Secondary Organic Aerosol Formation from Chinese Cooking Emission

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Organic aerosol (OA) constitutes a significant fraction of the atmospheric fine particulate matter that influences both air quality and climate. Secondary organic aerosol (SOA), which is formed through photo-oxidation of organic vapors in the atmosphere, is a major component of OA. There are some studies indicating the major role of Chinese cooking emissions in SOA formation in China. However, SOA formation is complex and uncertain.

In this study, we investigate the primary emission and secondary formation from Chinese cooking. The cooking ways include stir-fry, fry, and deep fry. The dishes were stir-fired shredded cabbage, fried Tofu, Kung Pao Chicken, and fired Chicken. Besides, different kinds of oils were fried to investigate the effect of oil on emission. The cooking emission was diluted and exposed a range concentration of oxidants (O_3 and OH) in the Go-PAM. Two SMPS were used to measure particle number concentrations before and after oxidation. A DMA-CPMA-CPC system was used to obtain the size resolved particle density, and together with particle number concentration, primary and secondary particle mass concentrations were calculated. One ptr-MS was used to measure primary VOCs concentration, and one Aerodyne VOCUS was deployed to measure the VOCs after PAM. An AMS was used to measure the secondary particles. Our results showed that the SOA/POA ratios varied significantly from 5-35, depending on cooking ways. The emission stir-fired shredded cabbage has largest SOA/POA ratio of 35, followed by fried Tofu (22), Kung Pao Chicken (16), and fried chicken (5). The O:C ratio increased from 0.12~0.26 of cooking POA to 0.40~0.52 of cooking SOA. Our results suggest Chinese cooking contributes significantly to ambient not only primary particles but secondary particles.