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Usefulness of Supernatant Solutions of Jellyfish for Cultivation of Ice Plant: Determination of Organic Acids in Ice-Plant Using Capillary Zone Electrohoresis

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Summary

We developed a capillary zone electrophoresis (CZE) method with direct UV detection for the determination of Cl^-, NO_2^-, NO_3^-, organic (oxalic acid, citric acid, and malic acid) and amino acids (asparatic acid and glitamic acid) in ice plants (*Mesembryanthemum crystallinum* L.). As the background electrolyte, a mixture of 20 mM disodium hydrogenphosphate adjusted to pH 10.6 and 0.001% hexadimethrine bromide (HDB) was used for the direct detection of the analytes. Calibration graphs for the analytes were linear using both the peak area (correlation coefficient, r=0.9980-0.9997) and peak height (r=0.9834-0.9998) as analytical response. The limits of detection (LODs) were 0.035-2.6 mg/l at a signal-to-noise ratio of three. The values of the relative standard deviation (RSD, n=3, intra-day) of migration time, peak area, and peak height were, respectively, 0.26-0.58%, 3.1-16%, and 2.4-13% when extracts from ice plant were analyzed. The concentrations of Cl^-, NO_2^-, NO_3^-, oxalic acid, citric acid, malic acid, asparatic acid, and glitamic acid in ice plant were 460, 3.3, 230, 230, 6.4, 1.8, 5.0, and 7.6 mg/100 g (flesh weight), respectively. The proposed method determined the above analytes for 12 min. We also developed a CZE method with direct UV detection for the determination of metal ions such as Mg^{2+}, Ca^{2+}, Mn^{2+}, Fe^{3+}, and Zn^{2+} in ice plants. The following optimum conditions were established: capillary, $L_{tot.}$=59.6 cm, $L_{det.}$=49.3 cm, 75 μm I.D.×375 μm O.D.; BGE, 75 mM sodium tetraborate containing 2 mM *trans*-cyclohexane-1,2-diaminetetraacetic acid (CyDTA) (pH 9.2); applied voltage, 20 kV with the sample inlet side as the anode; detection wavelength, 200 nm; pressure injection period of a sample, 10 s (50 nl). Calibration graphs for the analytes were linear using both the peak area (correlation coefficient, r=0.9970-0.9985) and peak height (r=0.9961-0.9999) as analytical response. The LODs were 0.051-0.16 mg/l. When extracts from ice plant were analyzed, the RSDs for migration time were 0.42-0.50%; the RSDs of peak area were 1.5-5.3%; the RSDs of peak height were 2.2-12%. The proposed method determined the above analytes for 25 min. The concentrations of Mg^{2+}, Ca^{2+}, Mn^{2+}, Fe^{3+}, and Zn^{2+} in ice plant were 9.0, 15, 0.51, 0.61, and 0.21 mg/100 g, respectively. We intend to analyze ice plants cultivated with different irradiation time and different color of light using supernatant solutions of jellyfish.