Co-formation of oxygenated and non-oxygenated aromatics in the flames of biofuel and fuel mixtures

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Biofuels and other biomass-derived chemicals are now considered as a vital part of sustainable energy portfolio, where they promise to contribute to our society's energy security [1]. Despite the undeniable interest presented by these biofuels, their combustion processes are likely to modify the formation of PAHs and OPAHs [2] that may profoundly modify the properties of formed soot particles.

In this work, five laminar premixed flames of anisole (a surrogate for lignin-based biofuels) and hydrocarbon fuel blends have been investigated using advanced gas chromatography which is equipped with a pre-concentration device to trap sufficient material in order to allow detection of PAHs and OPAHs at ppb levels. Employing this sample enrichment technique has enabled us to spot around 100 aromatic species in chromatographic analysis. An example of a part of a representative chromatogram and OPAH/PAH profiles has been shown in *Fig. 1*. Besides PAHs, several oxygenated aromatics (phenol, cresols, benzofurans, xanthones, etc.) were detected which highlights their significant co-formation. Moreover, anisole addition in flames is found to increase the formation of polyaromatic compounds. These species would allow us to link several primary reactions with the formation of pollutants and potential soot particles formed during the combustion of biofuels. The present results build a solid database for analysing OPAH/PAH co-formation during the combustion of lignin-based biofuels. Moreover, the impact of the biofuel composition on soot formation is envisioned to be studied in this project.

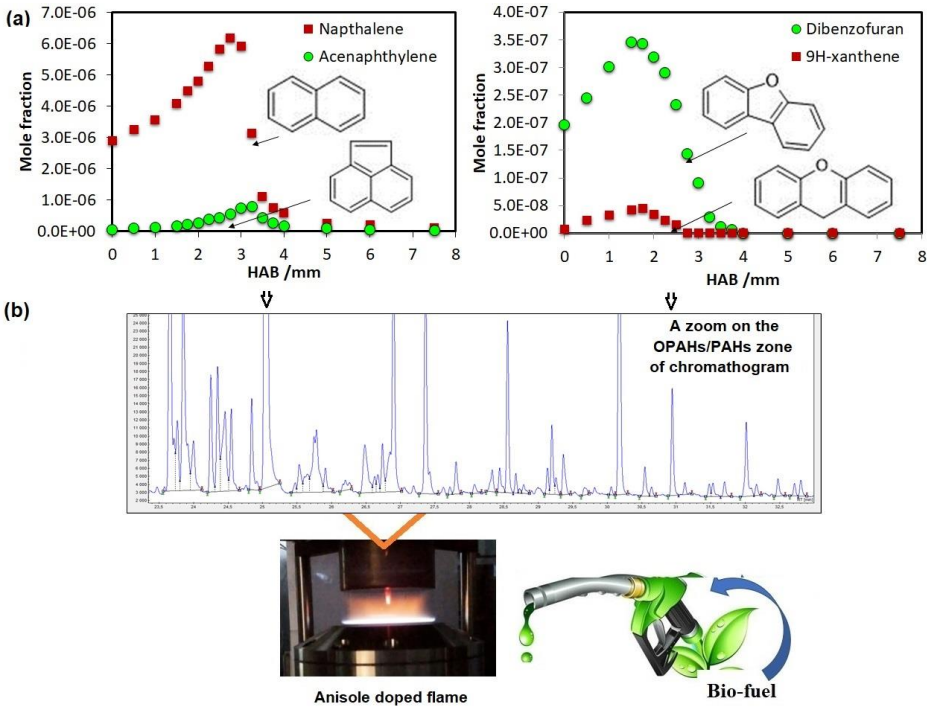

Fig. 1. Examples of OPAH/PAH profiles (a) and chromatogram for an anisole doped flame (b)

References

[1] W. Leitner, J. Klankermayer, S. Pischinger, et al., *Angew Chem-Int Edit*, 56, 5412-5452 (2017).

[2] C. Guan, C.S. Cheung, X. Li, Z. Huang, *Atmospheric Pollution Research*, 8, 209-220 (2017).