

# Characterization of gas and particle phase cooking emissions using advanced online and offline techniques

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Cooking processes are one of the main sources of volatile organic compounds (VOC) and particulate matter (PM) in non-smoking households and restaurants with obvious implications for public health. Ko et al (2000) reported a direct link between cooking emissions and lung cancer in non-smoking Chinese women. However the chemical and physical properties of gas and particle phase emissions from cooking are mostly unknown.

The approach adopted for our study involves laboratory quantification of PM and VOC emission factors from the main emitting processes. Primary emissions from deep frying, vegetable boiling, vegetable frying and meat cooking using different oils, meats and vegetables were analysed under controlled conditions after ~100 times dilution. A high-resolution time-of-flight aerosol mass spectrometer (HR-ToF-AMS), a high resolution proton transfer time-of-flight mass spectrometer (PTR-ToF-MS) and a two dimensional gas chromatography time-of-flight mass spectrometer (GC×GC-ToF-MS) were used to quantify the PM and VOC emissions and to investigate their chemical composition.

Our measurements suggest that PM emissions from cooking are mostly related to fat release from frying with vegetable oils or grilling fatty-meats (Fig.1). The VOC emissions from frying consist mainly of saturated and unsaturated aldehydes which are formed through breaking of fatty acids. Vegetable cooking was associated with significant VOC emissions composed mainly of alcohols and considerable amounts of sulfur species (Fig.2). PM emissions from boiling vegetables are below detection limit and also the VOC emissions are lower than the ones from frying. Particle and gas phase composition as well as emission factors from all cooking styles and products will be presented.

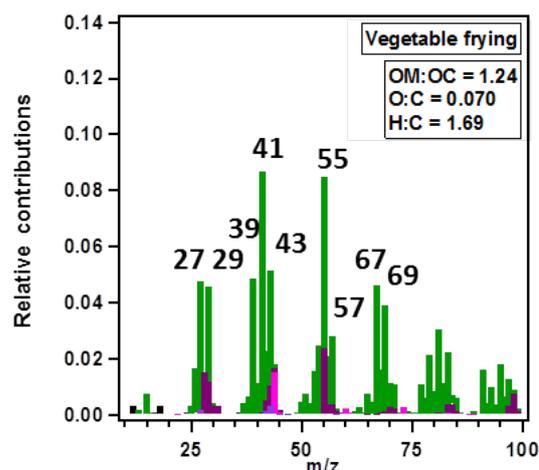


Figure 1. Mass spectrum of the primary aerosol from frying vegetables

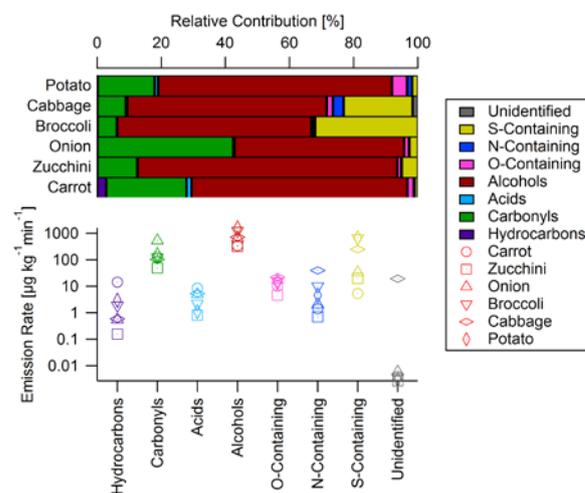


Figure 2. Chemical composition and emission factors of non-methane VOC for boiling different vegetables

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Ko et al (2000) *Am. J. Epidemiol.* **151**, 140-147.