Enantioseparation with Capillary Electrophoresis (CE) as Evidence of Chirality Retention during Kolbe Electrolysis of Amino Acids

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The radical Kolbe electrolysis can be applied to synthesize non-proteinogenic amino acids starting from L-glutamic acid (or L-aspartic acid, respectively). Using suitable protecting groups for both amino and carboxy functionalities, the retention of chirality at the α-carbon atom can be expected. Z-L-Norleucine was prepared by cross reaction of Z-L-glutamic acid and propionic acid. Then, the carboxylic acid protecting group was removed to obtain a charge carrier function which is necessary for a separation via CE.

Electrochemical synthesis of Z-L-norleucine via Kolbe electrolysis

β-Hydroxypropyl-cyclodextrin was used as chiral additive in the mobile phase to obtain chiral selectivity [1]. The composition of the mobile phase and other operation parameters were varied to enhance peak resolution until a baseline separation of the two enantiomers was achieved. 50 mM Boraxbuffer (pH 10.5) with 10 mM β-hydroxypropyl-cyclodextrin and 5% methanol at 20 °C and 20 kV impressed voltage turned out to be optimal convenient.

Z-L-Norleucine, obtained by Kolbe electrolysis as described above, was compared to L-norleucine and D,L-norleucine which are commercially available. Racemization could not be observed. In a further experiment, the Kolbe product was treated with aq. NaOH for about 24 hours to force racemization. In that case, Z-D-norleucine could also be detected.


Presented at the 21st Scientific Congress of the Austrian Pharmaceutical Society April 16th to April 18th 2009, Vienna, Austria.