



The Formation of Secondary Products during the Ozone-initiated Reactions with Biogenic Hydrocarbons Emitted from Natural Paint

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Natural paint containing raw ingredients of resins, plant pigments, and essential oils is a potential source of volatile biogenic hydrocarbons mainly consisting of monoterpenes. The monoterpenes have been extensively studied due to their reactivity with atmospheric oxidants (O_3 , NO_3 , and OH). Recent studies have shown that gas-phase oxidation between terpenes and atmospheric oxidants can generate sub-micron size particles and toxic volatile organics such as aldehydes and ketones. No significant researches have been conducted to investigate the formation of toxic gas and solid-phase products during the oxidation in indoor environments. We have conducted a research to identify and quantify the products during ozone-initiated oxidations with volatile biogenic hydrocarbons emitted from the natural paint applied to the indoor environments. The major chemical compounds emitted from the natural paint were α -pinene, β -pinene, camphene, p-cymene, and limonene, which exhibited significant decrease in the presence of indoor ozone. A parametric study has been conducted to identify the effect of physicochemical parameters including 5 levels of ozone concentrations (50, 100, 200, 500 and 1000 ppb) and two different volumes of paint (10 and 30 ml). We have observed the formation of secondary gas-phase and solid-phase products in a gas chamber system. The increase of concentrations of ozone and natural paint resulted in the increases of particle counts ranging from 8,000 – 100,000 particles/cm³ and of gas-phase low molecular weight carbonyl products (i.e., formaldehyde, acetone, propionaldehyde, and acetaldehyde). The concentrations of carbonyl products quantified were 40.7 – 106 ug/m³ (formaldehyde), 0.0 - 72.0 ug/m³ (acetaldehyde), 7.0 - 227.0 ug/m³ (acetone), and 0.0-106.0 ug/m³ (propionaldehyde), respectively. The low molecular weight carbonyl products were not easily oxidized with ozone and OH rad-

icals produced during the reactions and accumulated throughout the reactions. The research shows that the natural paint applied to the indoor environments could significantly affect indoor air quality and cause serious health problems by producing toxic gas-phase organics and particles.