

CHROM. 7092

## Note

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### Quantitative gas chromatographic determination of the major alkaloids in gum opium

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A rapid gas chromatographic method for the simultaneous and quantitative determination of codeine, morphine, thebaine, papaverine and narcotine has been developed. These alkaloids are completely separated on a column packed with a 50:50 mixture of OV-17 and SE-30. The standard deviation of the method for the individual alkaloids is between 0.05 and 0.18%.

### MATERIALS AND METHODS

#### *Materials*

OV-17 phenylmethyl silicone (50% phenyl) on 80–100 mesh Varaport 30 from Varian Aerograph, Palo Alto, Calif., U.S.A. SE-30 silicone gum rubber on Chromosorb W (AW, DMCS) from Perkin-Elmer, Norwalk, N.J., U.S.A. Resmethrin [(±)*cis,trans*-(5-benzyl-3-furyl)-methyl 2,2-dimethyl-3-(2-methylpropenyl)-cyclopropane-carboxylate] from S. B. Penick & Co. Didecyl phthalate from Eastman-Kodak, Rochester, N.Y., U.S.A. Analytical standards (codeine, morphine, thebaine, papaverine and narcotine) purified samples from S. B. Penick & Co.

#### *Extraction of alkaloids from gum opium*

A sample of opium was cooled for several hours at  $-10^{\circ}$  and then powdered with a mortar and pestle. 1 g of the powdered gum opium was placed in an erlenmeyer flask containing 30 ml of water, 1.0 g of isoascorbic acid and 50 mg of sodium hydrosulfite. The flask was placed on a reciprocating shaker for 2 h and the contents were then filtered through a small (1/8 in.) bed of filter aid. After washing the filter cake with  $3 \times 5$  ml of a 0.25 *M* aqueous solution of isoascorbic acid, the insoluble resins were scraped off the filter aid and returned to the erlenmeyer flask. This material was extracted two additional times using the above procedure. To the combined filtrates and washes were added 10 g of sodium chloride and 50 ml of a chloroform–isopropyl alcohol mixture (85:15). The mixture was heated to  $50^{\circ}$  and the pH adjusted to 8.8 with 10% ammonium hydroxide. The layers were separated and the aqueous phase re-extracted with  $3 \times 40$  ml of chloroform–isopropyl alcohol (85:15). The combined organic extracts were washed once with 10 ml of water. This water phase was re-extracted with 10 ml of chloroform–isopropyl alcohol (85:15). The

combined organic phase was evaporated *in vacuo* and the residue prepared for gas chromatography as described below.

#### *Preparation of sample*

The above residue was quantitatively transferred, with the aid of a methanol-chloroform (25:75) solvent mixture to a 25-ml volumetric flask containing 50 mg of didecyl phthalate and 25 mg of resmethrin (internal standards). The mixture was warmed slightly to effect solution, cooled to room temperature and diluted to 25 ml with the above solvent mixture.

#### *Preparation of standard solution and determination of response factor*

The following materials were accurately weighed into a 25-ml volumetric flask: codeine (35 mg), morphine (125 mg), thebaine (60 mg), papaverine (50 mg), narcotine (70 mg), resmethrin (12 mg) and didecyl phthalate (25 mg). The mixture was dissolved in and diluted to 25 ml with a methanol-chloroform (25:75) mixture. The response factor for each of the alkaloids was obtained in the usual manner.

#### *Instrument and operating conditions*

A Perkin-Elmer Model 881 gas chromatograph equipped with hydrogen flame ionization detector, Leeds and Northrup Speedomax W recorder and Hewlett-Packard Digital Integrator 3373B was employed.

A glass spiral chromatographic column (Perkin-Elmer 008-1285) 6 ft. in length with an internal diameter of 0.08 in. was used. The column was packed with a 50:50 mixture of 3% OV-17 on 80-100 mesh Varaport 30 and 5% SE-30 on 80-100 mesh Chromosorb W (AW, DMCS).

The operating conditions were: injector temperature, 310°; oven temperature,

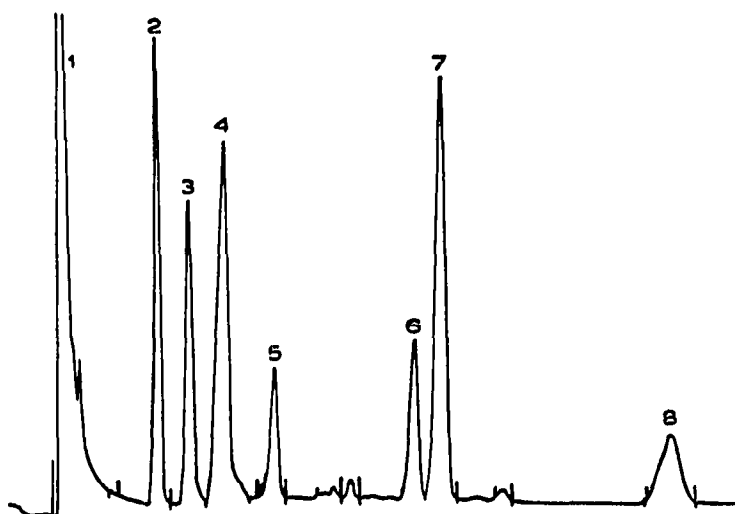


Fig. 1. GLC analysis of opium alkaloids. 1= Solvent; 2= resmethrin (internal standard) ( $t_R$ = 2.72 min); 3= codeine ( $t_R$ = 3.51 min); 4= morphine ( $t_R$ = 4.25 min); 5= thebaine ( $t_R$ = 7.63 min); 6= papaverine ( $t_R$ = 9.15 min); 7= didecyl phthalate (internal standard) ( $t_R$ = 9.80 min); 8= narcotine ( $t_R$ = 15.65 min).

TABLE I  
PERCENTAGE ALKALOIDS IN GUM OPIUM

Values were calculated using resmethrin (A) or didecyl phthalate (B) as internal standard.

Determination	Codeine		Morphine		Thebaine		Papaverine		Narcotine	
	A	B	A	B	A	B	A	B	A	B
1	3.50	3.46	9.79	9.89	2.21	2.20	2.27	2.27	5.93	5.67
2	3.54	3.55	9.40	9.66	2.51	2.13	2.22	2.26	5.69	5.85
3	3.52	3.57	9.39	9.77	2.29	2.35	2.18	2.24	5.75	5.59
4	3.60	3.55	9.28	9.37	2.37	2.15	2.24	2.24	5.49	5.61
5	3.54	3.64	9.77	9.56	2.57	2.19	2.16	2.25	5.77	5.93
6	3.63	3.47	9.26	9.59	2.32	2.33	2.37	2.30	5.76	5.50
7	3.50	3.46	9.24	9.74	2.49	2.28	2.30	2.28	5.67	5.91
8	3.34	3.49	9.56	9.39	2.35	2.27	2.11	2.22	5.77	5.93
9	3.53	3.54	9.54	9.45	2.31	2.16	2.27	2.28	5.76	5.59
10	3.54	3.56	9.45	9.86	2.26	2.11	2.22	2.25	5.53	5.72
11	3.55	3.58	9.31	9.88	2.26	2.30	2.23	2.26	6.07	5.66
12	3.56	3.46	9.31	9.76	2.30	2.21	2.22	2.26	6.10	5.64
Average	3.53	3.53	9.47	9.64	2.35	2.22	2.23	2.26	5.77	5.72
S.D.	0.05	0.05	0.17	0.18	0.09	0.07	0.05	0.02	0.16	0.13

programmed at 250° for 5 min followed by increasing the temperature to 280° at a rate of 48°/min; detector temperature, 270°; flow-rate of carrier gas (helium), 30 ml/min; hydrogen pressure, 10 p.s.i.g.; air pressure, 40 p.s.i.g.

## DISCUSSION

Several gas-liquid chromatographic (GLC) methods have been developed for opium alkaloids<sup>1-5</sup>. Similar GLC procedures are in use for biological fluids, toxicology, and illicit drug screening<sup>6-10</sup>. Most of the procedures use silylated or acetylated derivatives for the opium alkaloids. We have found that these alkaloids can be chromatographed without derivatization on a mixed column of SE-30 and OV-17.

Fig. 1 depicts a typical chromatogram. Both resmethrin and didecyl phthalate have been found to be excellent internal standards. The reproducibility of the GLC analysis is illustrated in Table I. Values in columns A and B were calculated using resmethrin and didecyl phthalate, respectively, as the internal standards.

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