

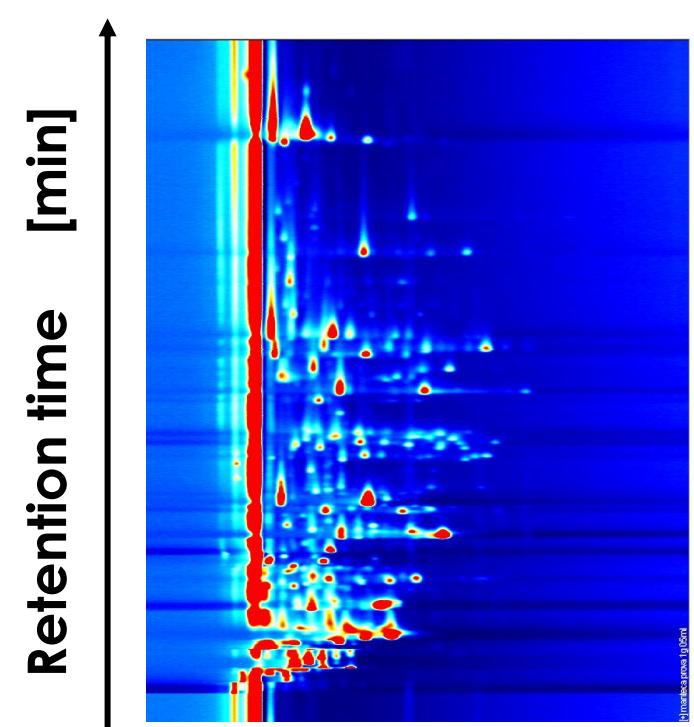
Alkyl pyrazines determination in roasted hazelnut pastes by Gas Chromatography – Ion Mobility Spectrometry (GC-IMS)

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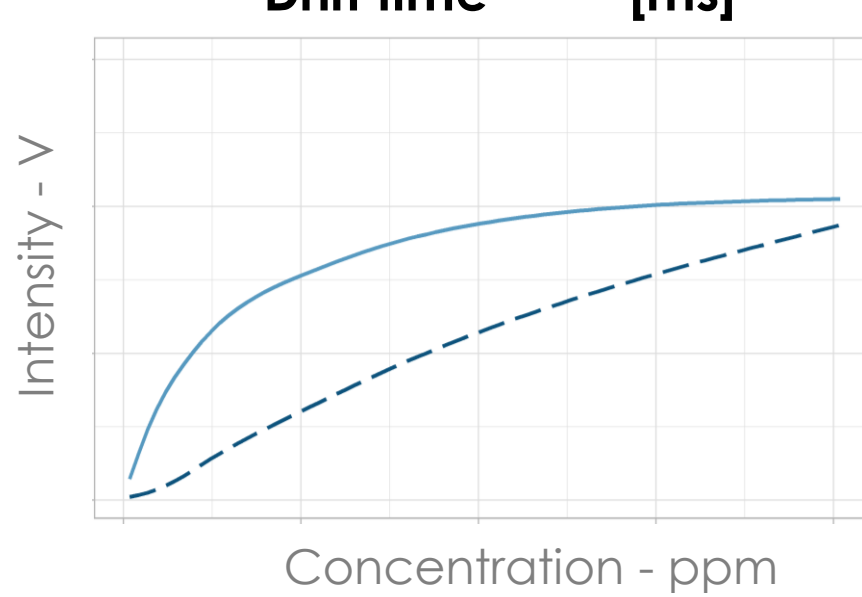
GC-IMS

GC-IMS is rapidly gaining popularity in food flavour analysis. Most of the current studies are based on untargeted fingerprinting and qualitative approaches¹.

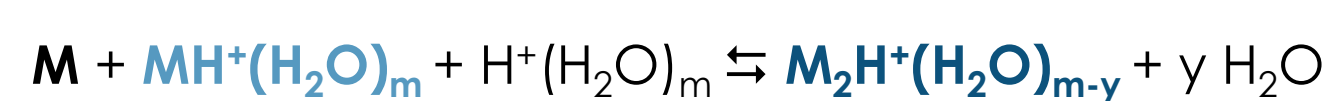


- High sensitivity (ppb)
- Orthogonal separation
- Static Headspace sampling
- Short analysis run time (30 min)
- User-friendly commercial analytical platform/reduced bench space requirements

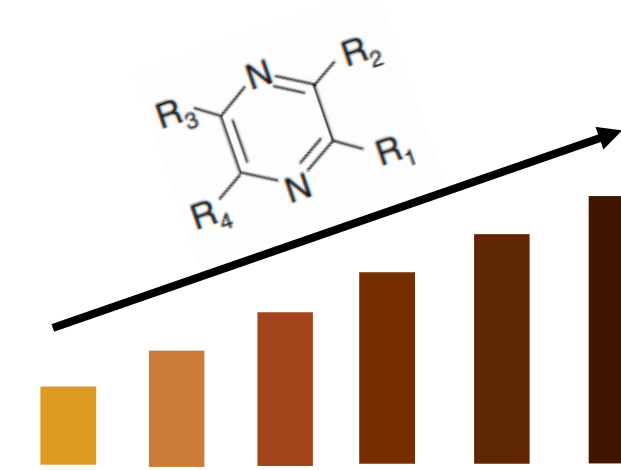
Limited literature available for HS-GC-IMS quantitative applications^{2,3,4}



Multiple ionized species
protonated monomer and proton bound dimer



Limited dynamic range
1-2 order of magnitude



Aim

Validation of HS-GC-IMS as potential technique to **monitor alkyl pyrazines** within a context of **industrial roasting**

Alkyl pyrazines

Alkyl pyrazines are an important class of **aroma compounds** generated in **thermally treated foods** within the framework of the Maillard reaction⁵. They are responsible for **roasted, nutty** and **burnt notes**, and, due to their **low odour-thresholds**, they greatly contribute to the aromatic profile even in small concentrations (ng/kg).

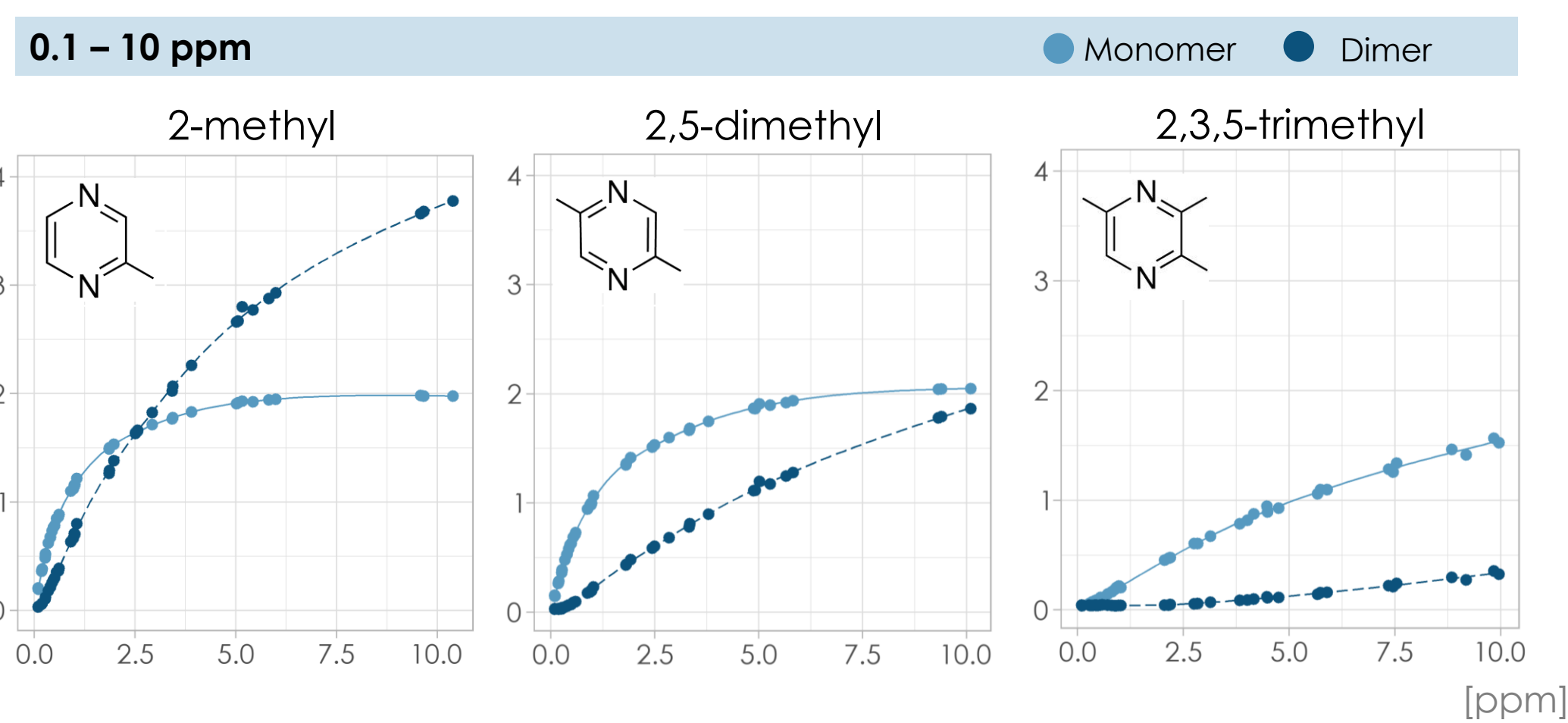
Roasting is a thermal treatment mainly carried out as **industrial process**, therefore, its monitoring is critical to control the aroma development of roasted foods such as coffee, cocoa, peanuts and hazelnuts.

Alkyl pyrazines have been proposed as **roasting markers** and **roasting indices**^{6,7} and several alkyl pyrazines have been reported as **key-odorants of roasted hazelnut**⁸ (*Corylus avellana* L.).

1 Assessment of GC-IMS response for target alkyl pyrazines

a. Concentration response-curves → impact of the aromatic ring substitution pattern

Fat model matrix: Medium Chain Triglycerides (MCT)

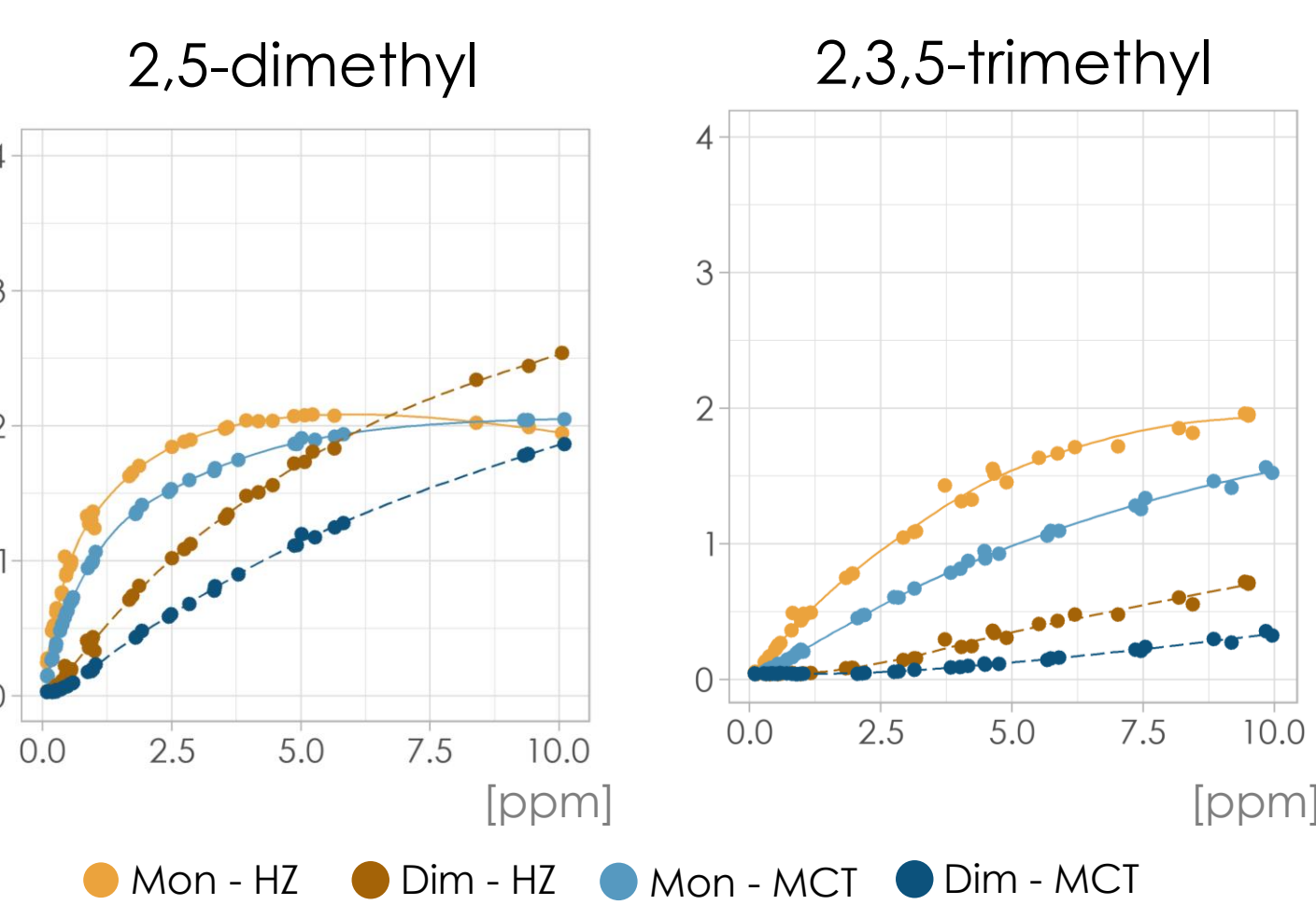


- Different trends of the protonated monomer/proton bound dimer curves
- Different dynamic range
- Different LOD/sensitivity

External standardization approach to perform a reliable quantification

b. Matrix effect

Fat model matrix (MCT) vs deodorized roasted hazelnut paste (HZ)



- Non-negligible matrix effect
- Lower fat % (HZ) - higher signal

2 Determination of alkyl pyrazines in roasted hazelnut paste samples

Hazelnut paste samples were obtained by roasting kernels from different geographical and botanical origins. The roasting process was carried out in a pilot scale **infrared (IR)** roaster at **140°C**.



3 roasting intensities

15 min - 20 min - 25 min

Identified alkyl pyrazines

- 2-methyl (2M)
- 2,5-dimethyl (25DM)
- 2-ethyl (2E)
- 2,3,5-trimethyl (TRI)
- 2,6-dimethyl (26DM)*

* Not quantified because < LOQ

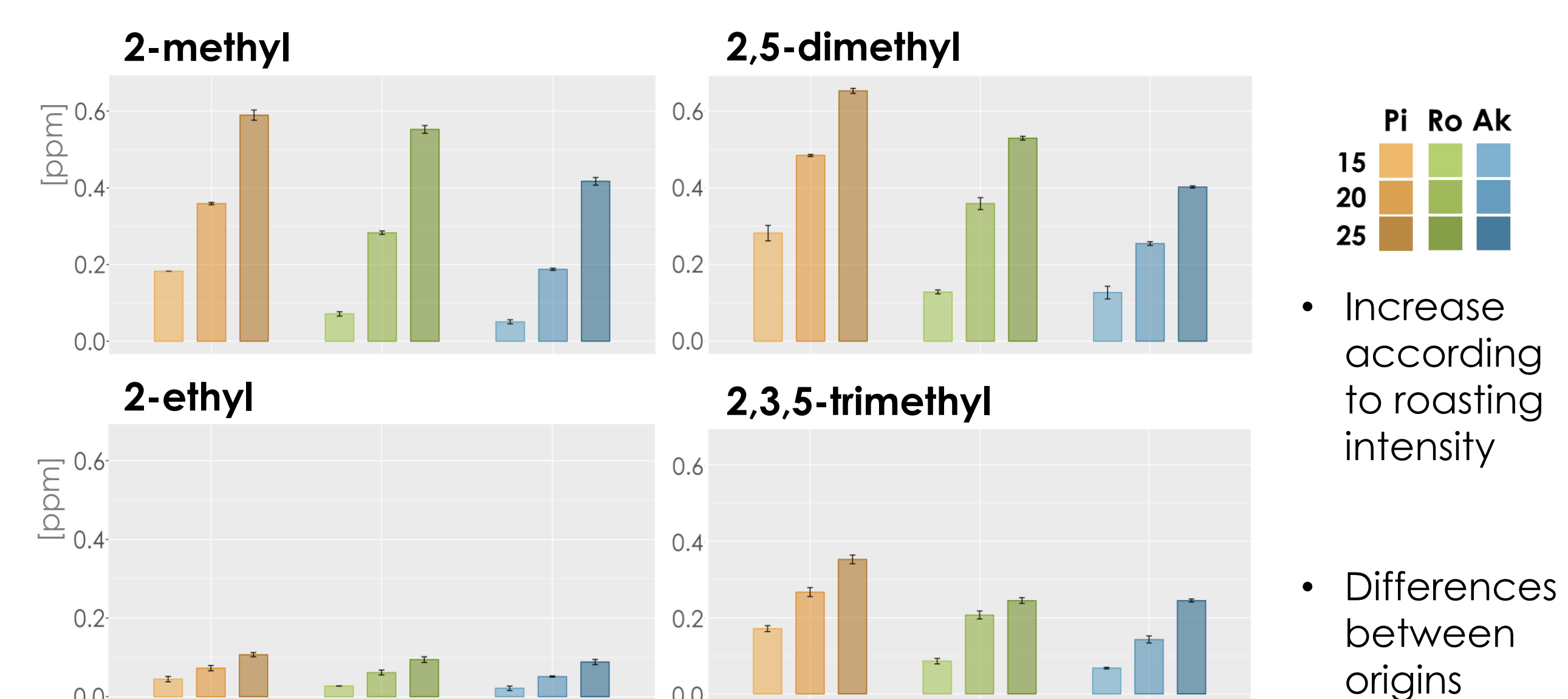
A quantification protocol based on **external standard calibration** has been optimized to determine the content of the identified analytes:

- 0.01 – 1 ppm
- Spikes in deodorized HZ paste

The ion (monomer or dimer) used for the quantification was carefully selected depending on the analyte concentration in the samples and the presence of coeluting peaks.

	Ion species	Curve fitting
2M	Dimer	linear
25DM	Dimer	linear
2E	Monomer	polynomial(2 nd)
TRI	Monomer	linear

Effect of roasting and origin



- Increase according to roasting intensity
- Differences between origins

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