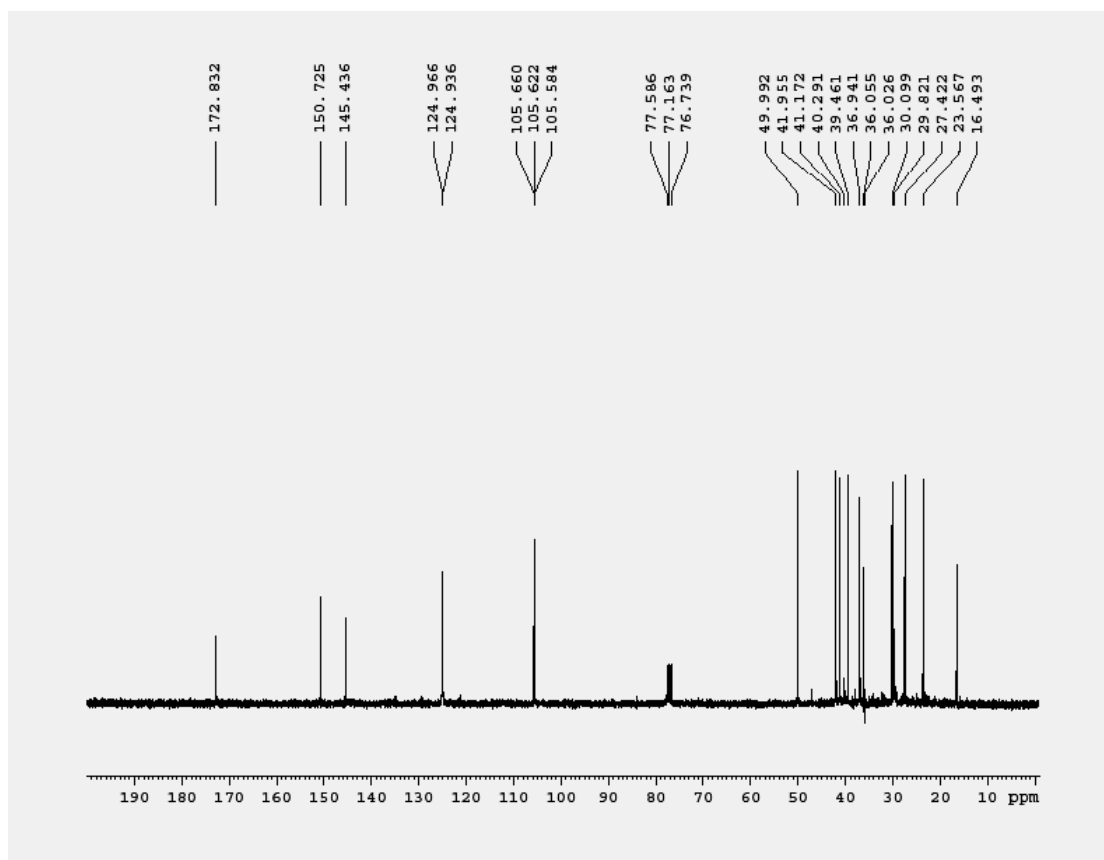
#### **Table of contents:**

<sup>1</sup> H NMR of costic acid	S2
<sup>13</sup> C NMR of costic acid	S3
DEPT 45°, 90° and 135° spectra of costic acid	S4
COSY spectrum of costic acid	S5
COSY spectrum of costic acid (0.0–4.5 ppm)	S6
HMBC spectrum of costic acid	S7
HMBC spectrum of costic acid ( <sup>13</sup> C: 0–65 ppm; <sup>1</sup> H: 0.0–2.6 ppm)	S8
HMQC spectrum of costic acid	S9
HMQC spectrum of costic acid ( <sup>13</sup> C: 0–65 ppm; <sup>1</sup> H: 0.0–2.6 ppm)	S10
NOESY spectrum of costic acid	S11
NOESY spectrum of costic acid (0.7–3.1 ppm)	S12
FTIR spectrum of costic acid	S13
Mass spectrum of costic acid	S14

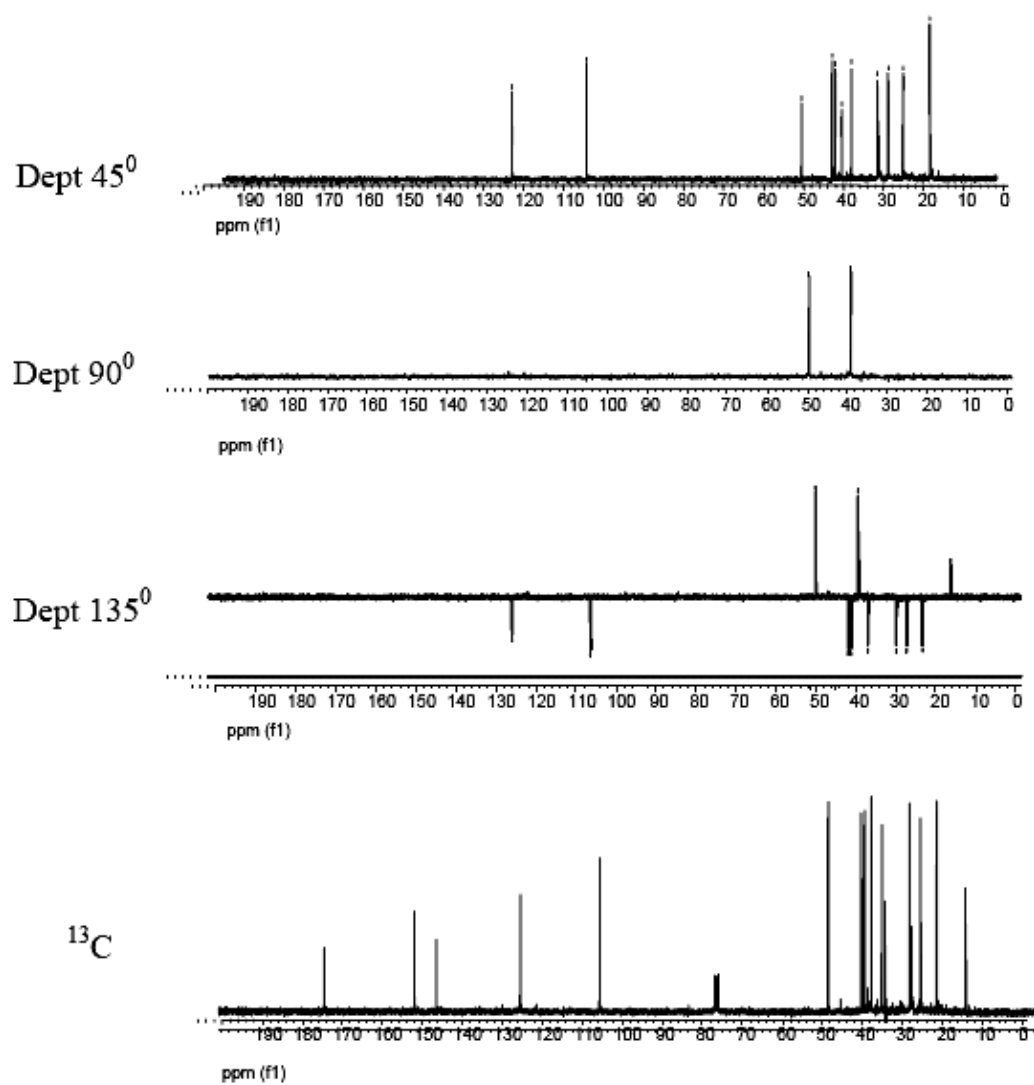
$^1\text{H}$  NMR of costic acid



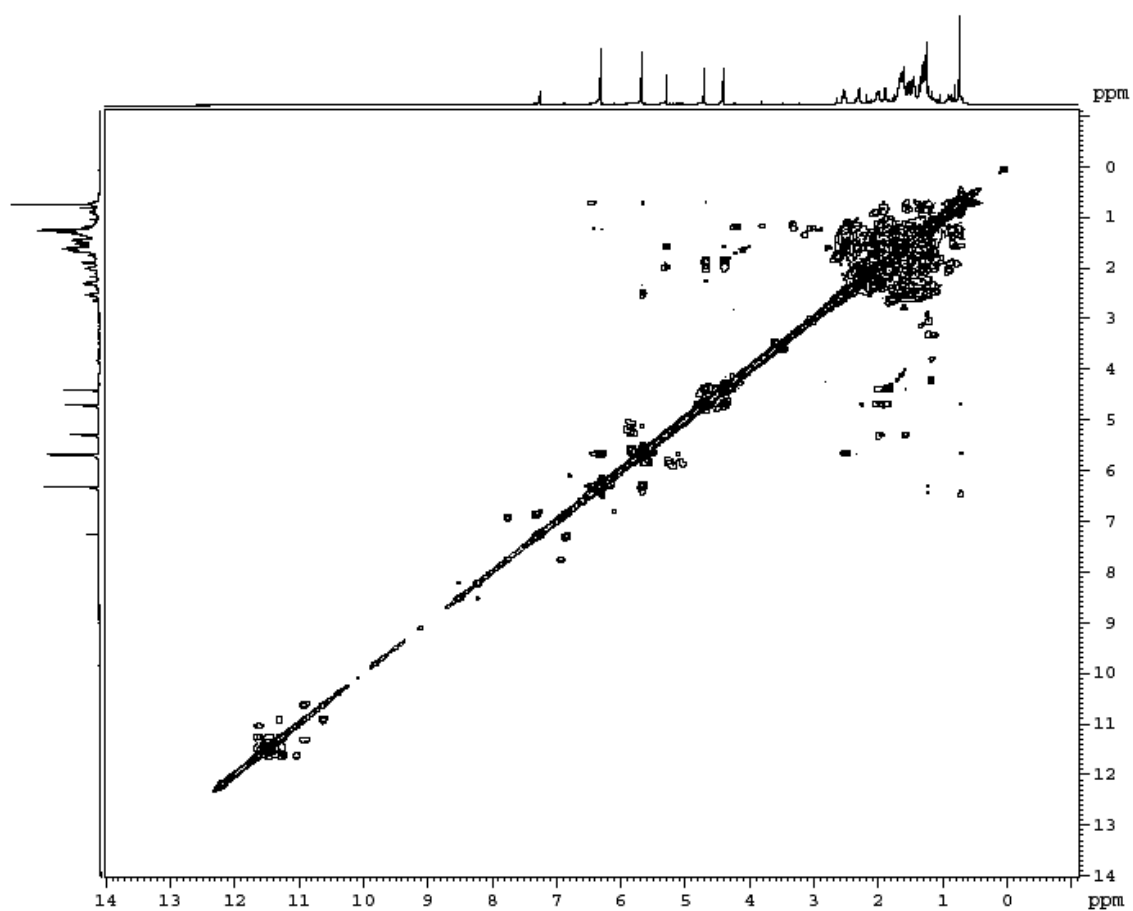
$^{13}\text{C}$  NMR of costic acid



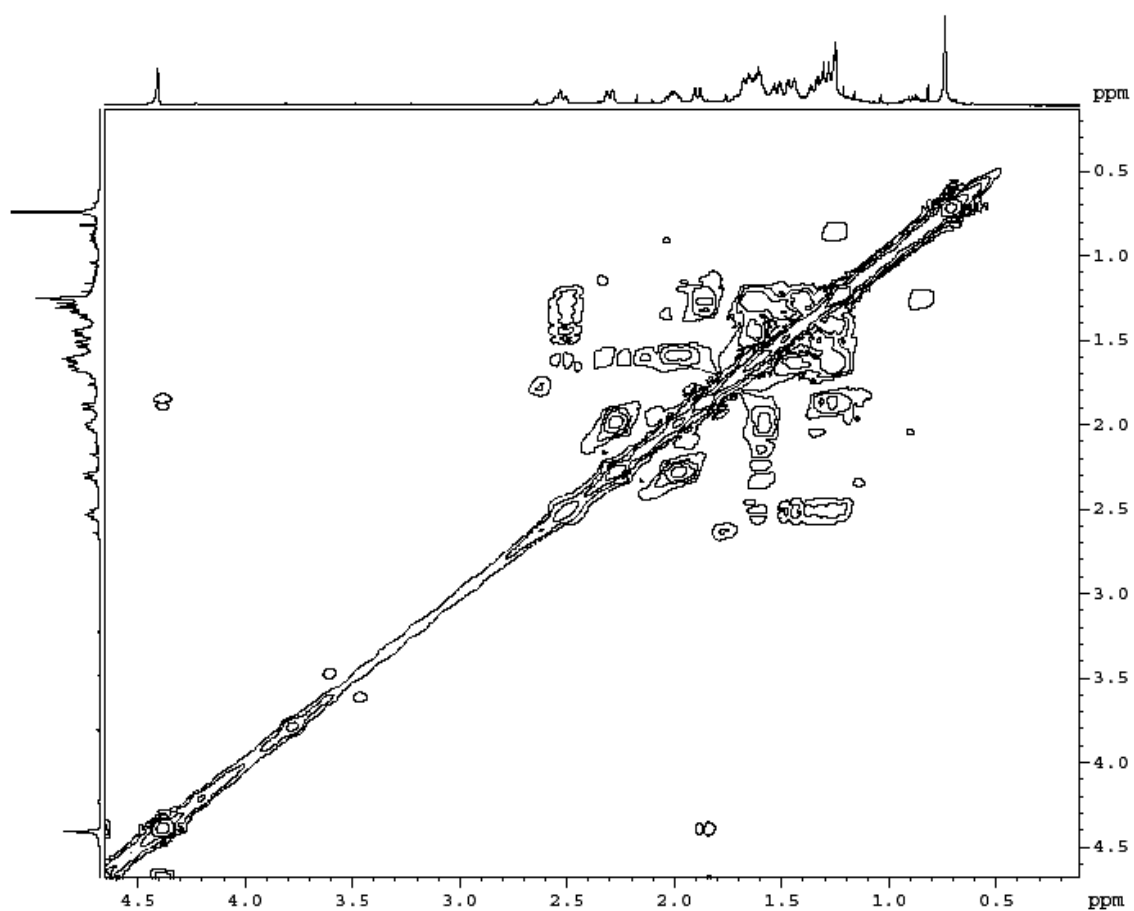
DEPT 45°, 90° and 135° spectra of cistic acid



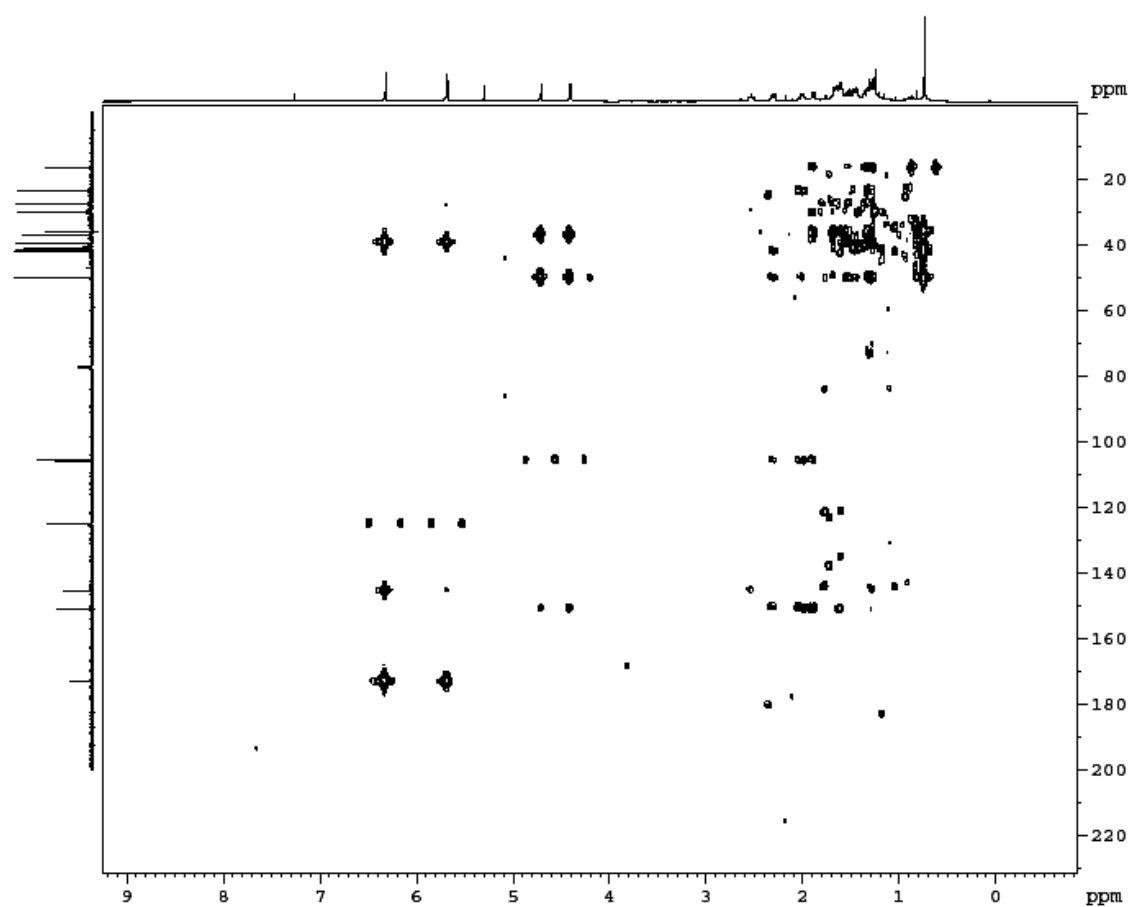
# COSY spectrum of costic acid



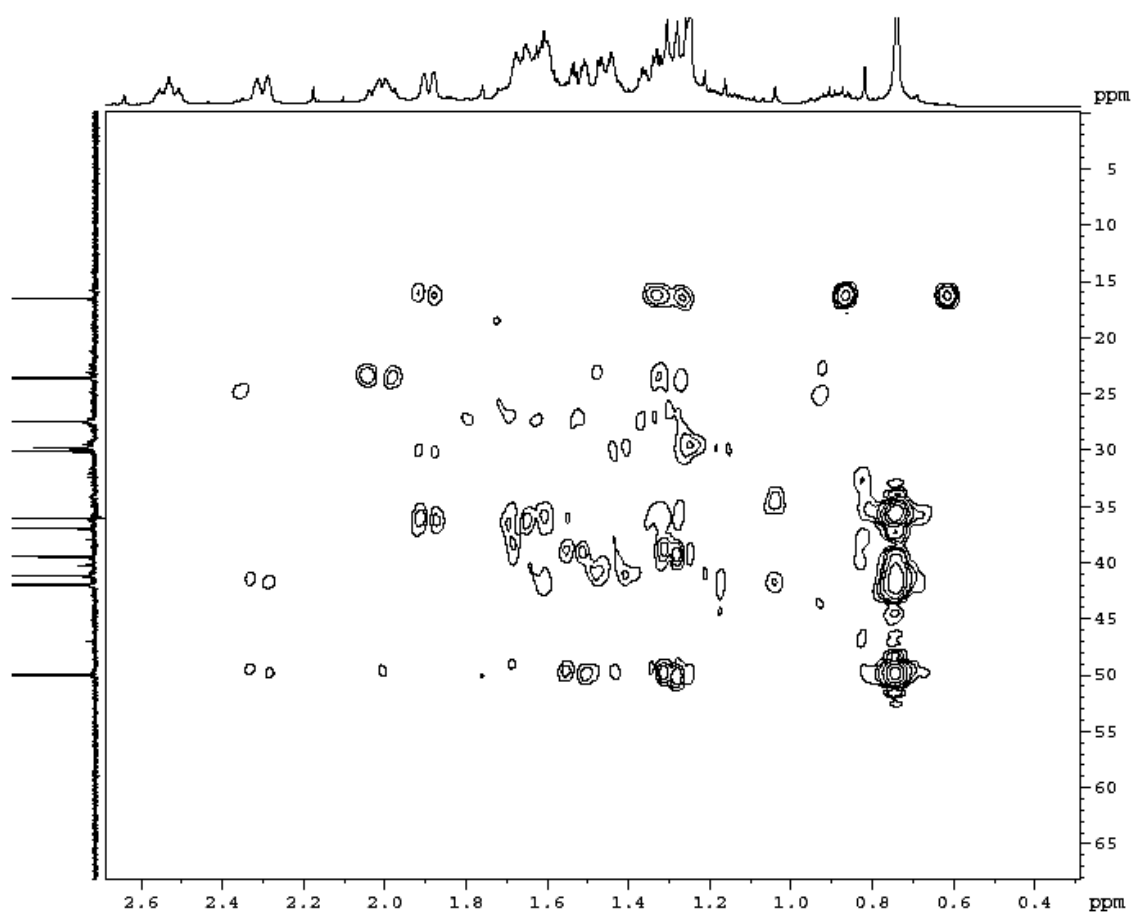
COSY spectrum of costic acid (0.0–4.5 ppm)



# HMBC spectrum of costic acid

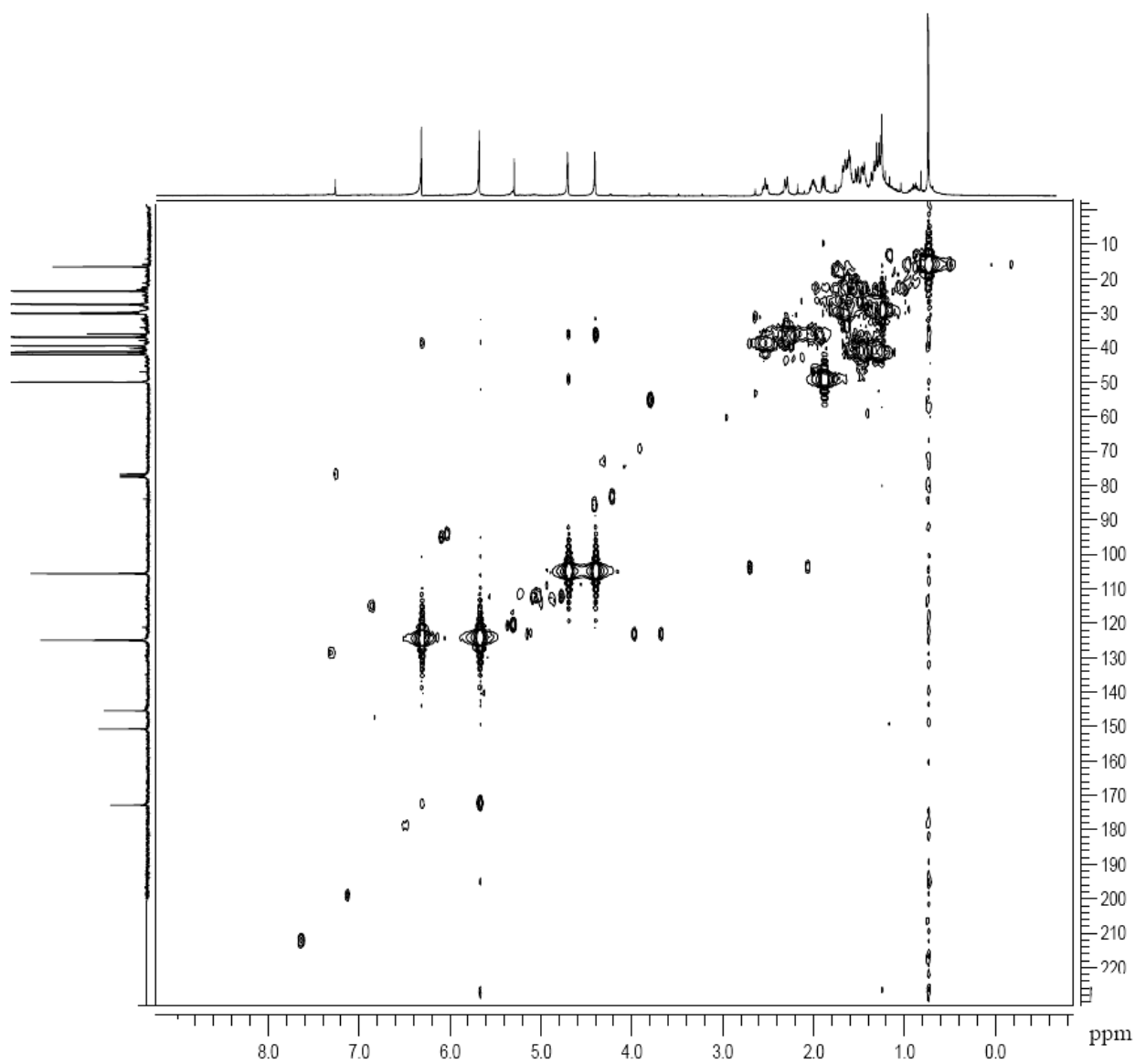


HMBC spectrum of costic acid ( $^{13}\text{C}$ : 0–65 ppm;  $^1\text{H}$ : 0.0–2.6 ppm)

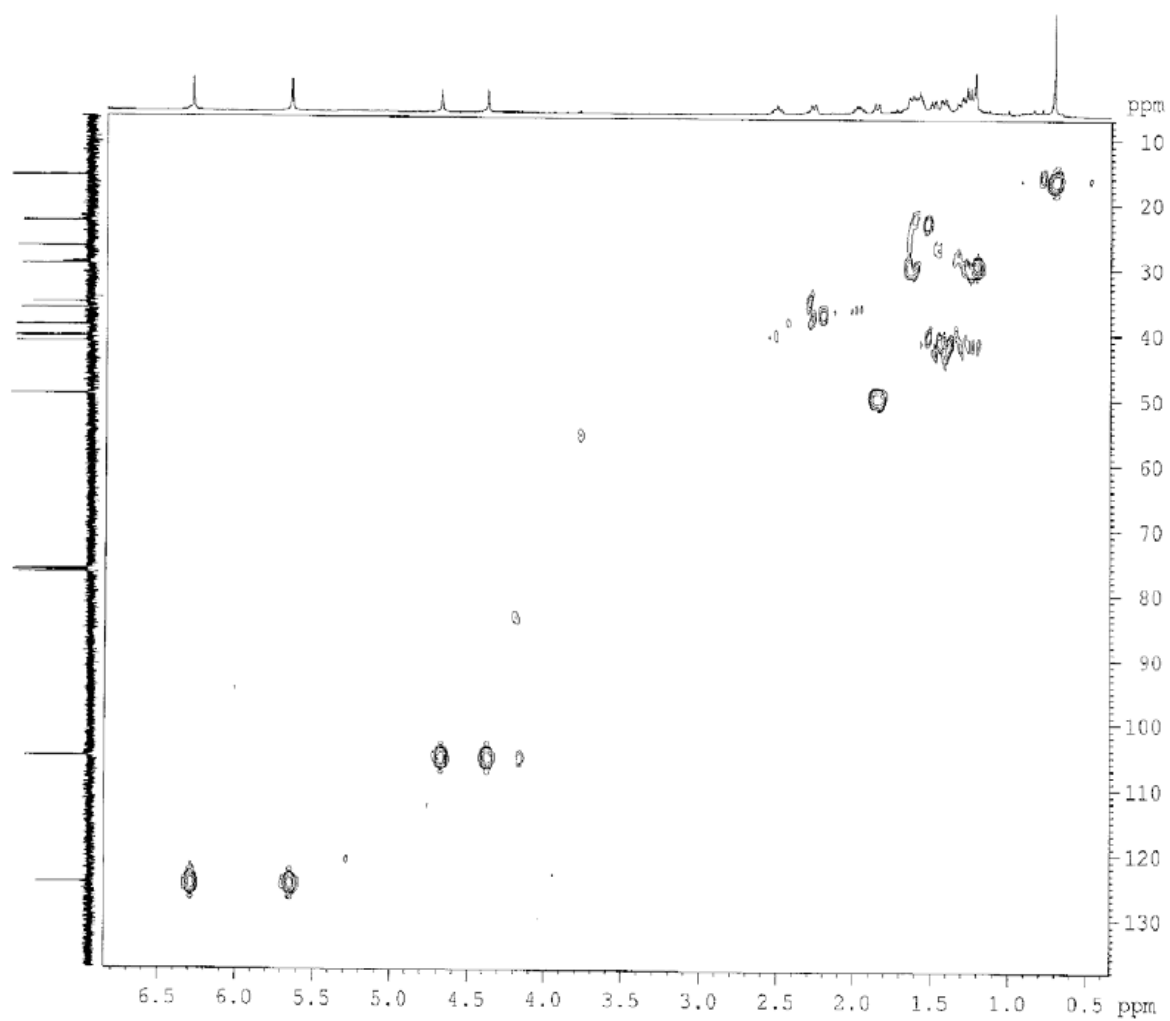




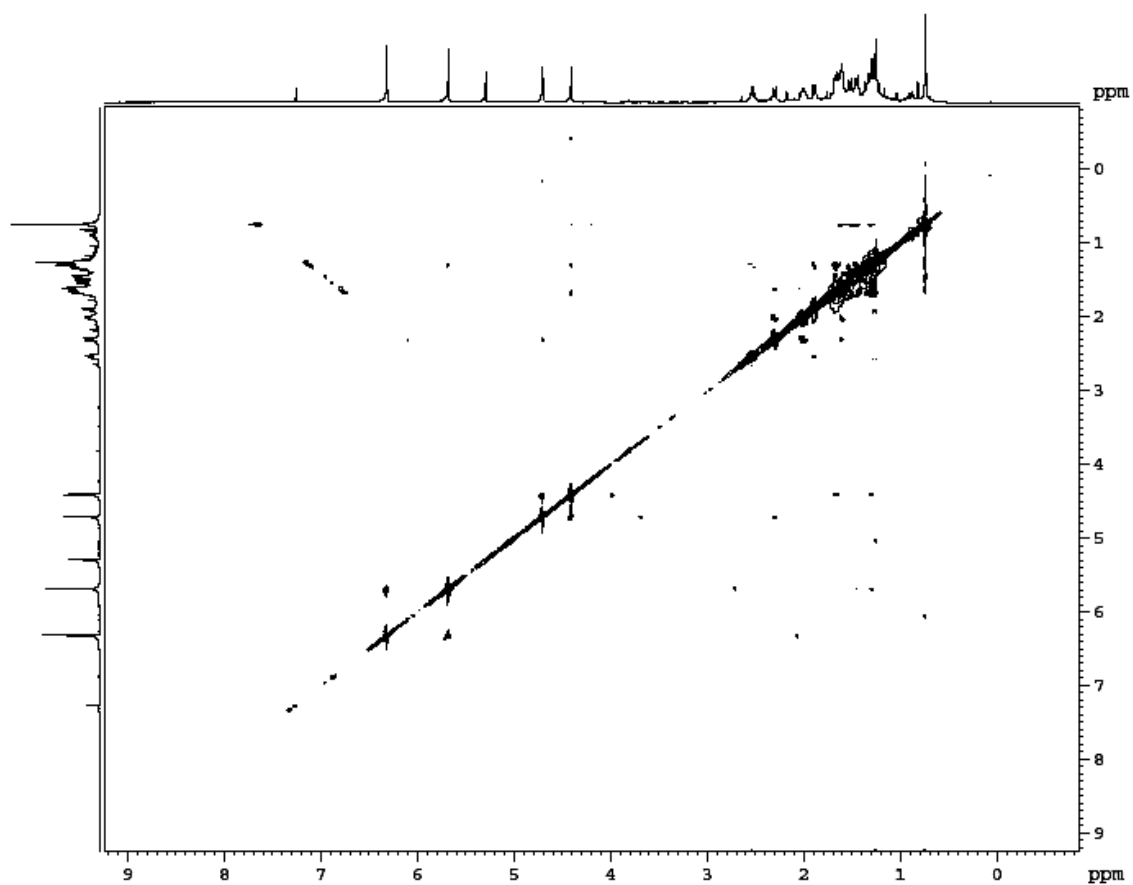
HSQC spectrum of costic acid



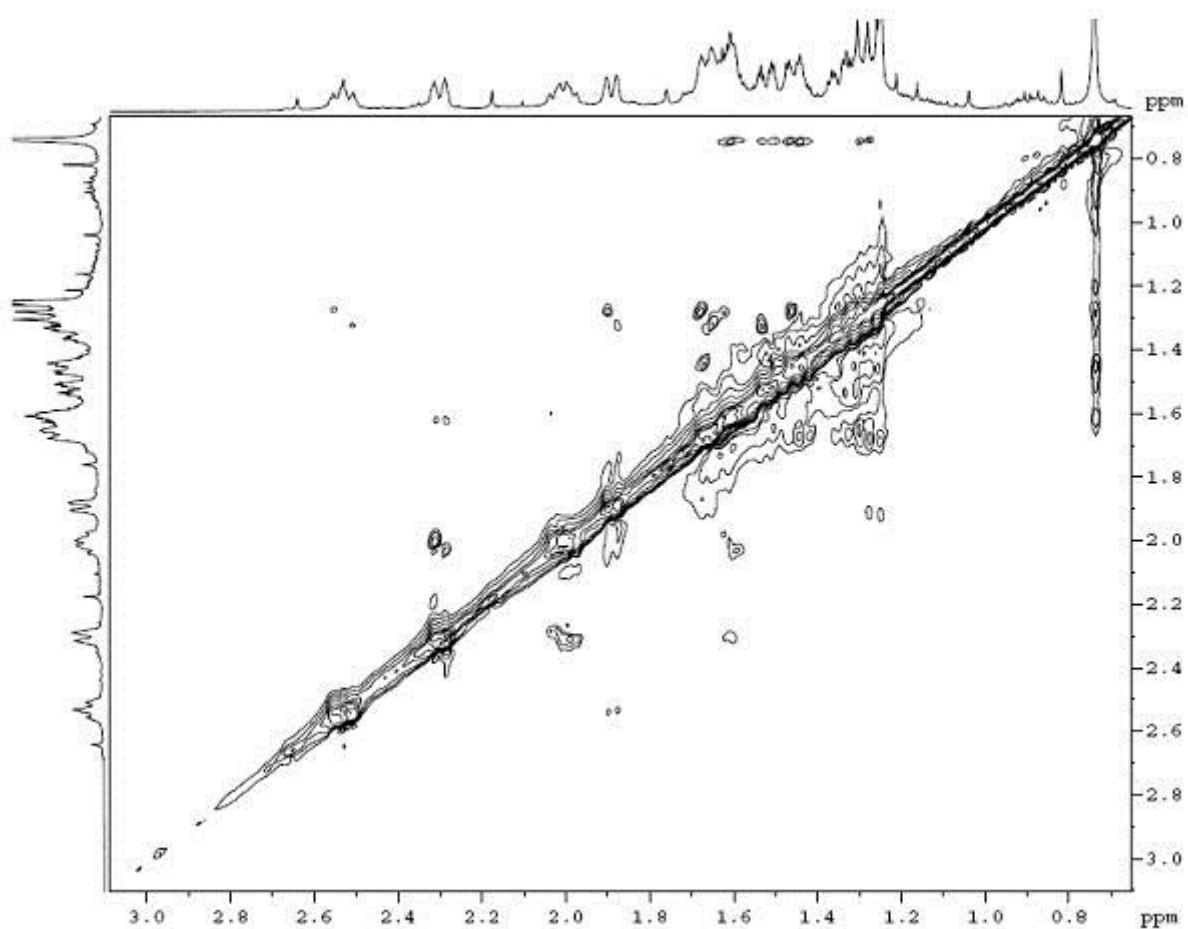
HSQC spectrum of costic acid ( $^{13}\text{C}$ : 0–65 ppm;  $^1\text{H}$ : 0.0–2.6 ppm)



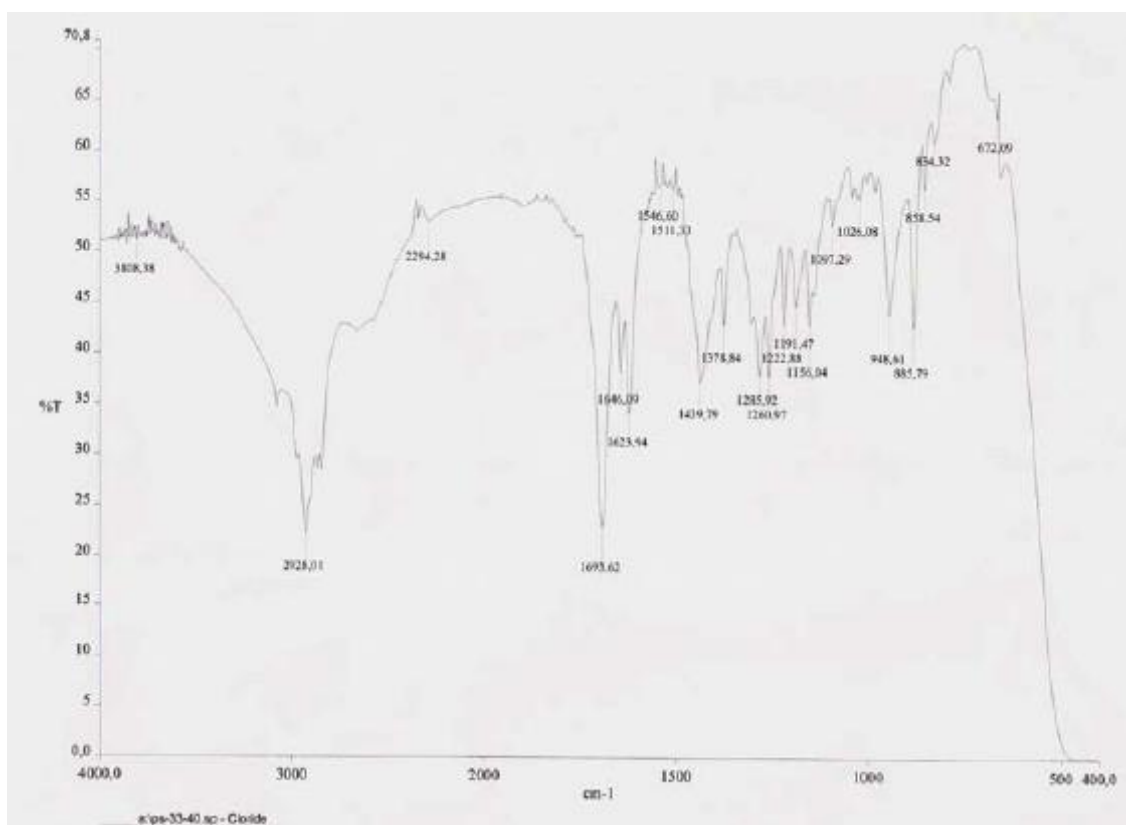
NOESY spectrum of costic acid



NOESY spectrum of costic acid (0.7–3.1 ppm)



# FTIR spectrum of costic acid



# Mass spectrum of costic acid

