Distribution and composition of mosquito coil fuming smoke

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Background

The mosquito problem is sustained in the Asian environment for prolonged period of a year, and the coils are fumed to repel mosquito, which contribute significantly to the indoor air pollution (*Weili et al., 2003*). The major active ingredients of mosquito coils are toxic compound: pyrethrins, salts, etc. The smoke is a complex mixture of freshly nucleated fine and ultrafine particulate matters (PM) inclusive of other constituents i.e. organic carbon (OC), elemental carbon (EC), salts, acids, etc. These particulates expose an elevated health risk due to their penetration into the human organism via the lungs to cause oxidative stress and inflammation as well as exacerbation of asthma symptoms in susceptible individuals.

The distribution and composition of the smokes and their constituents i.e. organic carbon(OC), elementary carbon(EC), total carbon(TC), polycyclic aromatic hydrocarbons(PAH) and ions (i.e. Cl^-, NO_3^-, SO_4^{2-}, NH_4^+, Na^+, K^+, Mg^{2+} and Ca^{2+}) emitted during fuming of the mosquito coils in the Indian houses are discussed.

Methods

In the present work, the mosquito coil smokes generated during fuming of 4 coils were collected over the quartz filter by using low volume air sampler. The OC and EC contents of the particulates were analysed by the combustion method. Thirteen PAH (i.e. Phe, Ant, Fla, Pyr, Baa, Cry, Bbf, Bkf, Bap, Dba, Bgh, Ind and Cor) contents were quantified by the HPLC. The water soluble anion and cation contents of the smoke were measured by the IC.

Results and Discussion

The mean (n=4) concentration value of PM, OC, EC, TC(total carbon), ∑WSI(total water soluble ions) and PAH in the smoke are 0.60±0.04, 0.31±0.06, 0.07±0.01, 0.10±0.02 and 0.06±0.03 mg m^{-3}, respectively, Among constituents, the OC exhibits the highest concentration likely to biomass smoke. The OC and EC has fair to good correlation (r = 0.52 – 0.84) with the PM, indicating their origin from the burning processes. The mean (n=4) fraction of OC, EC, ∑WSI and other elements include 50, 11, 38 and 1%, respectively. The high ratio (4.7±1.0) of the OC/EC in the smoke is due to structures break apart of cellulose, lignin and small resinous materials of wood used in preparation of the coil. The major ingredients of the MC smokes are Cl^-, SO_4^{2-}, and K^+, Figure 1. The sum of total equivalent concentration ratio of the $[\sum PM_{anion}]/[\sum PM_{cation}]$ in the smoke is 1.4±0.78. The smokes are found to be acidic due to presence of relatively higher concentration of Cl^- and SO_4^{2-}. Some ions i.e. Cl^- with Na^+, K^+, Mg^{2+} and Ca^{2+}; NO_3^- with NH_4^+; SO_4^{2-} with Cl^-, NO_3^-, Na^+, NH_4^+ , Mg^{2+} and Ca^{2+}; Na^+ with NO_3^-, K^+, Mg^{2+} and Ca^{2+}; K^+ with Mg^{2+}, Ca^{2+}, and Mg^{2+} with Ca^{2+} have fair to excellent correlation values (r = 0.62 – 1.00). The concentration of total $\sum PAH_{13}$ in the indoor air (n=4) is ranged from 0.07 – 92 µg m^{-3} with a mean value of 0.12±0.07 µg m^{-3}. The mean concentration of 13 individual PAH in the air is presented in Figure 2. Among them, Pyr and Cry exhibit the highest concentration. The concentration of PM and $\sum PAH_{13}$ (n=4) in the indoor environment during the burning processes is being several folds higher than WHO permissible limit of 50 µg/m^3 and 1.2 ng/m^3 for PM_{10} and PAH, respectively. The fuming of mosquito coil