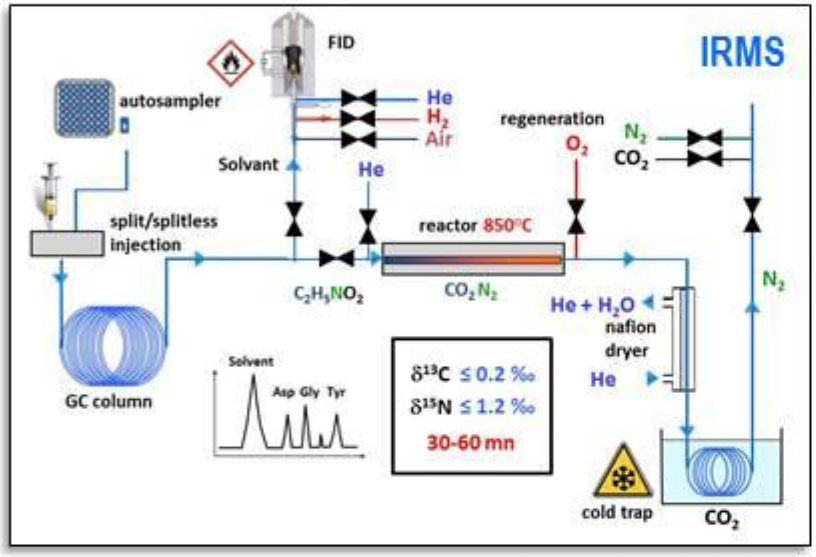
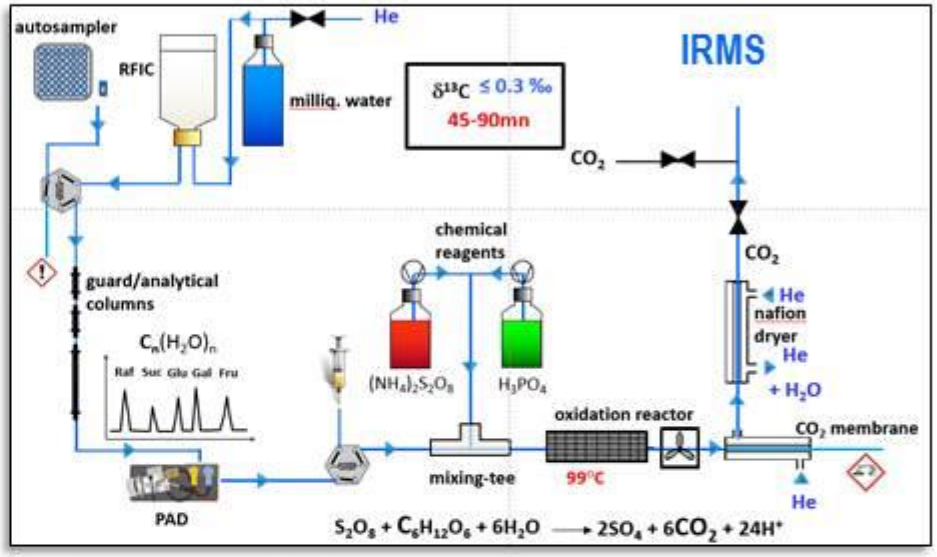
GC-IRMS and LC-IRMS: principles





- GC separates organic molecule in gas phase
- Volatilization of dissolved molecules by a Flame Ionization Detector.
- Chemical conversion to CO_2 in gas phase (oxi./red)
- IRMS determines relative abundance of $\delta^{13}C$ in CO_2

- LC separates organic molecule in liquid phase
- Chemical conversion to CO_2 in liquid phase (chemical oxi.)
- Degassing unit for CO_2 separation from the liquid phase by He
- IRMS determines relative abundance of $\delta^{13}C$ in CO_2

GC-IRMS and LC-IRMS: principles

- Volatilizable compounds
- Volatility reduces with functional groups:
  - ✓ COOH (e.g. fatty acids, amino acids)
  - ✓ OH (e.g. alcohols, sugars)
  - ✓ NH_2 (e.g. amino acids, amino sugars)
- Derivatisations needed
  - ✓ Blocking functional groups with apolar groups
  - ✓ Esterification (adding a group –COOR)
  - ✓ Silylation (adding a group $–SiMe_3$)
  - ✓ Acetylation (adding e group $–CO-CH_3$)

- Polar and thermo-labile compounds
  - ✓ amino acids
  - ✓ peptides
  - ✓ sugars/amino sugars
  - ✓ nucleotides
  - ✓ steroids
- Less sensitive and requires higher concentrations of compounds
- Requires inorganic (or pure water) eluents
- Requires degassing of solutions (water and reagents)

LC-IRMS vs GC-IRMS

LC 

GC 

isotopes	only ^{13}C	^{13}C, ^{15}N, ^{18}O, D
compounds	polar, thermo-labile, water-soluble	volatile or volatilizable
sensitivity	good (µmol range)	excellent (nmol range)
resolution	lower resolution (peak broadening during oxidation)	higher resolution (very long columns)
time consuming	sample extraction/purification eluent preparation (degassing) reagents preparation (instable oxidant 2-3 days) more parameters to adjust LC methods development necessary	sample extraction/purification derivatisation needed complex corrections and calculations impact on accuracy/precision
time saving	no derivatisation needed simple data processing/analysis reduced analysis error	no eluents, only He as carrier gas only flow and temperature to adjust GC methods well established
environment	safe (only organic buffer)	pollutant (organic solvent, e.g DCM)