

CHROM. 15,617

Note

Determination of organic ionic compounds by liquid chromatography with indirect photometric detection*

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(Received August 12th, 1982)

In a recent paper Small and Miller¹ used an aromatic counter-ion in an ion-exchange mode with an ultraviolet (UV) detector to determine ionic species. This technique, which has been named indirect photometric chromatography (IPC), was later used by Larson and Pfeiffer² for the determination of UV-transparent quaternary ammonium salts. This paper describes the application of the IPC approach for the determination of a variety of other aliphatic, organic compounds.

EXPERIMENTAL

Chemicals

Distilled-in-glass acetonitrile was obtained from Burdick & Jackson Labs. (Muskegon, MI, U.S.A.) Benzyltrimethylammonium chloride obtained from Chemalog (South Plainfield, NJ, U.S.A.) Benzylamine and potassium biphthalate obtained from Aldrich (Milwaukee, WI, U.S.A.). All chemicals were reagent grade.

HPLC conditions

The liquid chromatograph used consisted of a Laboratory Data Control Constametric III pump, a Rheodyne Model 7125 injection valve equipped with a 50- μ l loop, a Perkin-Elmer LC-75 variable wavelength UV detector and Sargent Model SRG recorder.

The column used for cations was a 250 \times 4.6 mm Partisil 10 SCX (Whatman). For anions, a 250 \times 4.6 mm Partisil 10 SAX (Whatman) was used.

RESULTS AND DISCUSSION

IPC has successfully been applied to a variety of UV-transparent organic species. In Figs. 1 and 2, the separation of mixtures of alkanolamines and alkylamines, respectively, are given. In Fig. 1, benzyltrimethylammonium chloride was used as the counter-ion while benzylamine was used as counter-ion for the alkylamines.

Other examples of organic cations that have been successfully chromato-

* The methods described in this publication are the subjects of pending patents which are licensed to Dionex Corporation for commercial use.

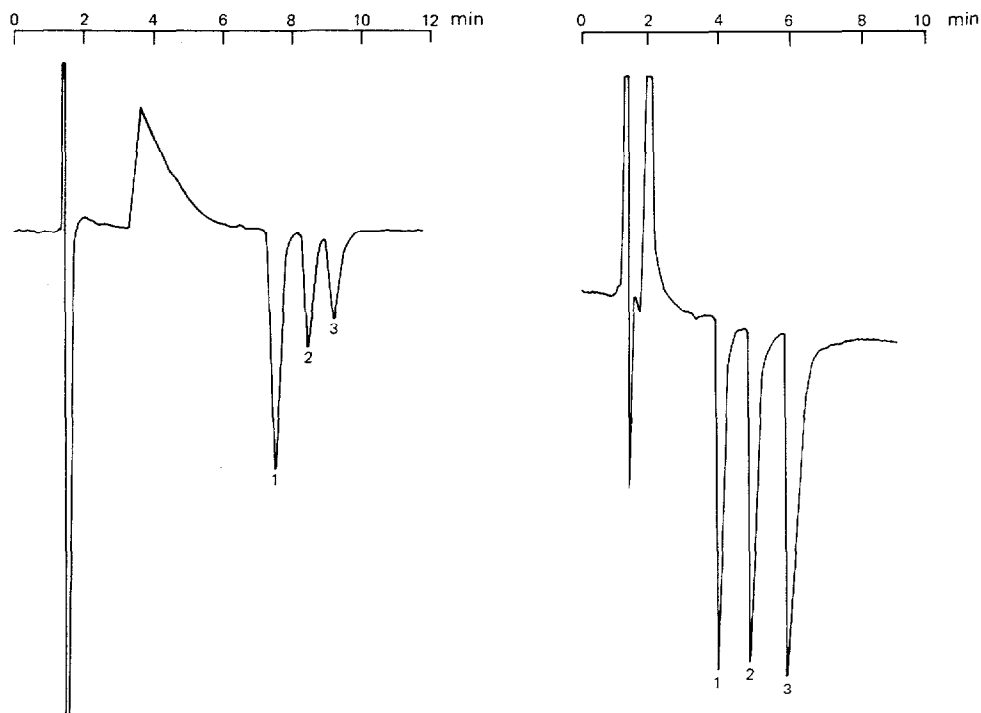


Fig. 1. Separation of monoisopropanolamine (1), diethanolamine (2), triethanolamine (3). Column: 250×4.6 mm Partisil 10 SCX. Mobile phase: acetonitrile-water (70:30) with $0.01 M$ benzyltrimethylammonium chloride and 1% acetic acid, $\text{pH} = 3.9$; flow-rate, 2.0 ml/min. Detection: UV at 268 nm and 0.16 a.u.f.s. Injection: $50 \mu\text{l}$ of 1.0 mg/ml of each alkanolamine in acetonitrile-water (70:30).

Fig. 2. Separation of tributylamine (1), dibutylamine (2), butylamine (3). Column: 250×4.6 mm Partisil 10 SCX. Mobile phase: acetonitrile-water (60:40) with $0.02 M$ benzylamine and 1% acetic acid, $\text{pH} = 5.0$; flow-rate, 2.0 ml/min. Detection: UV at 266 nm and 0.08 a.u.f.s. Injection: $50 \mu\text{l}$ of each alkylamine in acetonitrile-water (60:40).

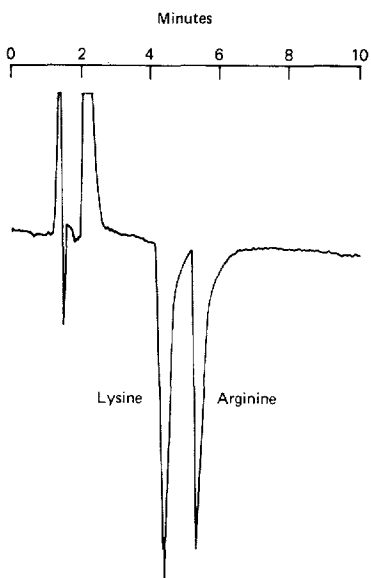


Fig. 3. Separation of lysine, arginine. Mobile phase: acetonitrile-water (10:90) with $0.01 M$ benzyltrimethylammonium chloride and 1% acetic acid, $\text{pH} = 3.9$. Other conditions as in Fig. 1.

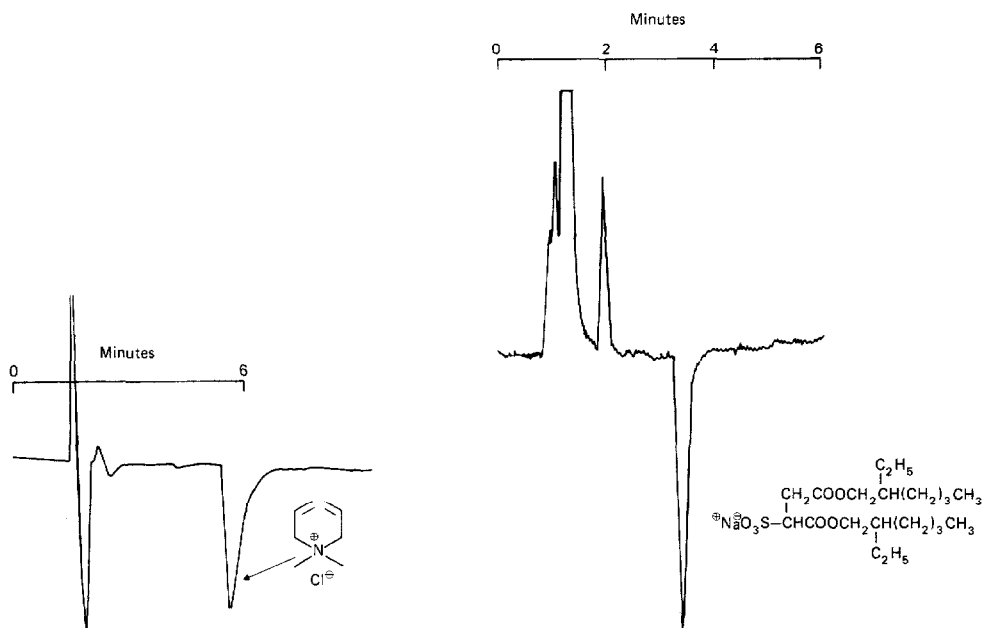


Fig. 4. IPC chromatogram of 2.5 mg/ml dimethyldiallylammonium chloride. Mobile phase: acetonitrile-water (25:75) with 0.025 *M* benzyltrimethylammonium chloride and 1% acetic acid. Detection: UV at 270 nm and 0.16 a.u.f.s. Other conditions as in Fig. 1.

Fig. 5. IPC chromatogram of 2.5 μ g of sodium dioctyl sulfosuccinate. Column: 250 \times 4.6 mm Partisil 10 SAX. Mobile phase: acetonitrile-water (60:40) with 0.0025 *M* potassium biphthalate and 1% acetic acid, pH = 5.0; flow-rate, 2.0 ml/min. Detection: UV at 293 nm and 0.04 a.u.f.s. Injection: 50 μ l of 48- μ g/ml sample in mobile phase.

graphed are shown in Fig. 3 and Fig. 4. Since amino acids (Fig. 3) are often present in complex mixtures, IPC with detection at higher UV wavelengths may have advantages over conventional UV detection at low wavelength.

As illustrated in Fig. 5, organic anions can also be determined by IPC. The sensitivity of IPC is also demonstrated as the peak obtained corresponds to 2.5 μ g of sodium dioctyl sulfosuccinate for a detection limit of 0.2 μ g.

CONCLUSION

Indirect Photometric Chromatography is a sensitive method for determination of UV-transparent organic cations and anions. No special equipment is required for this method, which should be applicable to a wide variety of organic ionic compounds previously considered photometrically undetectable. This approach should be especially useful for the determination of ionic organic compounds in complex matrices because of the selectivity of ion-exchange columns for ionic compounds.

REFERENCES

- 1 H. Small and T. E. Miller, *Anal. Chem.*, 54 (1982) 462.
- 2 J. R. Larson and C. D. Pfeiffer, *Anal. Chem.*, 55 (1983) 393.