

Influence of magnetic and electrostatic fields on amino acids and biogenic amines retention in TLC

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Why this topic?

Chromatography:

Method based on different interactions of the chromatographed solutes with stationary phase surface and components of the mobile phase



The different interactions are caused by different properties of the solutes

physical – GPC/SEC

chemical

structure

presence of functional groups

acid/base
properties

interactions

- hydrophilic (HILIC)
- hydrophobic (HIC)
- electrostatic – (ICC)
- with metal cations - chiral chromatography, argentation chromatography
- with stationary phase - NP, RP chromatography

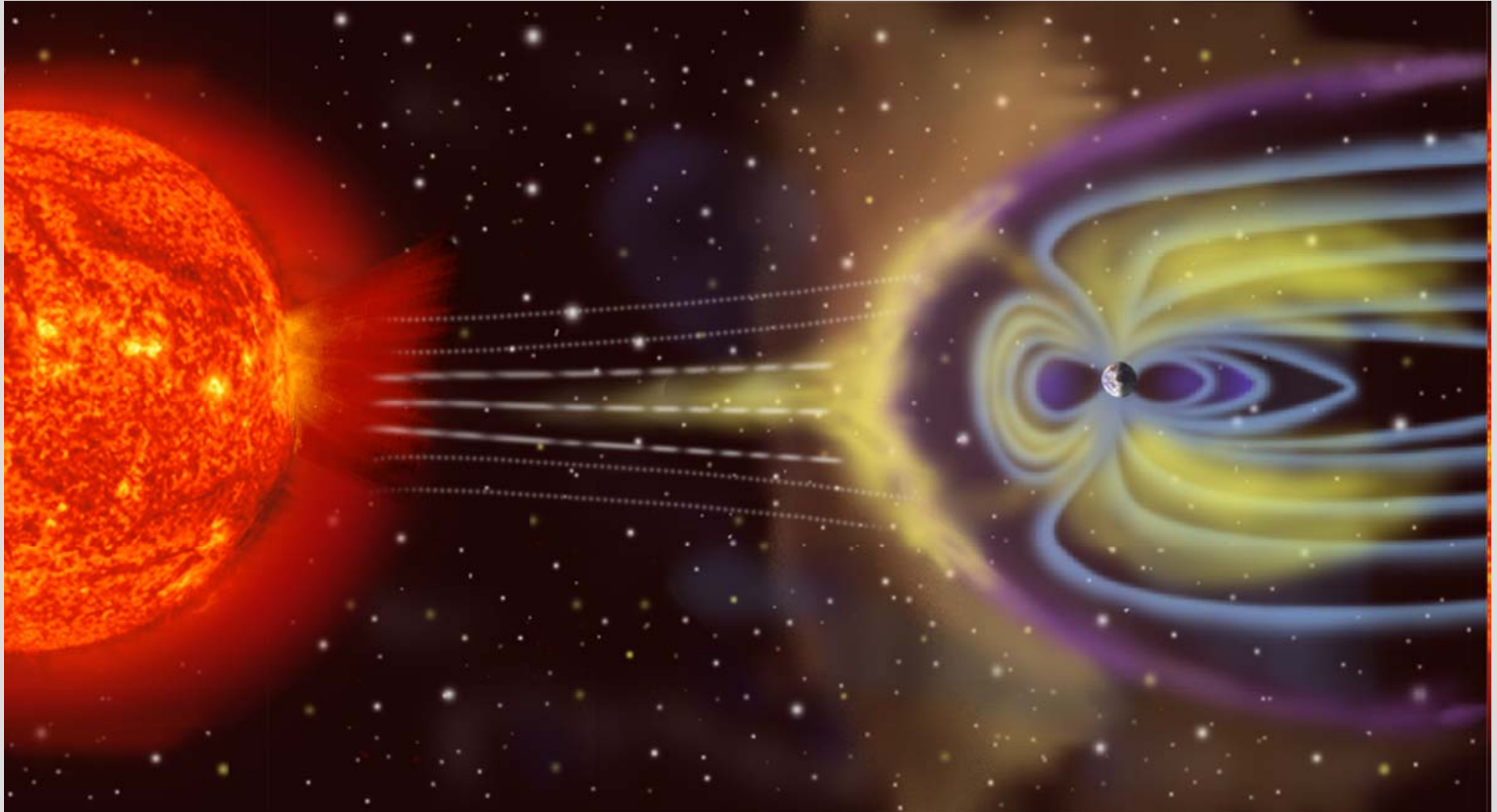
electric properties

The diagram consists of two parallel vertical flows. The left flow starts with a 3D-style box labeled 'electric properties' in black text. A green arrow points downwards from this box to a 2D-style box labeled 'polarizability' in black text. The right flow starts with a 3D-style box labeled 'magnetic properties' in blue text. A blue arrow points downwards from this box to a 2D-style box labeled 'Magnetic susceptibility' in blue text. The background is light gray with a blue and cyan decorative border at the top and bottom.

polarizability

magnetic properties

Magnetic susceptibility



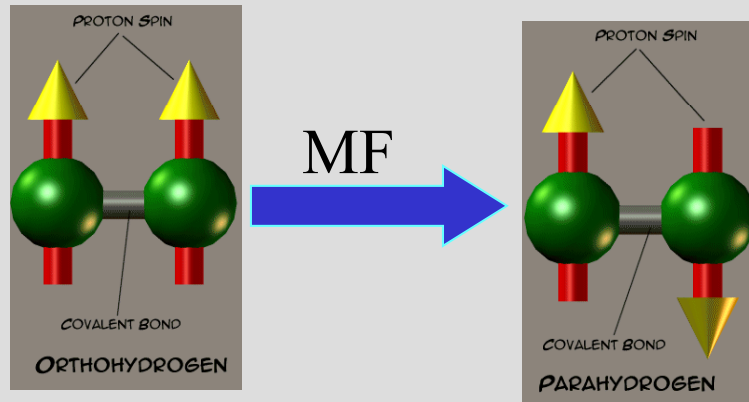
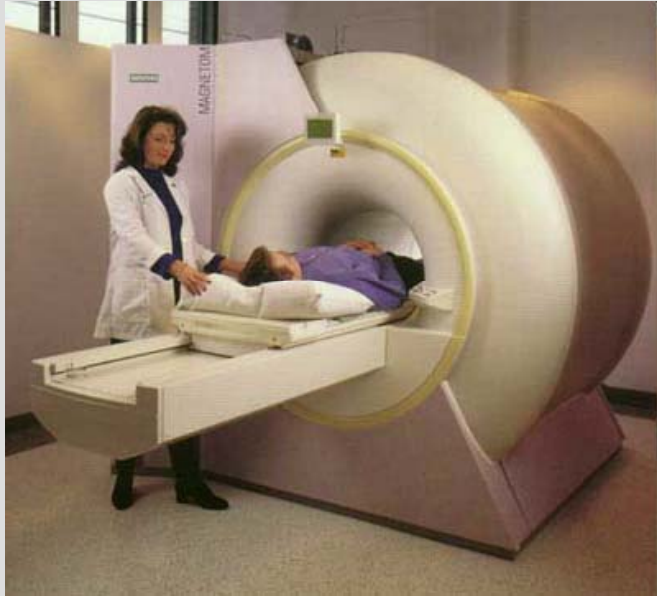


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Chromatography in electric and magnetic field

analytical

do electric or magnetic fields influence the solute retention and efficiency of chromatographic systems?

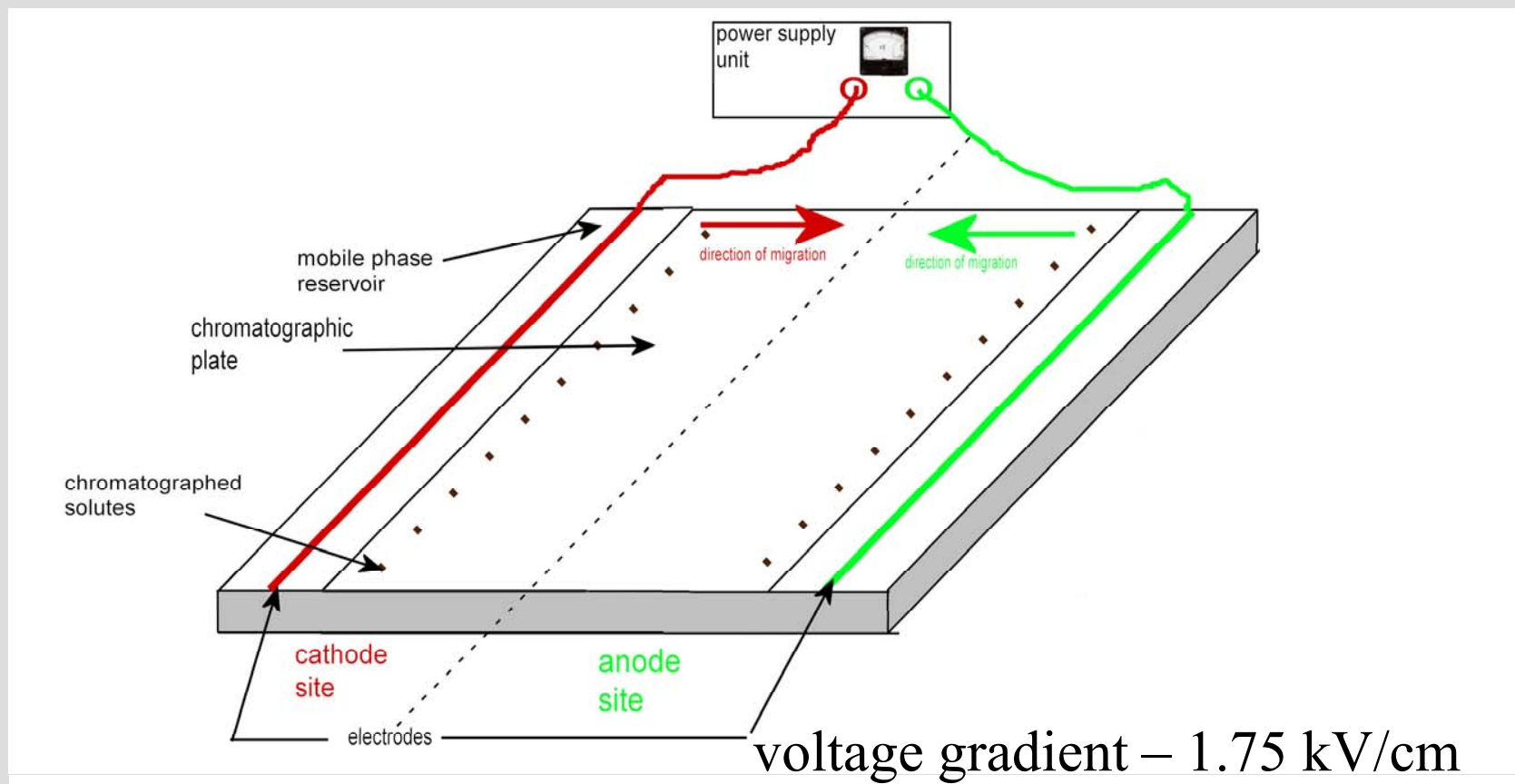
separation results?

Fundamental research

do electric or magnetic fields influence the interfacial phenomena?

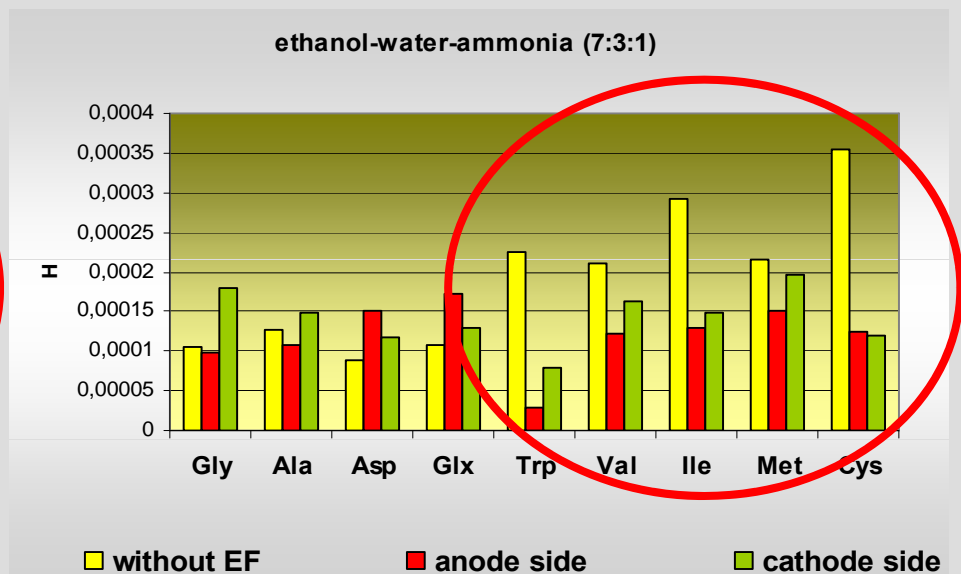
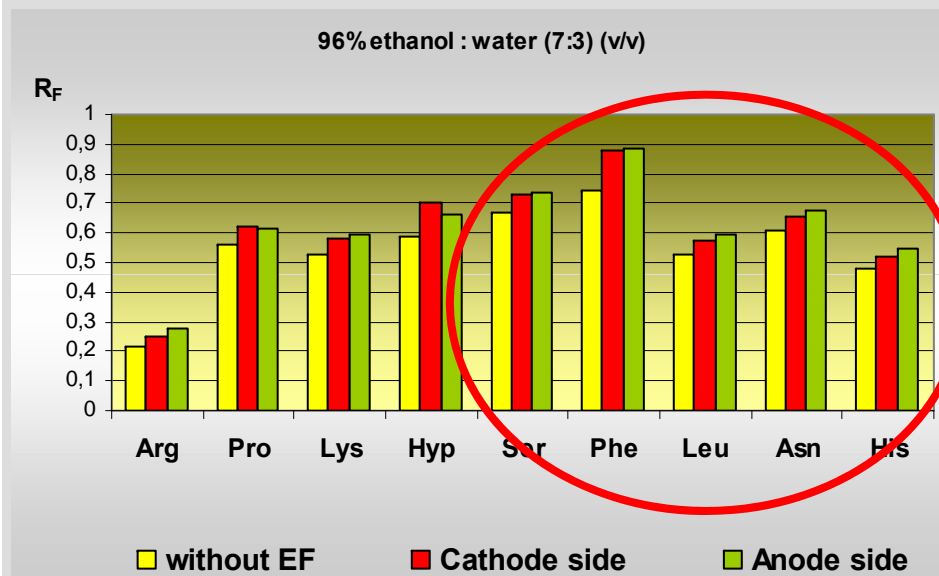
do electric or magnetic fields influence properties of solutes?

Chromatography in electric field

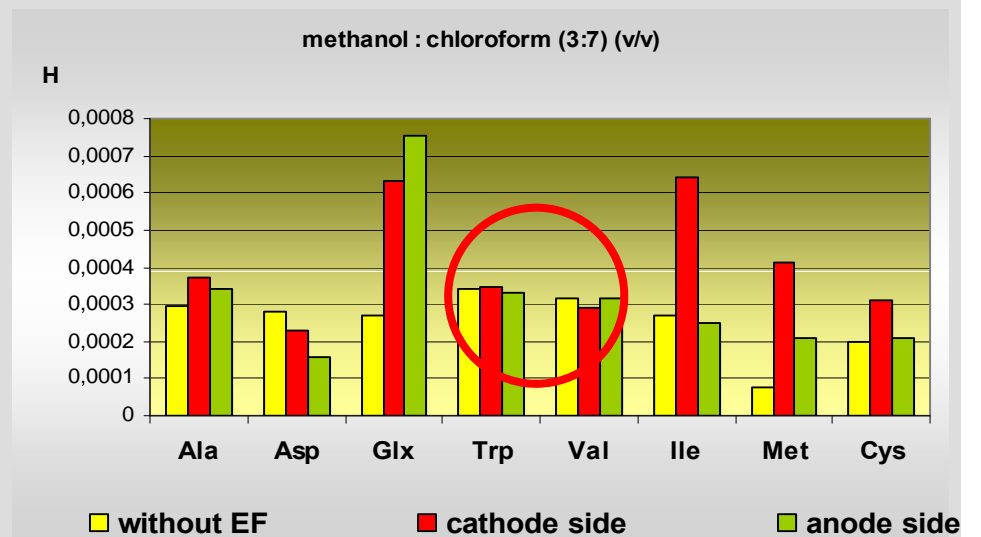
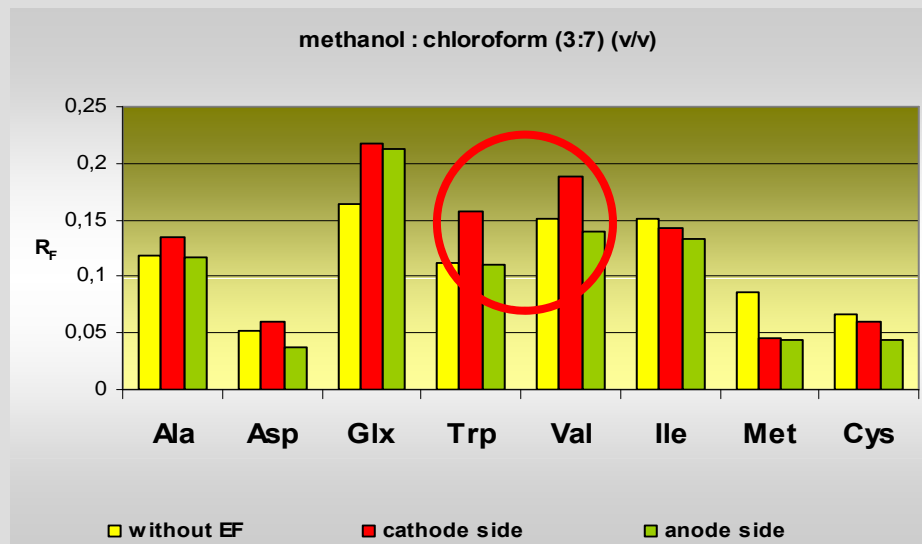


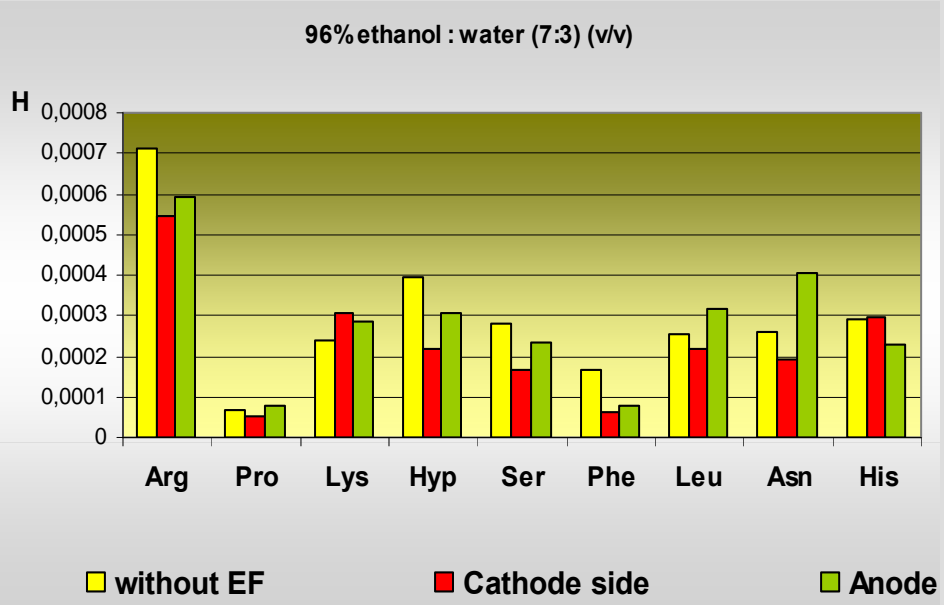
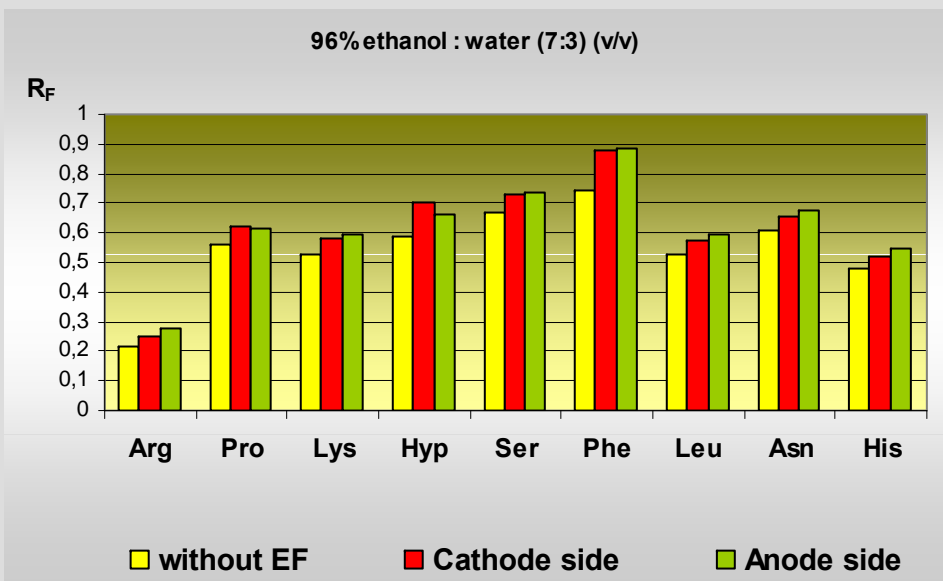
Amino acids in electric filed

Stationary phase SiO₂

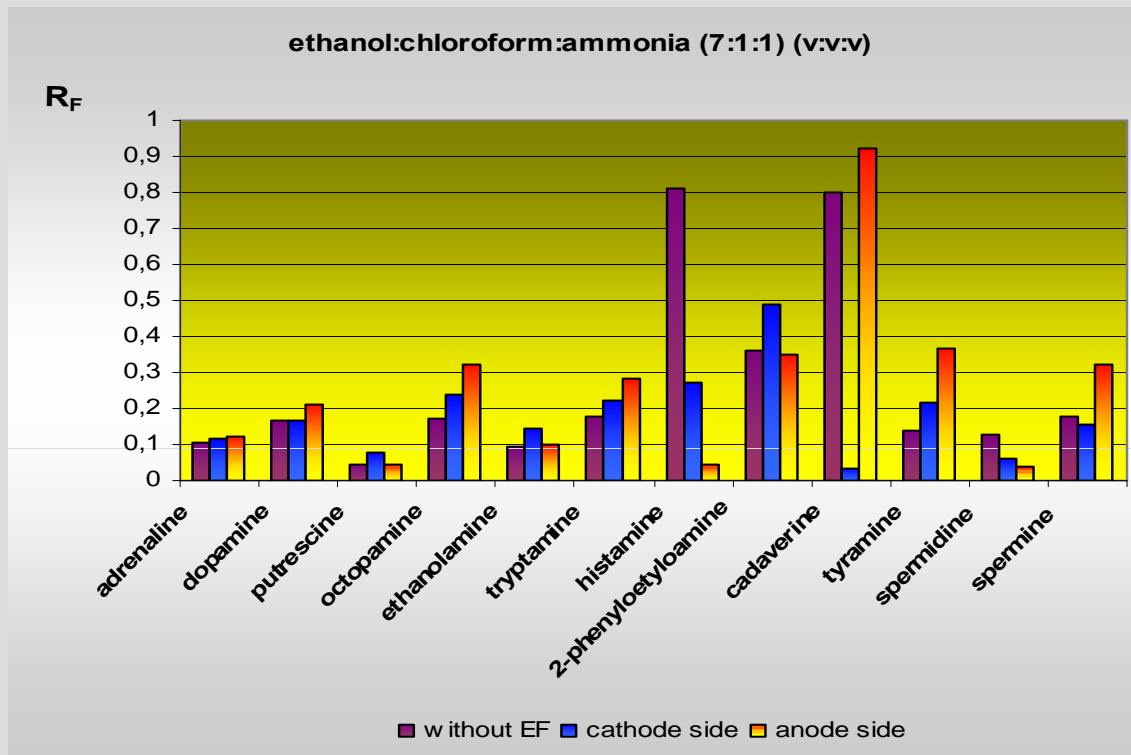


amino acids in electric field





biogenic amines in electric field



conclusions

Electric field can change retention of solutes and efficiency of chromatographic systems

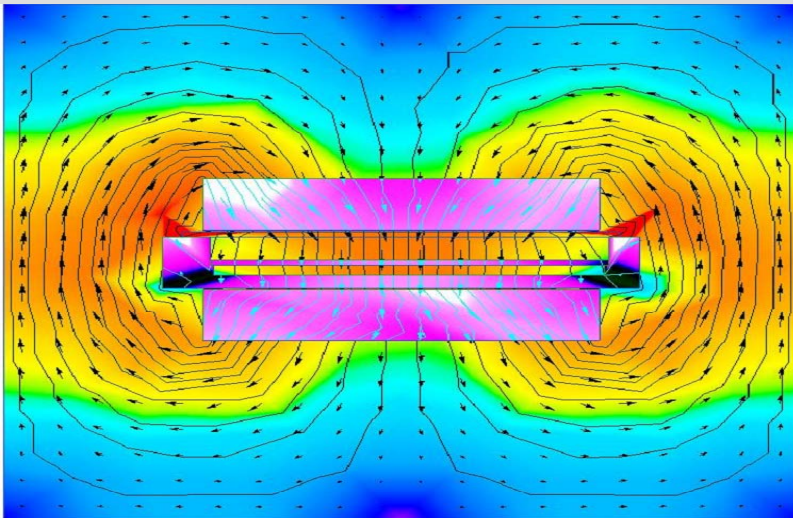
the changes depend on:

- solute structure,
- kind of mobile phase,
- in the case of charged molecules on migration direction of mobile phase in electric field.

Chromatography in magnetic field

sources of magnetic field

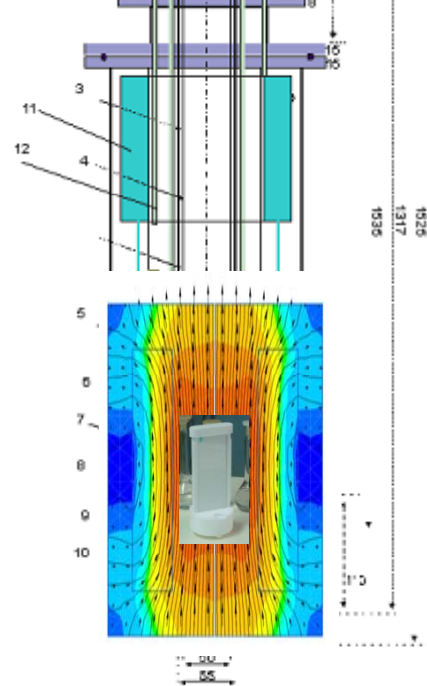
neodymium magnet



$B = 0.48 \text{ T}$

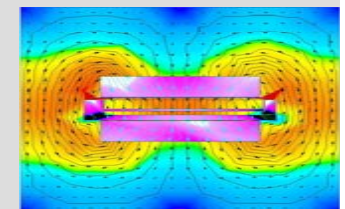
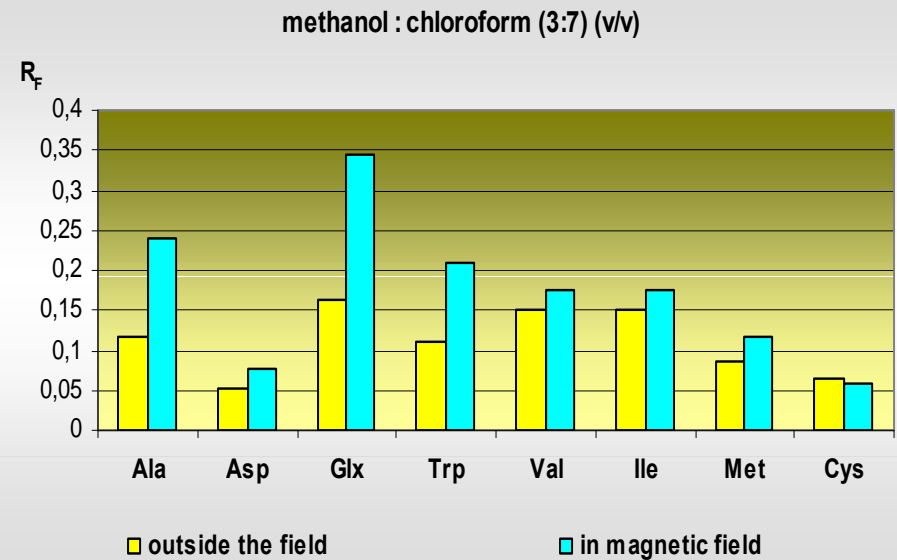
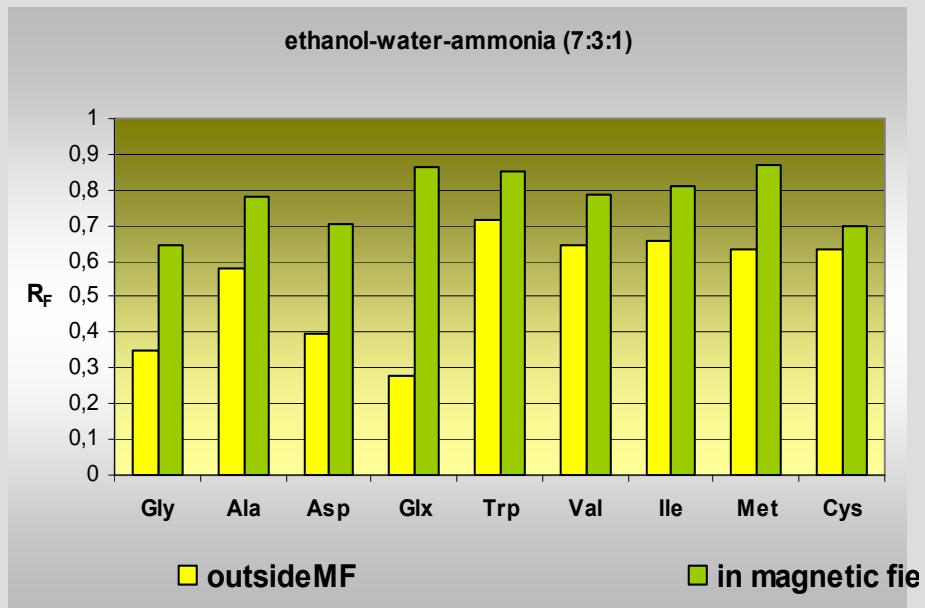


superconducting magnet



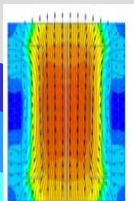
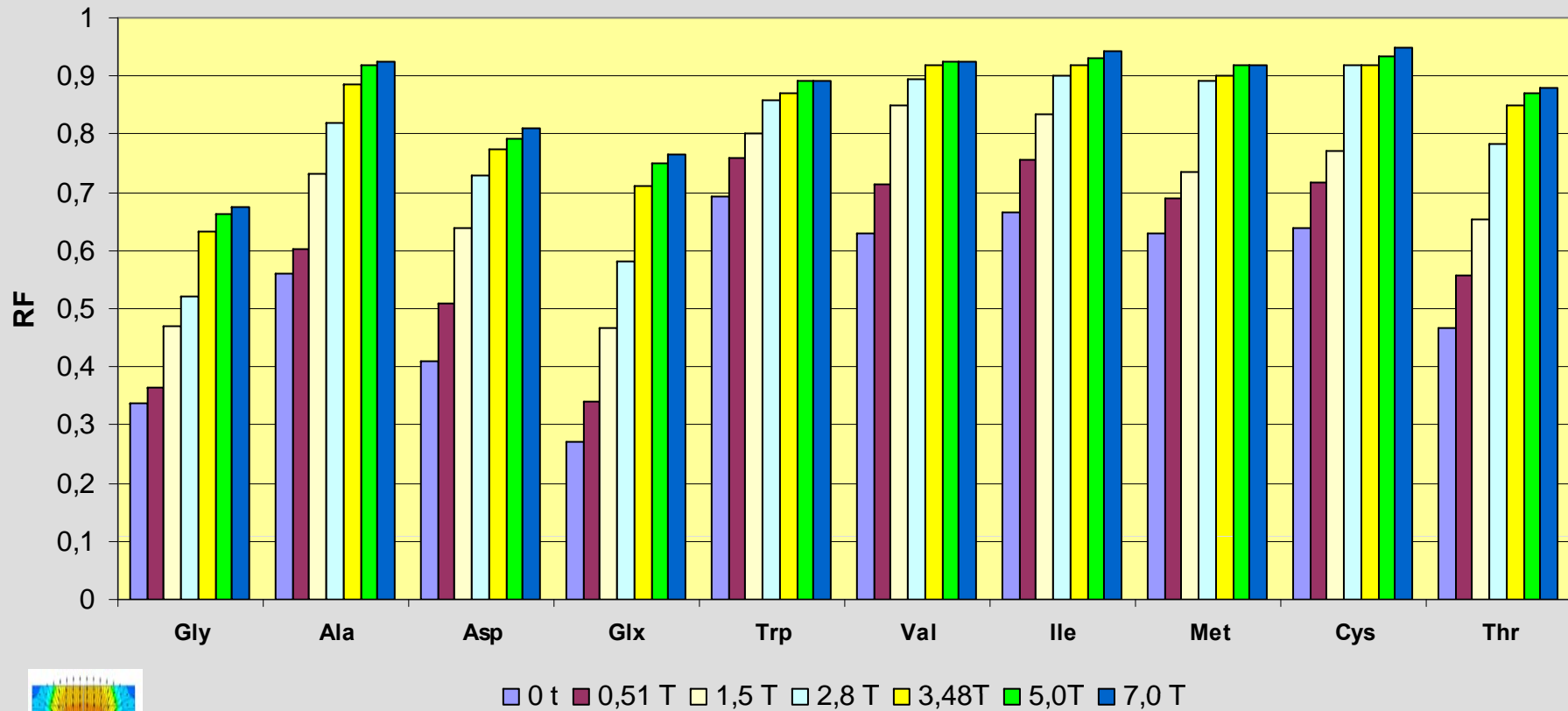
$B: 0.5-7.0 \text{ T}$

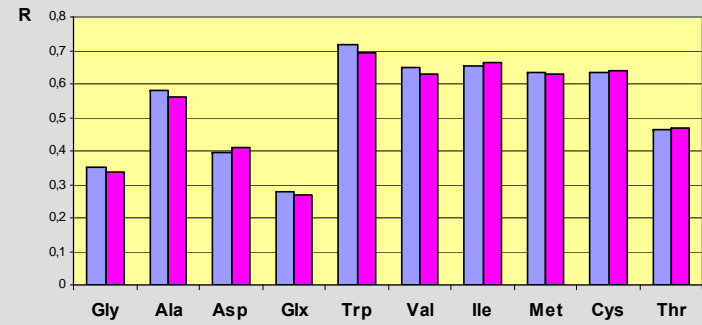
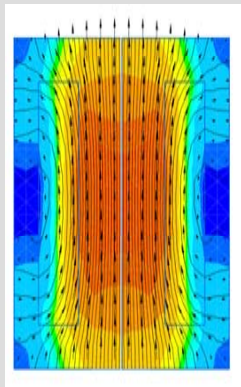
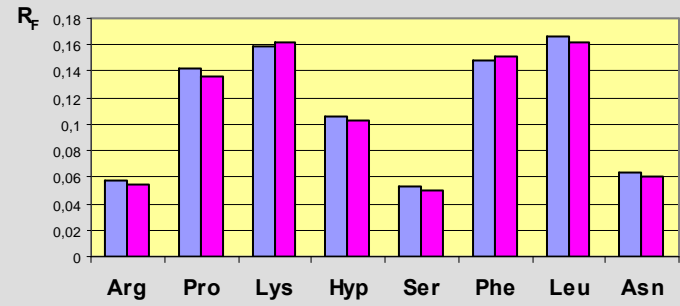
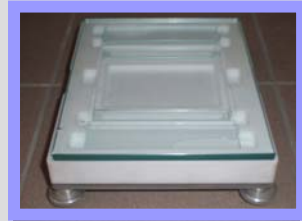
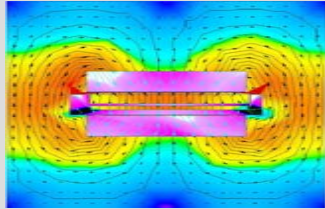
amino acids in magnetic field

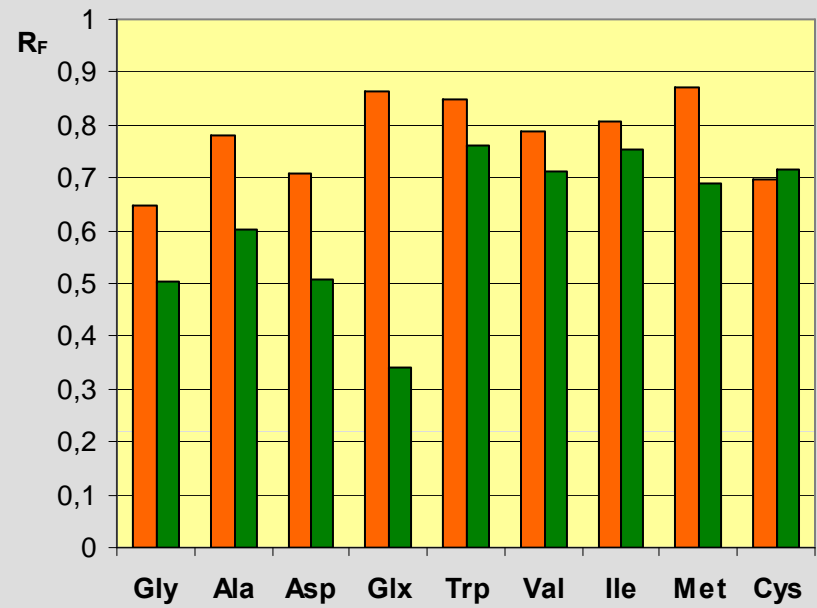
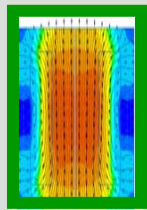
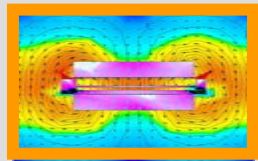


Amino acids in strong magnetic field

Ethanol-water-ammonia (7:3:1)

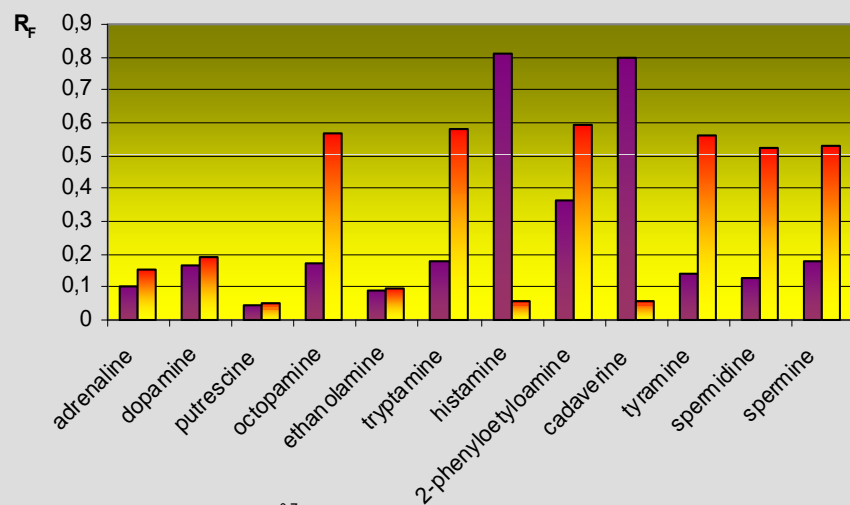




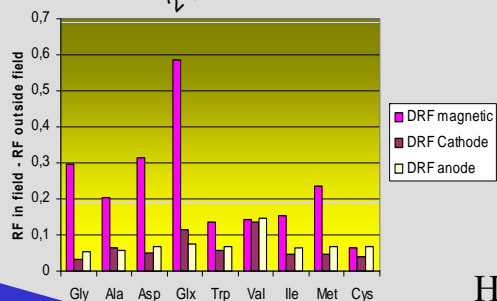
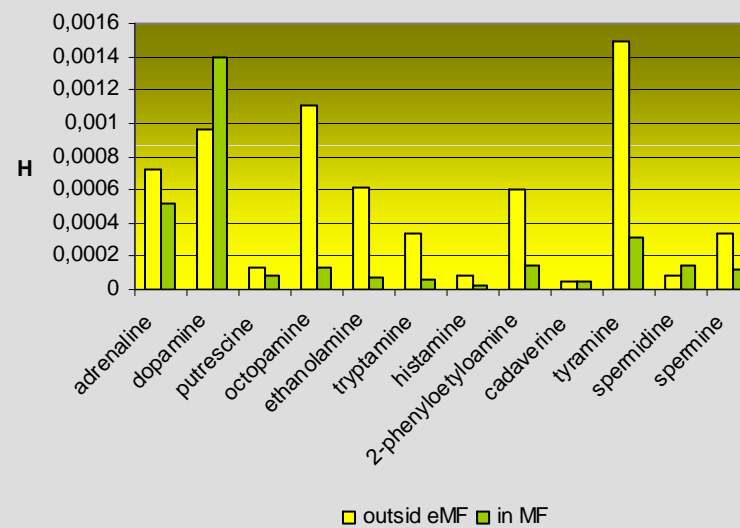


biogenic amines in magnetic field

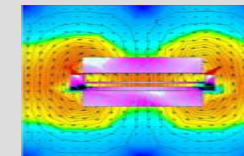
ethanol:chloroform:ammonia (7:1:1) (v:v:v)



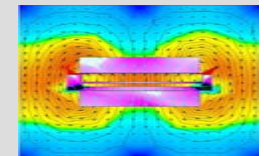
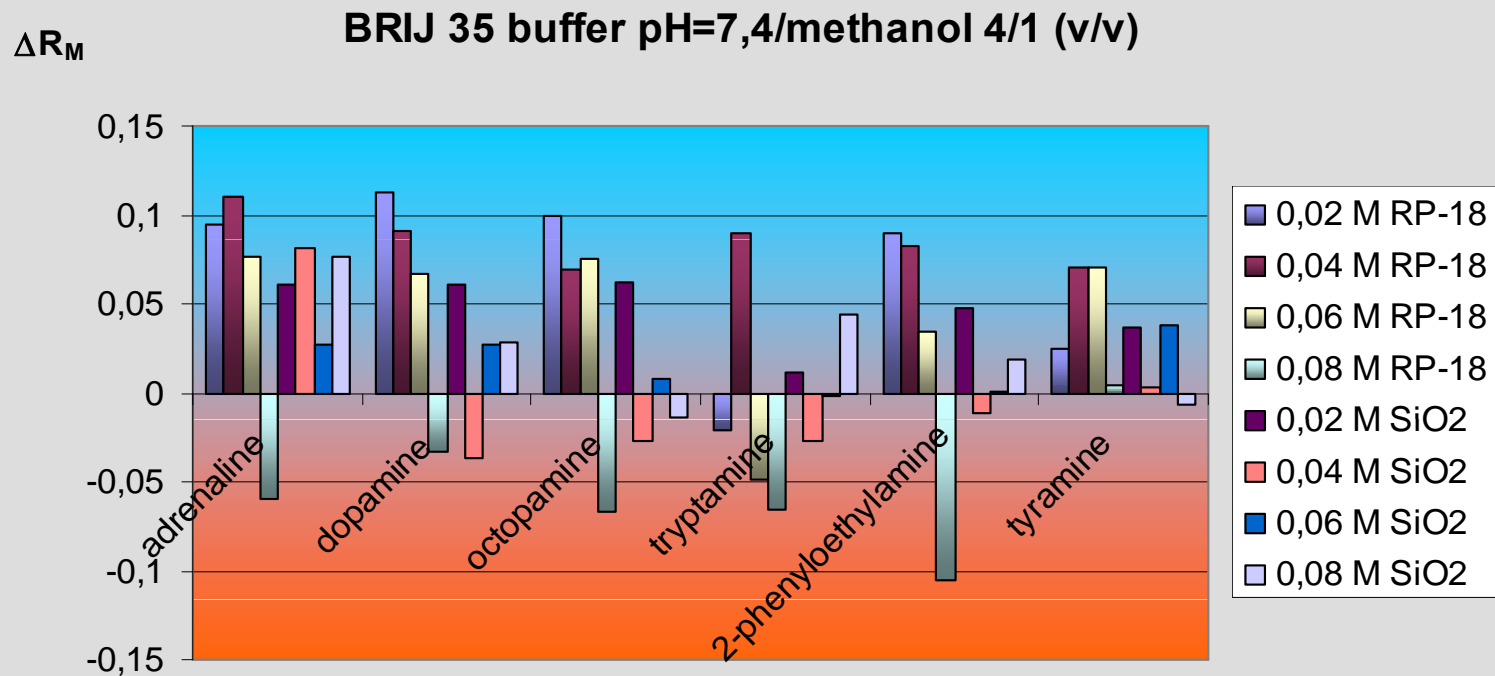
ethanol:chloroform : ammonia (7:1:1) (v:v:v)



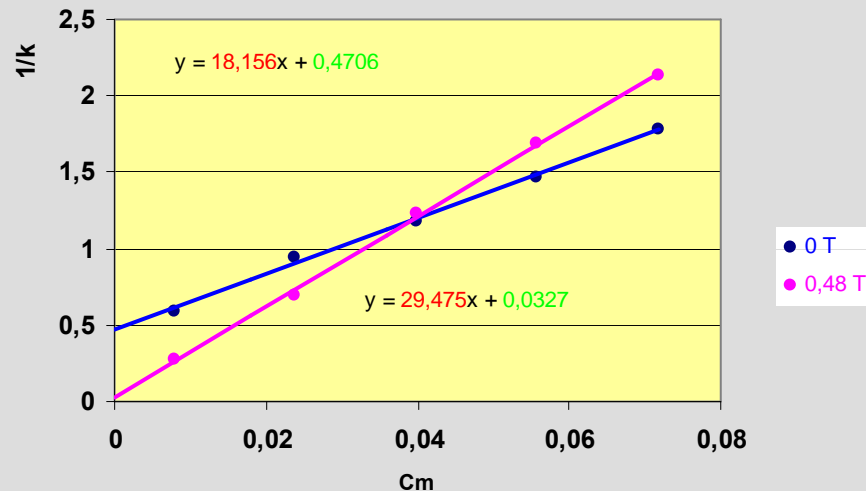
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MLC of biogenic amines in magnetic field



MLC of biogenic amines in magnetic field

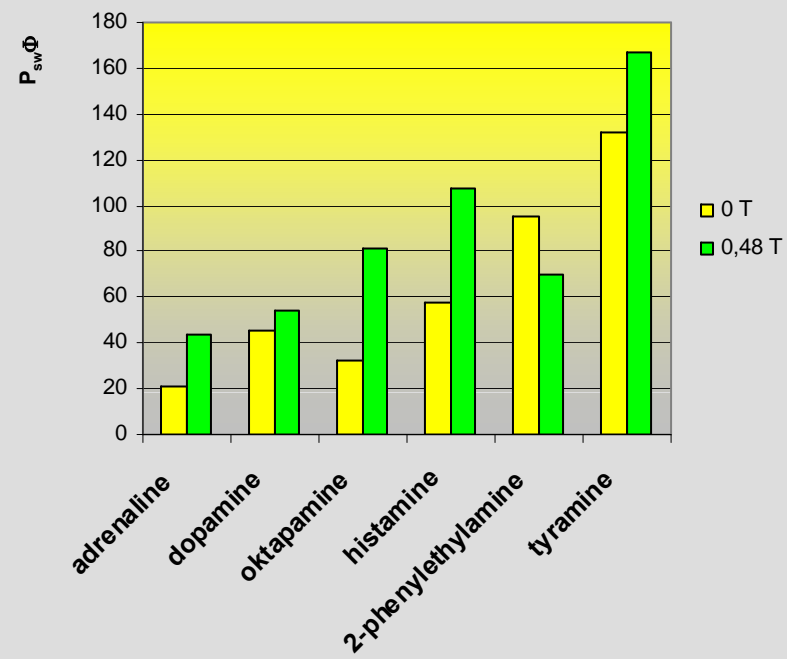
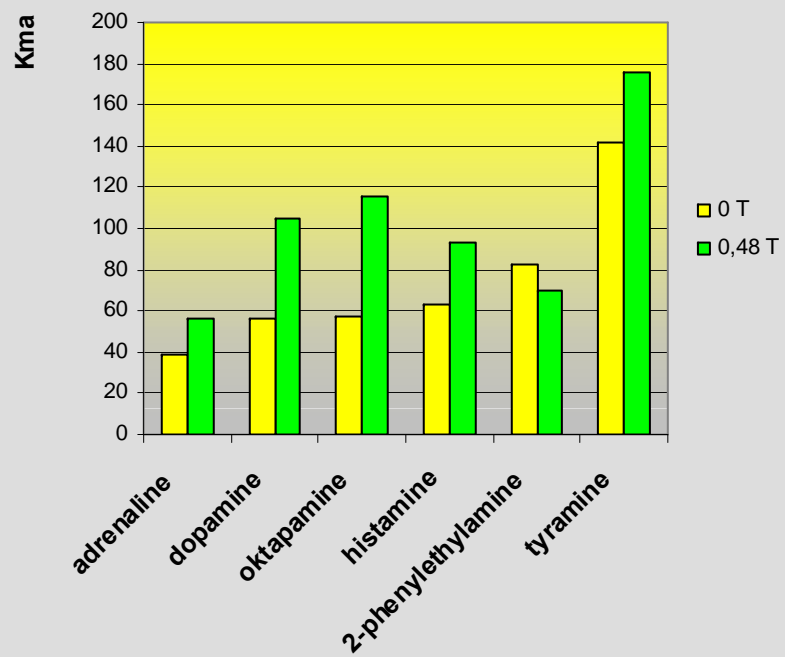


Foley's equation

$$\frac{1}{k} = \frac{K_{ma} C_M}{P_{sw} \Phi} + \frac{1}{P_{sw} \Phi}$$

K_{ma} – analyte – micelle association constant,

P_{sw} – partition coefficient of solute between stationary phase and water



conclusions

Magnetic field can influence on retention of chromatographic solutes

The influence depends on B of magnetic field, direction of magnetic field lines in relation of mobile phase migration direction.

In micellar systems magnetic field influence on hydrophobicity and interactions of chromatographic solutes with micelles.

acknowledgement

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MSc K. Niezabitowka



dr M. Studziński



dr H. Malinowski



thank you for your kind attention

