심포지엄 1) Current Status of VOC Pollution and Research in Japan

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Current Status

Volatile Organic Compounds(VOCs) are discharged into environments through combustion and evaporation processes. Automobiles and boilers are major emitters of outdoor VOCs through combustion; while evaporation of solvents used in paints and adhesives contributes to increase of outdoor VOCs concentrations. VOCs are also discharged from industrial cleaning processes. Their potentialenvironmental impacts consist of direct effects such as inducing adverse health effects as gaseous compounds, and indirect effects as a precursor of ozone and fine particulates through atmosphericreactions. Observation of high ozone concentration in non-industrial area along Japan Seais a hot topic in Japan due to long range transportation of ozone precursors, that is, VOCs and NOx discharged in Asia continent. Regional collaboration is needed to develop mitigation measures against these trans-boundary atmospheric pollutions.

VOCs discharged in indoor environments are somewhat different from outdoor VOCs. Combustions are major emission processes of VOCs in indoors as well as outdoors. Open fired cooking and heating appliances increase indoor VOCs when in use. Typical indoor sources of non-combustion VOCs are adhesives of building and furniture materials and paints. Formaldehyde and toluene are popular indoor pollutants. These chemicals are responsible for inducing sick-house syndrome and multi-chemical sensitivity. Reduction of indoor formaldehydeand toluene concentration were urgently required in Japan in 1990s. Determinant factors of indoor VOC concentration are not only emission strength of VOCs but also air exchange rates of the buildings. Establishmentof guidelines of indoor VOC concentrations and strengthening of building code to maintain air exchange rate have played significant role to reduce indoor formaldehyde and toluene as shown in Fig. 1.

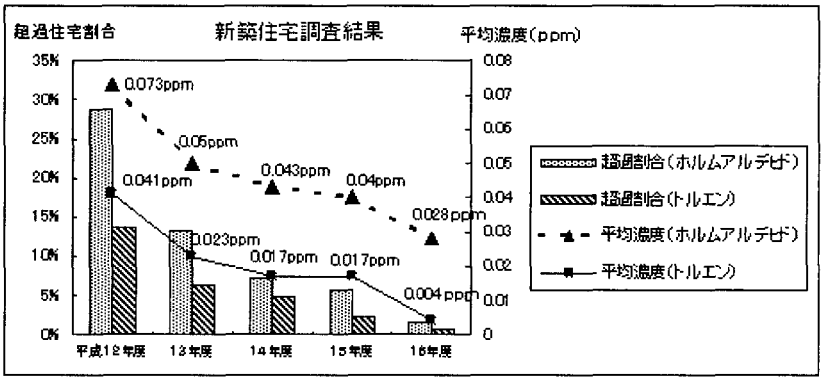

Fig. 1. Trend of Indoor Formaldehydeand Toluene concentration in New Houses(http://www.mlit.go.jp/kisha/kisha05/07/070510_.html).

Research

The guideline of indoor VOC concentrations in Japan covers 13 VOCs. How do you thing that covering 13 compounds by the guideline is enough or not? Number of organic compounds used in our modern society is huge. It is said that our daily life is supported by more than one hundred thousand organic compounds. VOCs observed in a typical office space in Japan are shown in the following chromatogram(Fig. 2).

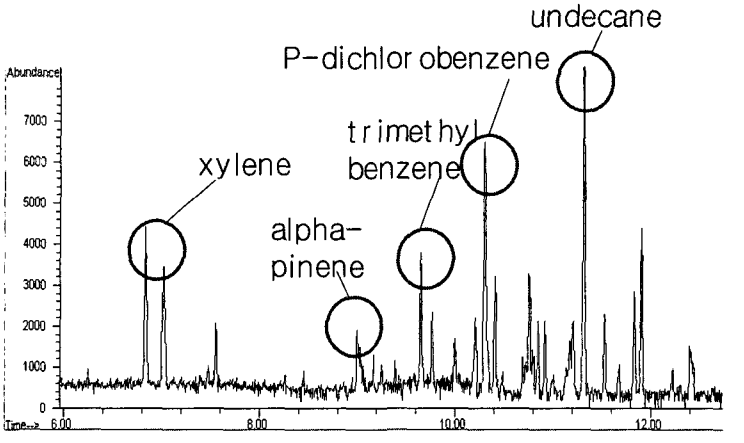

Fig. 2. Chromatogram of VOCs sampled in a typical office.

Rapid change of VOCs concentration requires real time monitoring of VOC concentrations as shown in Fig. 3. However, no instrument can measure various compounds simultaneously. TVOC could be a surrogate of many kinds of VOCs.

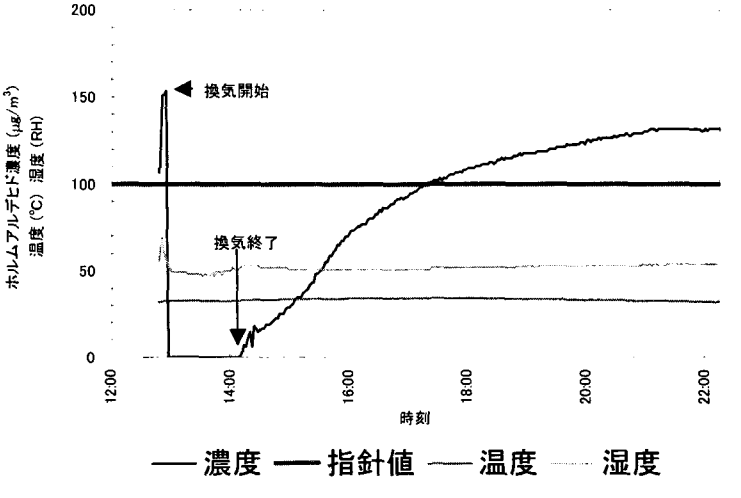

Fig. 3. Rapid change of indoor Formaldehyde concentration.

Fig. 4 shows observational results of TVOC personal exposures. Similar to the indoor VOCs, personal VOC exposures varies widely.

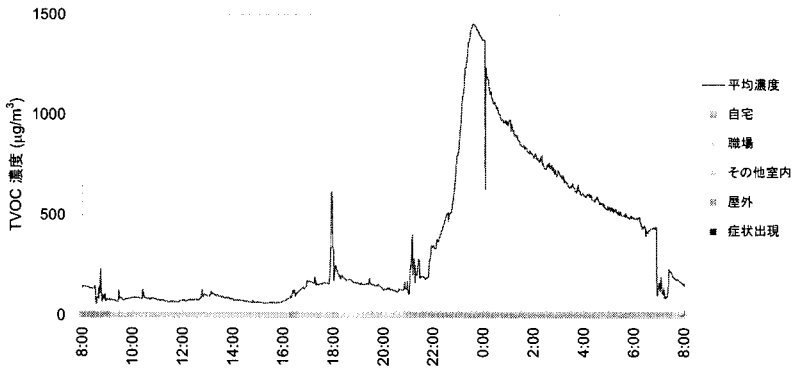

Fig. 4. Rapid change of personal exposures to TVOC.

Not only special and temporal distribution, but also kinds of VOCs are essential factors to evaluate VOCs in the environments.