Characterization of Exhaled Emissions from Smoking and Vaping of Commercial Nicotine Products in Malaysia

Nur Ismah Izzati Ismail[1]*; Mohd Talib Latif[1]; Sharifa Ezat Wan Puteh[2]; Mohd Shahrul Mohd Nadzir[1]; Haris Hafizal Abd Hamid[1]; Kraichat Tantrakarnapa[3]

[1]Department of Earth Science and Environment, Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 Bangi, Selangor, Malaysia
[2]Department of Public Health Medicine, Faculty of Medicine, Universiti Kebangsaan Malaysia, 56000 Cheras, Wilayah Persekutuan Kuala Lumpur, Malaysia
[3]Department of Social and Environmental Medicine, Faculty of Tropical Medicine, Mahidol University, 10400 Bangkok, Thailand

Abstract

Inhaling tobacco smoke has been connected to lung problems and bedridden individuals. To prevent smokers from quitting, the health industry should promote vaping and heated tobacco products (HTPs) as alternate nicotine delivery systems. However, the distinctions between smoke generated by cigarettes and non-combustible nicotine products require additional investigation. This study analyzed the amounts of volatile organic compounds (VOCs) and 2.5-micron particle matter (PM) in inhaled smoke and aerosol from normal cigarettes, vapes, and HTPs. The experiment included several parameters such as legal and illegal cigarettes, flavors, and vaping devices. This study examines exhaled breath from smoking cigarettes and other non-combustible nicotine products available in Malaysia. Exhaled breath was collected with a Bio-VOC breath sampler to determine VOC concentrations. Exhaled breath was used to assess $PM_{2.5}$ concentrations using an AS-LUNG air sensor. The chemical acetone generated by non-mentholated contraband tobacco cigarettes had the highest mean concentration of 0.6 µg/ m^3 for volatile organic compounds. Mentholated HTP tobacco sticks had the lowest acetone content, at 0.098 µg/ m^3. Non-mentholated illicit tobacco cigarettes produced the greatest mean concentration of $PM_{2.5}$ (1114 µg/m^3) at t = 60 min. Mentholated HTP tobacco sticks had the lowest concentration at 38 µg/ m^3 after 60 minutes. Based on this, HTPs produced the lowest quantities of VOC and $PM_{2.5}$ among the products and are the best alternative to traditional cigarettes.

Keywords: Nicotine delivery systems; Volatile organic compounds; Particulate matter; Bio-VOC breath sampler; AS-LUNG air sensor.