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CITP analysis of aminopolycarboxylic acids

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Abstract

This contribution concerns the analytical procedure of industrial samples of aminopolycarboxylic acids by means of capillary izotachophoresis (CITP).

Keywords: electromigration techniques, separation, aminopolycarboxylic acids

Introduction

CITP is an analytical electromigration technique which enables ion's separation based on their different mobilities and it can be used for determination of ionic analytes. A polyamino carboxylic acid (complexone) is a compound containing one or more nitrogen atoms connected through carbon atoms to one or more carboxyl groups. Polyamino carboxylates, which have lost acidic protons, form strong complexes with metal ions by donation of electron pairs from the nitrogen and oxygen atoms to the metal ion to form multiple chelate rings. This property makes polyamino carboxylic acids useful in a wide variety of chemical, medical and environmental applications (Anderegg et al. 2005). The goal of this work was to verify the possible application of this technique for the migration study of zwitterionic compounds and their determination in a mixture and in industrial samples.

Materials and Methods

Method optimization for separation and determination of analytes were carried out on electrophoretic equipment EA 102 (Villa Labeco, Spišská Nová Ves, Slovakia) on PTFE capillary (diameter 0.3 mm, length 90 mm) joined with conductivity detector under laboratory temperature. Compounds (injection 30 μl) were analyzed in the following system: 20 mM HCl + glycylglycine (leading electrolyte, pH = 3.1), 20 mM acetic acid + NH_3 (terminating electrolyte, pH = 4.80). 0.5% hydroxyethylcellulose solution was added in order to eliminate electroosmotic flow.

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Results and Discussion

The procedure was optimized by analysis of aminopolycarboxylates of known concentration in the mixture (Fig 1 & Fig 2). The optimal pH = 3.1 was determined by mobility measurement in region pH = 2.5–4.5 since no formation of mixed zones was observed. Detection limits of chosen analytes were determined from the calibration curves in 0.1–0.8 mM concentration region: NTA (0.058 mM), EDTA (0.052 mM), IDA (0.082 mM), glycolic acid - GlyA (0.097 mM). This new analytical procedure was employed in the analysis of real industrial samples (Syntron A, Syntron B – Draslovka, Trilon A, Trilon B – BASF, Ferrazone – Akzo Nobel).

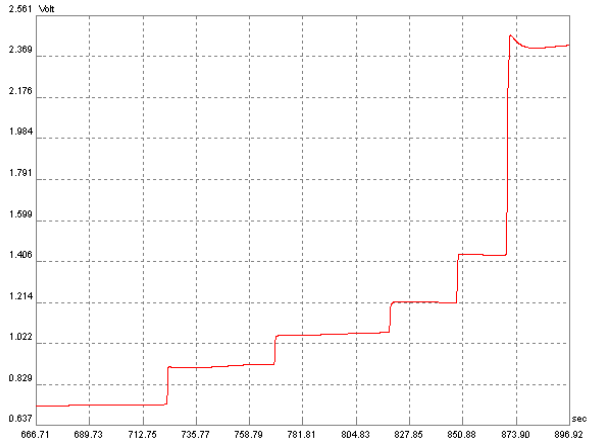

Figure 1: The ITP analysis of mixture of aminopolycarboxylates (c = 0.5 mM, left): NTA, EDTA, IDA, GlyA – the order of analytes in CITP record).

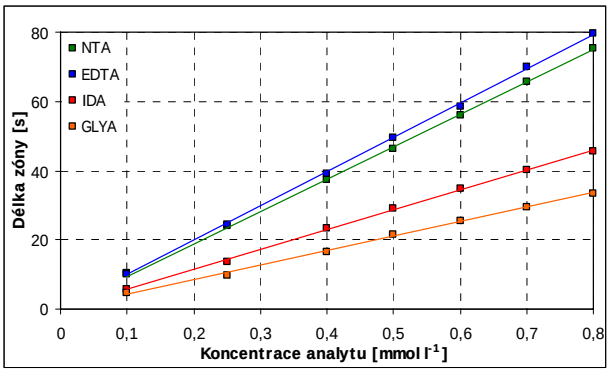

Figure 2: Calibration plots for analyzed samples

The mobilities of species of studied analyses were calculated from pH dependences and their estimates were used for simulation of ITP record (Fig 3). Comparing with experimental record (Fig 1 & Fig 2), the agreement is evident.

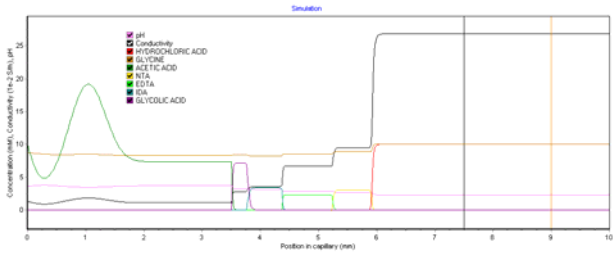

Figure 3: The CITP record of mixture of analytes (c = 4 mM) simulated by means of SIMUL v 5.0 software (Bohuslav Gaš et al. 2007).

Conclusion

This contribution is focused on optimization and determination of aminopolycarboxylic acids in industrial samples by means of CITP which is suitable alternative to other analytical methods.

Acknowledgement

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References

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