

MUNI
PHARM



Alternative Green Solvents and Hyphenated Techniques

Alternative green solvents

- Subcritical water
- Supercritical fluids
- Bio-based solvents
- Surfactant-based solvents
- Deep eutectic solvents
- Ionic liquids

Subcritical water

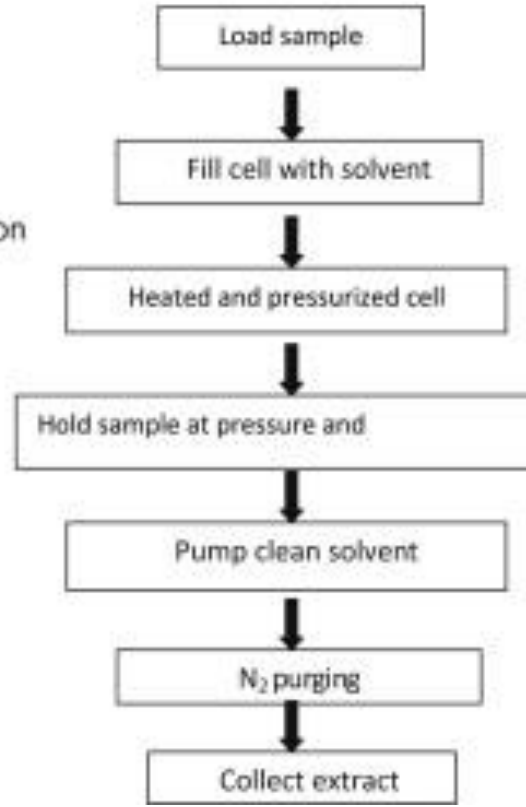
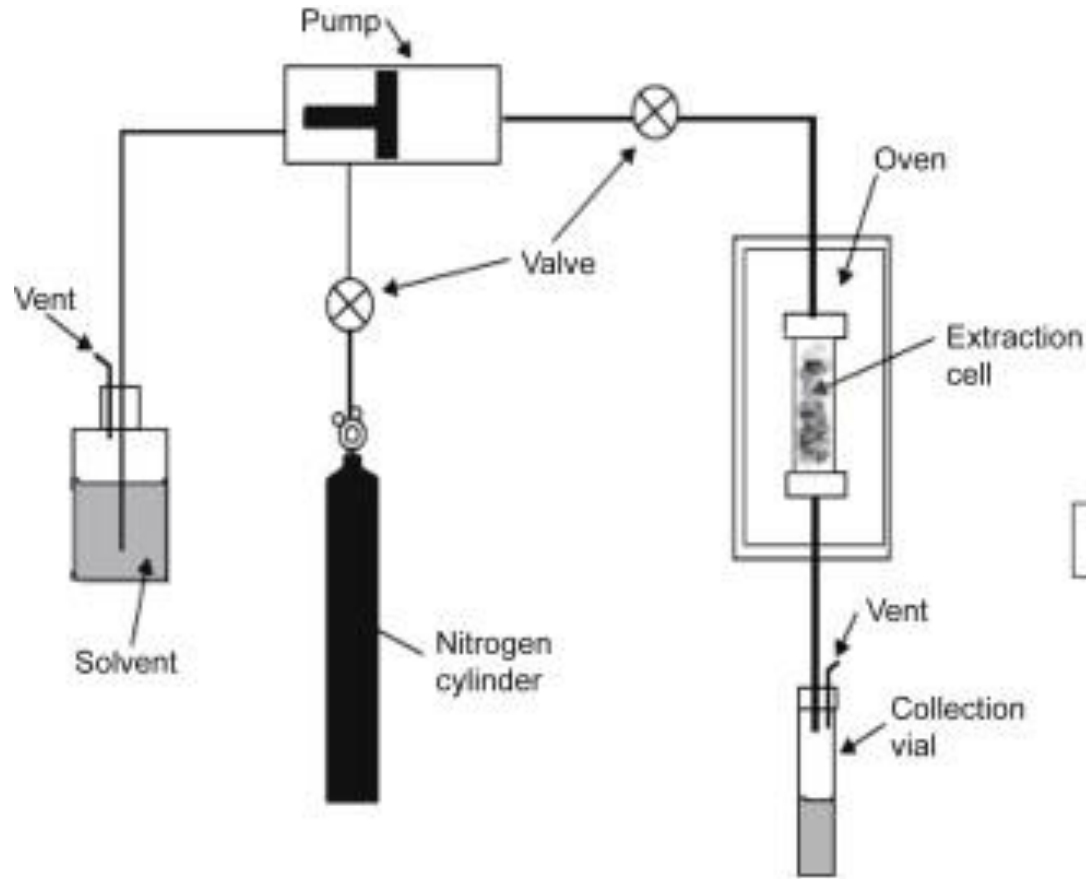
= liquid water at temperature and pressure below its critical point ($T_c = 374.15 \text{ }^\circ\text{C}$,

$$P_c = 22.1 \text{ MPa})$$

= pressurized hot water extraction = superheated water extraction = pressurized liquid extraction

- \downarrow dielectric constant, viscosity, surface tension; \uparrow diffusion coefficient
- similar to ACN, MeOH, or EtOH

Pressurized liquid extraction (PLE)

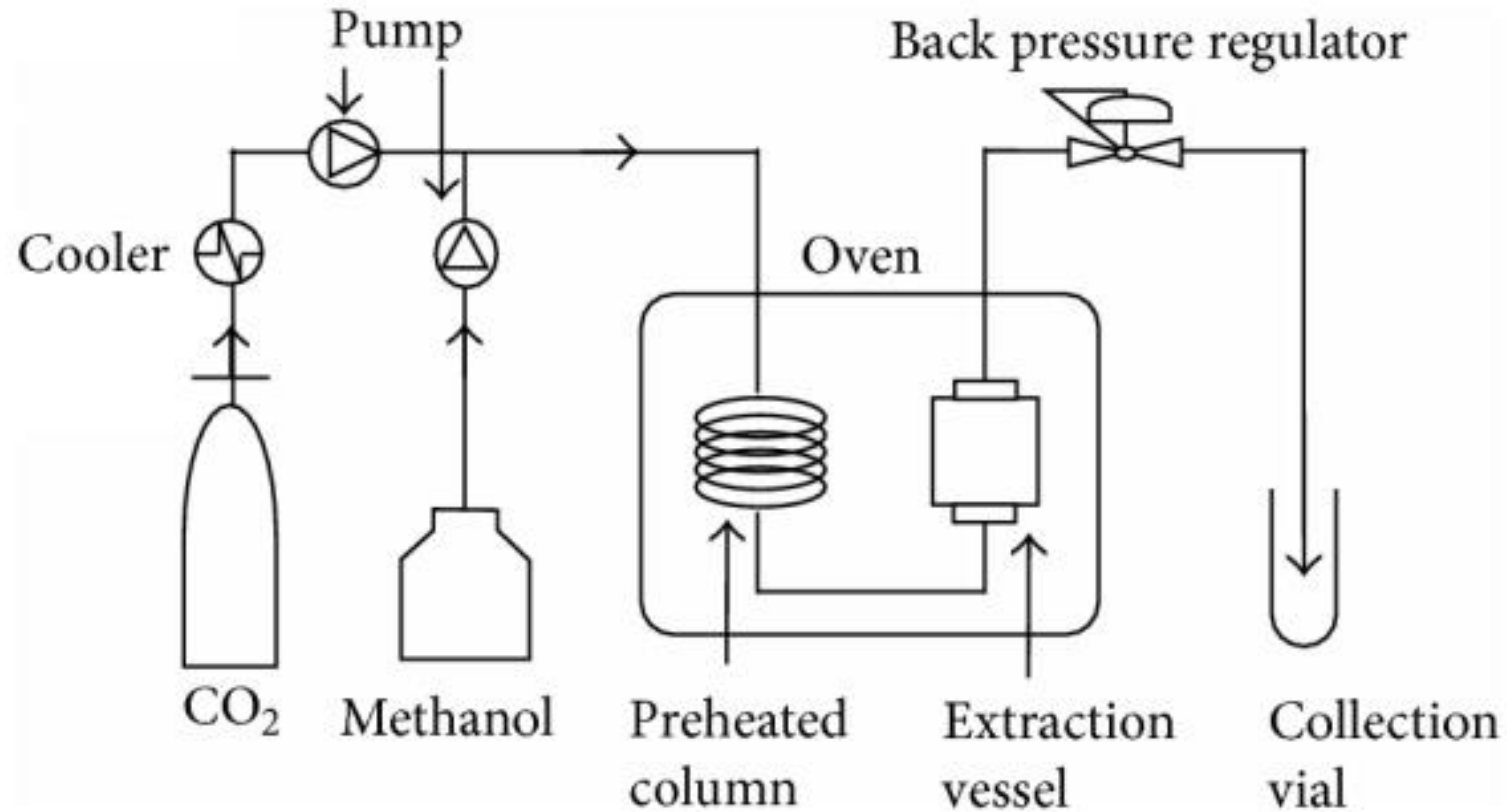


Supercritical fluids

= substances at temperature and pressure above their critical points

- ↑ permeability of the solvents
- CO₂ ($T_C = 31\text{ °C}$, $P_C = 74\text{ bar}$), rarely EtOH or water
- energy demanding

Supercritical fluid extraction (SFE)



Bio-based solvents

= solvents produced from biomass with a renewable origin (crops, forest products)

- bio-ethanol, bio-acetone, D-limonene, glycerol, ethyl lactate, ...
- cheap, accessible
- limited application

Surfactant-based solvents

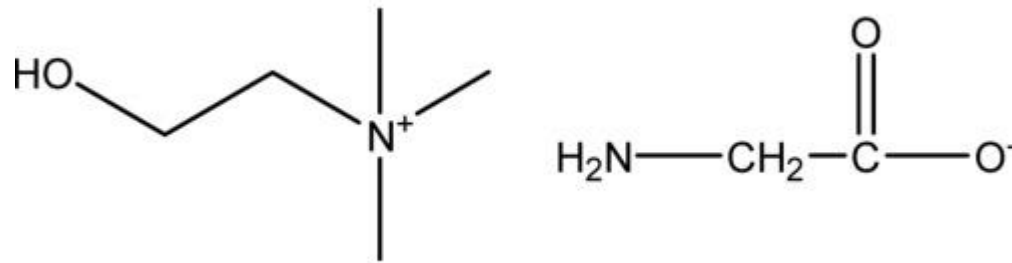
= solvents that decrease the surface tension

- aqueous solvents with the addition of surfactants generate micelles, microemulsions, hexagonal phases, or vesicles
- Triton, Tween, ...
- cheap, highly efficient, and user-friendly
- incompatibility with some instruments (LC or GC)

Deep eutectic solvents

= a combination of hydrogen bond acceptor and hydrogen bond donor

- cholinium-based solvents, organic acids, aminoacids, ...
- low volatility, low vapour pressure, high tunability, non-flammability, chemical and thermal stability, and possibility to dissolve inorganic and organic compounds
- some of them are toxic

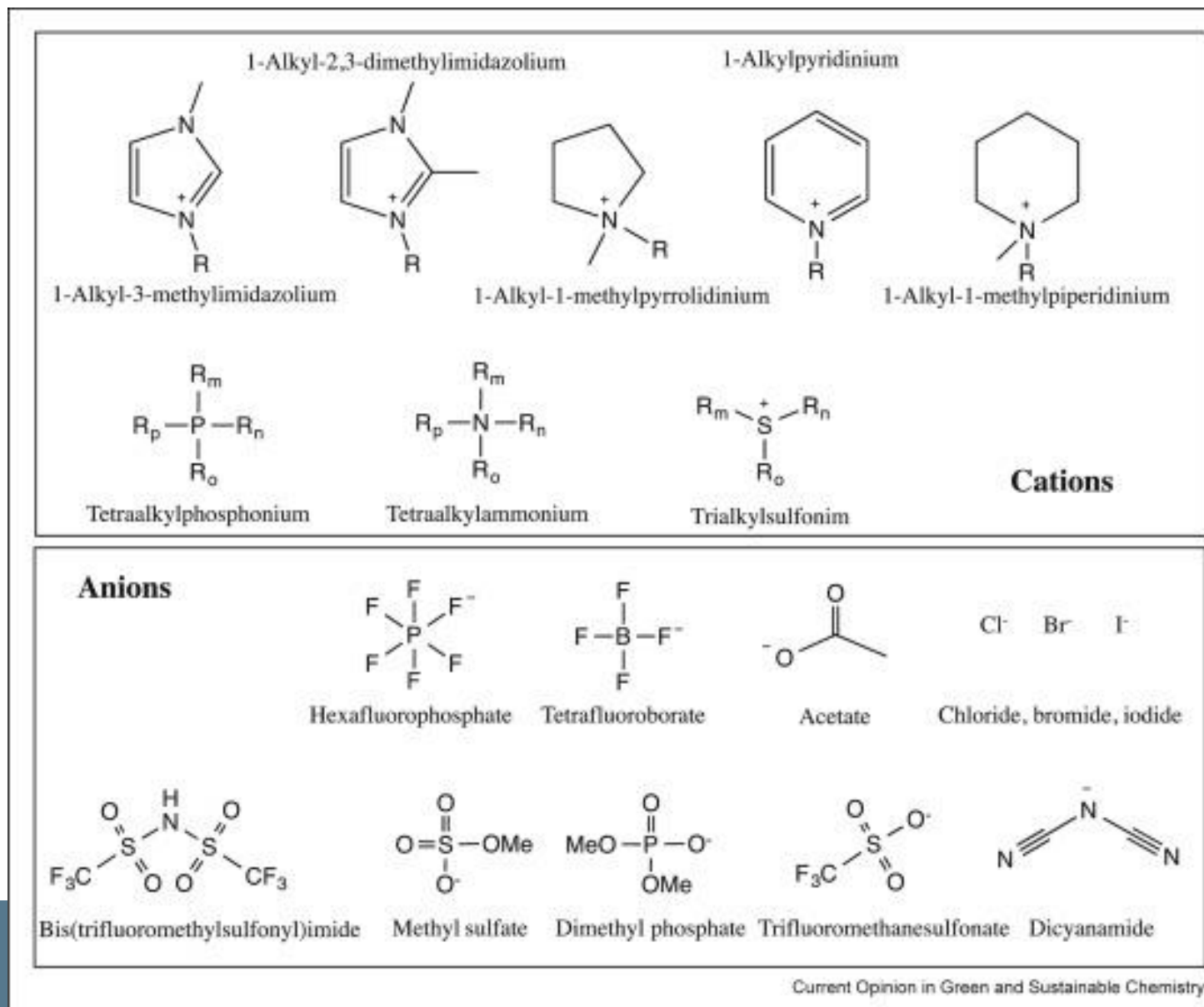


Ionic liquids

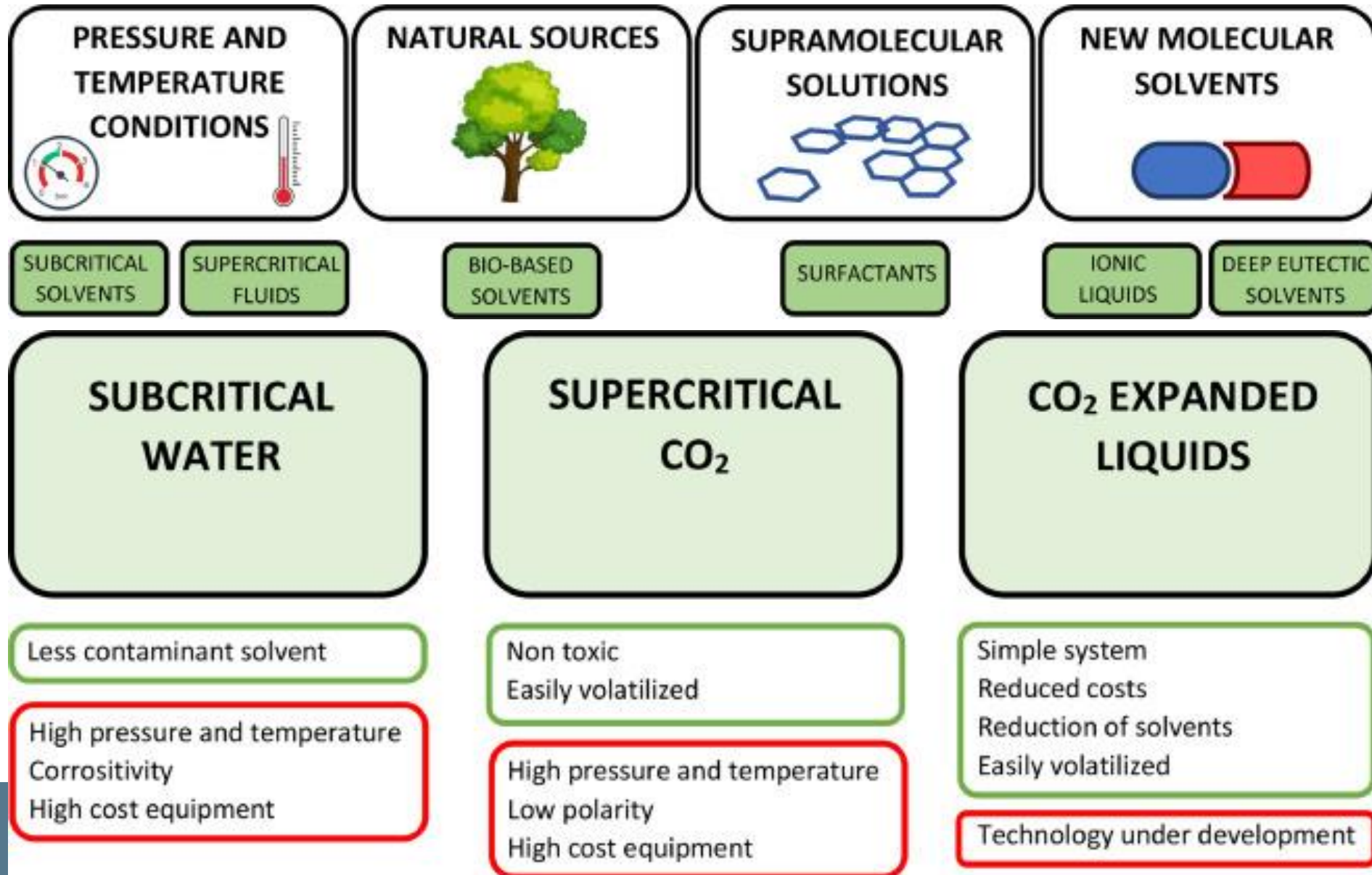
= compounds completely composed of ions with melting points below 100 °C

- typically consists of organic cation and organic or inorganic anion
- low volatility, low vapour pressure, high tunability, non-flammability, chemical and thermal stability, and possibility to dissolve inorganic and organic compounds
- some of them are toxic

Ionic liquids

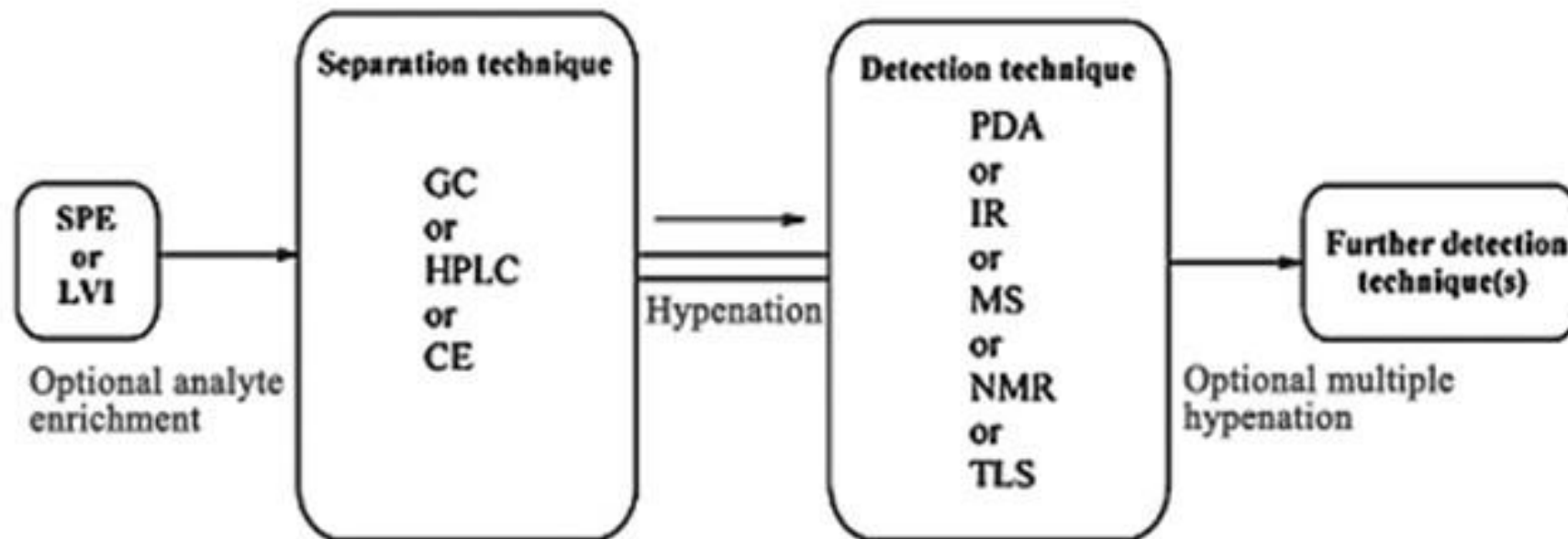


Alternative green solvents

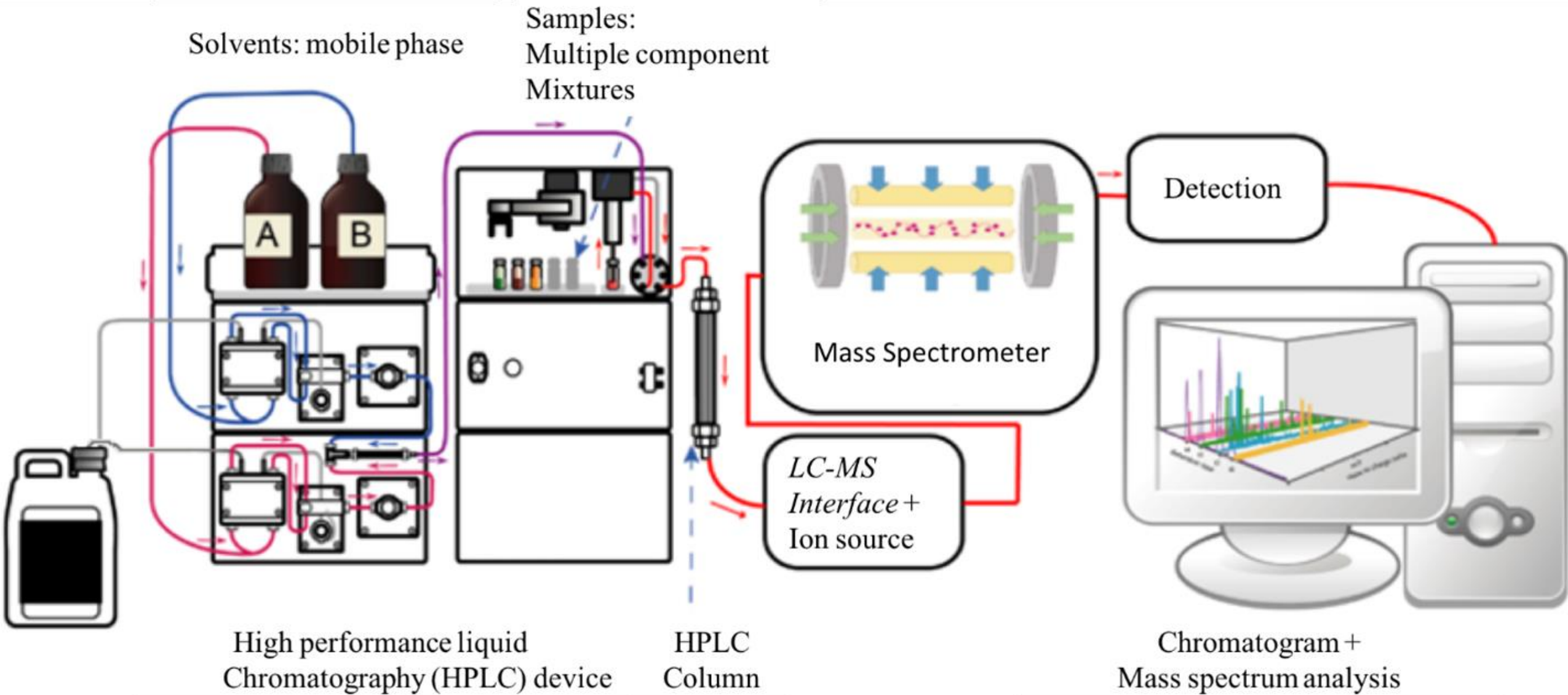


Hyphenated techniques

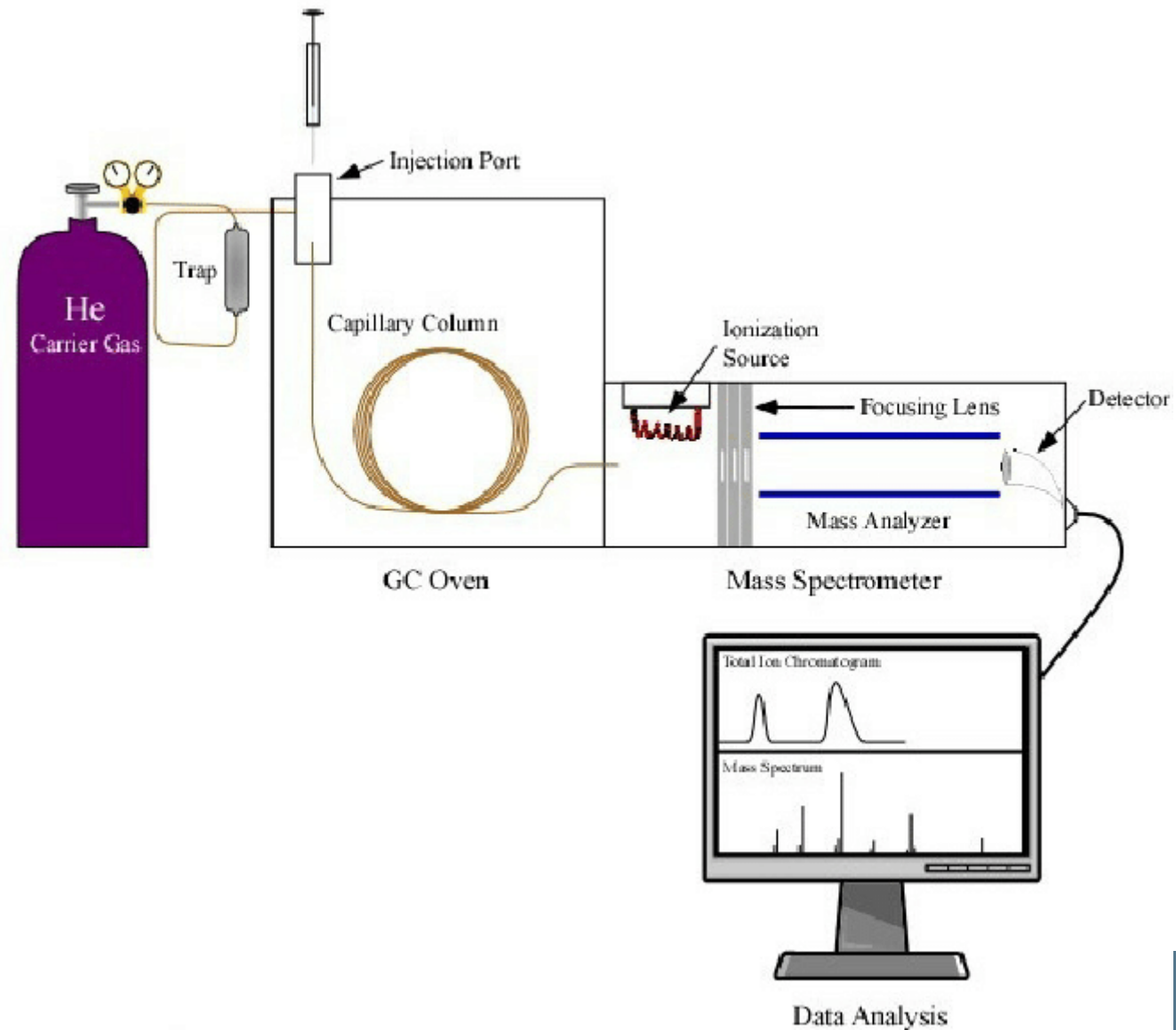
= an analytical techniques in which a chromatographic technique(s) and spectroscopic technique(s) are coupled for separation and identification purposes



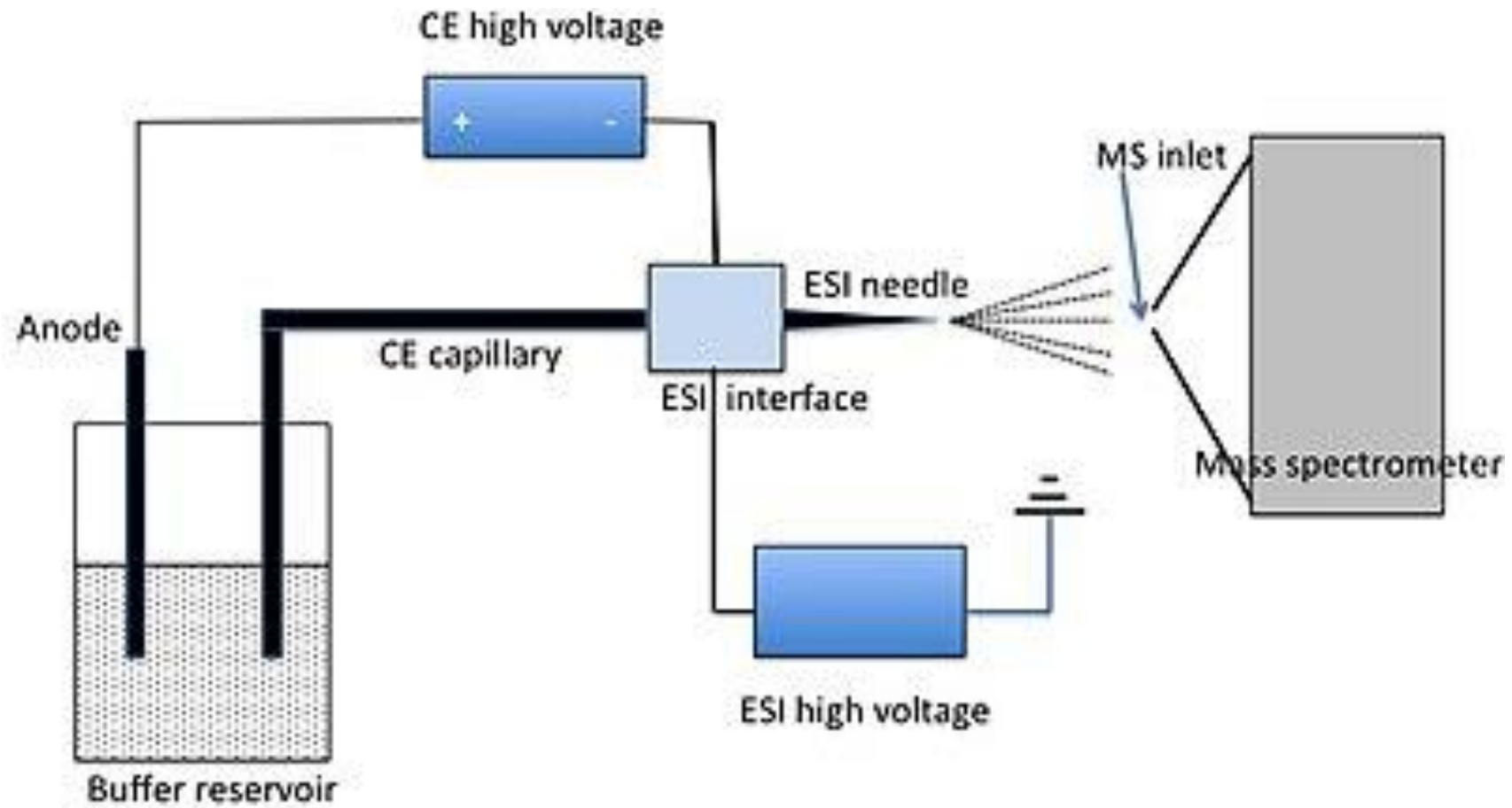
LC-MS



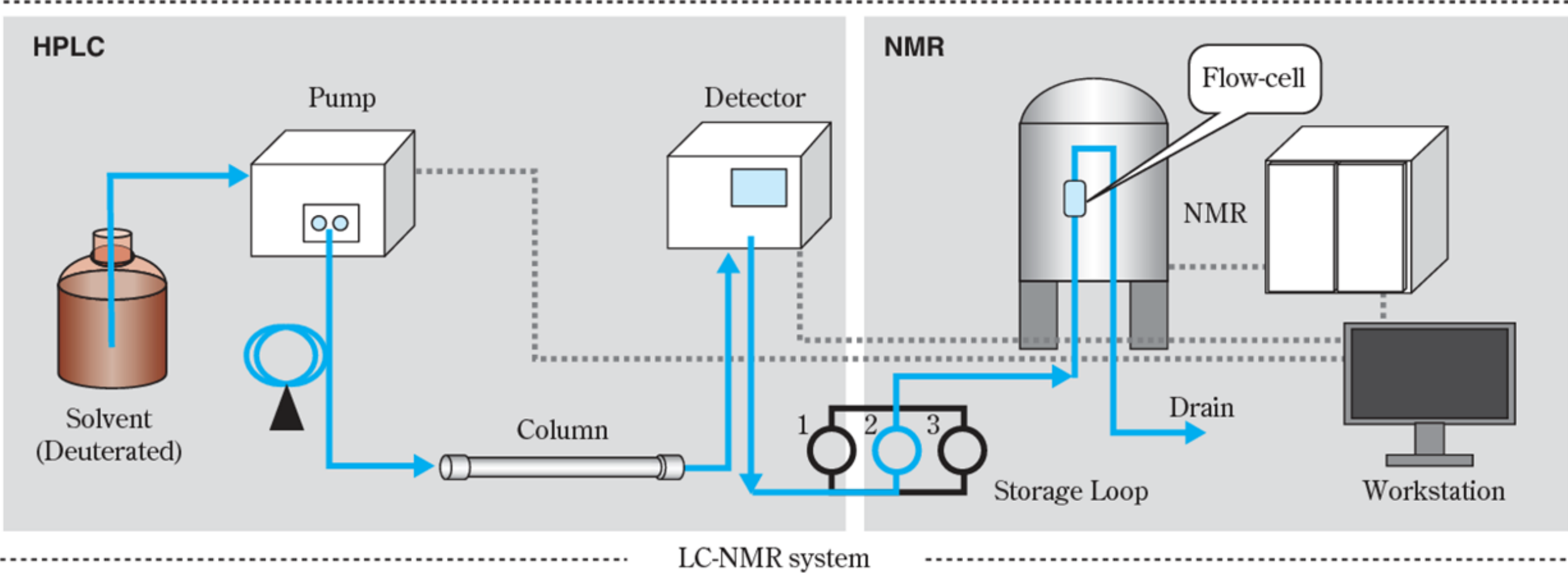
GC-MS



CE-MS



LC-NMR



Chiral LC-CD-NMR

