

**Tabelle 1.** Gleichzeitige Bestimmung von Bor, Chlorid, Bromid und Iodid in verschiedenen Oberflächenwässern durch MS-IVA

Wasserprobe	Gehalt			
	B (ng/g)	Cl <sup>-</sup> (µg/g)	Br <sup>-</sup> (ng/g)	I <sup>-</sup> (ng/g)
Weiber (Sarching)	20,8 ± 0,1	89,7 ± 1,8	121,3 ± 0,4	2,69 ± 0,10
Weiber (Schwetzendorf)	20,1 ± 1,1	48,2 ± 0,4	24,2 ± 0,6	0,85 ± 0,27
Kleiner Fluß (Schwarze Laaber)	45,4 ± 1,3	22,2 ± 0,4	16,9 ± 0,5	0,84 ± 0,16
Fluß (Donau)	54,8 ± 0,7	19,0 ± 0,1	7,4 ± 0,6	12,0 ± 1,6
Nachweisgrenze	0,2	0,005	0,5	0,3

wie von Chevallier-Haaf u. a. [6] werden mit photometrischen Methoden für Bor 16 ng/g bzw. 1 ng/g als Nachweisgrenze angegeben, so daß damit das Nachweisvermögen des in dieser Arbeit beschriebenen Verfahrens noch etwas günstiger liegt. Entsprechend den natürlichen Gehalten dürften so mit der MS-IVA die Bor-, Chlorid-, Bromid- und Iodidkonzentrationen der meisten Wasserproben bestimmbar sein.

*Danksagung.* Der Deutschen Forschungsgemeinschaft und dem Fonds der Chemischen Industrie danken wir für die finanzielle Unterstützung.

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Eingegangen am 15. Juli 1987

*Fresenius Z Anal Chem* (1987) 329:485–486  
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## Comments on the use of liquid-membrane electrodes for potentiometric titrations\*

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### Bemerkungen zur Verwendung von Flüssig-Membran-Elektroden für potentiometrische Titraktionen

In the recent literature there appear several papers dealing with the use of coated-wire or liquid-membrane electrodes in potentiometry [1–4]. In two of these [1, 4] the electrode matrix is based on poly(vinyl chloride), using a plasticizer as well as an electroactive substance. The latter usually is a compound which forms an ion-association complex with the ion to be determined. For the *direct* potentiometric measurement (based on Nernstian or near-Nernstian relationship between log concentration and emf) of an ion, such a material is required for ensuring adequate

selectivity of the membrane. However, we should like to point out that for *potentiometric* titrations no such material is required. Graphite or aluminium rods coated with a solution of poly(vinyl chloride) and a plasticizer in tetrahydrofuran make rugged and inexpensive sensors. The plasticizer used by us is dioctylphthalate [5] while Vytras [6] has recommended 2-nitrophenyl octylether. These sensors have been used in potentiometric precipitation titrations using titrants such as tetraphenylborate, 1,2,4,6-tetraphenylpyridinium acetate, as well as various cationic and anionic surfactants including cetylpyridinium chloride and sodium dodecylsulfate.

The work on potentiometric titrations based on ion-pair formation has been admirably reviewed recently [6]. Many workers seem to be unaware of this review and of the fact that no electroactive material is necessary in the liquid-membrane for satisfactory response in potentiometric titrations.

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Received June 29, 1987

\* Work performed under the auspices of the U. S. Department of Energy by the Lawrence Livermore National Laboratory under contract number W-7405-ENG-48

*Fresenius Z Anal Chem* (1987) 329:486  
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