Electromigration dispersion: theory vs. experiment[1] SANDIP
GHOSAL, ZHEN CHEN, Northwestern University — When the concentration of
sample ions in zone electrophoresis is significant compared to that of the carrier
electrolyte, axial variation of electrical conductivity along the capillary could arise.
The consequent variations of the electric field results in electromigration dispersion
of the sample peak. It has been shown (S. Ghosal and Z. Chen, Bull. Math. Biol.
2010 vol.72, pg. 2047), that, in an idealized three-ion system consisting ofthe sam-
ple ion, a co-ion and a counter-ion, all of equal diffusivity, the time evolution of
the sample concentration is governed by a single nonlinear one dimensional trans-
port equation. If the solute concentration is not too large, this equation reduces
to Burger's equation that permits exact analytical solution. In the aforementioned
analysis, ionic dissociation and recombination was neglected, so that the model only
describes systems of strong electrolytes. Here we show that the one dimensional
model derived earlier also describes electrophoresis of a solute in the presence of
a buffer consisting of a single weak acid (or base). A simple approximate formula
is derived for the number of theoretical plates in the presence of electromigration
dispersion and compared with published experimental data.

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