

Chemical composition of hookah smoke derived aerosol measured with an Aerosol Chemical Speciation Monitor

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Hookah (also known as narghile, shisha, and hubble-bubble) smoking originated in India during the 15th century and has since spread to various Middle Eastern and Mediterranean regions as well as western countries, including the United States where there has recently been a dramatic increase in its prevalence (Eisenberg et al., 2008). In a hookah, as users inhale, air is drawn over charcoal which indirectly combusts the tobacco. The mixture of charcoal and tobacco smoke is then drawn through water and to the user. The tobacco smoked with a hookah is often sweetened with, for instance, molasses. While smoke from cigarettes has been relatively well characterized, little is known about the chemical composition of hookah smoke aerosol, which is expected to be different due to the different method of combustion, the water filtration, the added influence of the charcoal, and the presence of sweeteners in the tobacco.

Here we present on-line aerosol chemical composition measurements of hookah smoke using the recently developed Aerodyne Aerosol Chemical Speciation Monitor (ACSM). The ACSM samples the air through a 100 μm orifice into an aerodynamic focusing lens where particles are focused into a beam which is transmitted through a vacuum system to a tungsten surface that is heated to 600°C. The particles are vaporized and the resulting gases along with the remaining air are ionized with electron impact and detected with a small quadrupole mass spectrometer. The particle-only mass spectrum is determined by switching an automated 3-way valve between whole air and filtered air and taking the difference of the filtered and unfiltered mass spectra (Ng, et al., 2011).

Previous studies of the particle phase of hookah smoke aerosol are quite limited and have relied on off-line techniques to examine total particle mass, individual compounds or classes of compounds (such as nicotine, polycyclic aromatic hydrocarbons, or aldehydes), or tar (nicotine-free dry particulate matter) extracted from filters (Shihadeh, 2005). This study is the first to measure bulk chemical composition of hookah smoke particles using an on-line technique.

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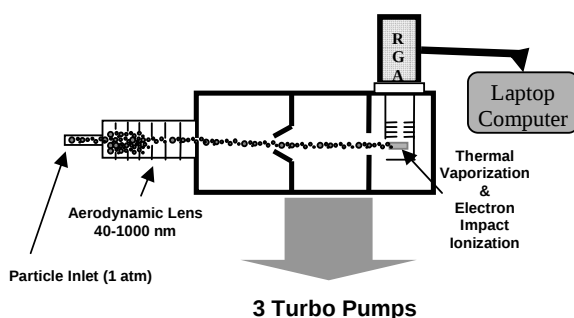


Figure 1: A diagram of the aerosol chemical speciation monitor