

Emissions of VOCs from polymers during their life cycle and risks for use and recycle

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We measured the emissions of VOCs from polymeric materials such as PVC, PP and PE under various environmental conditions. We prepared a passive type flux sampler made of a glass petri dish of which the inner diameter is 22 mm and the height is 5 mm. A fixed amount of Tenax GR powder is placed on the inner bottom of the sampler as an adsorbent for capturing VOCs. A sheet of a target polymeric material was placed on the sampler for a given period under constant temperature condition. The VOCs emitted from the polymeric sheet diffused through the sampler space and were captured onto the adsorbent. The captured VOCs were then analyzed by the ATD-GC/MS technique to determine the composition and the emission rates. The temperature was change in the range of 25°C (room temperature) to 75°C and the sampling period was set 24 hrs. To examined the time-course of the VOC emission behaviors, the test polymeric materials were left under the same conditions up to 4 weeks and the emission measurements were carried out every 1 week. The total VOC emission (TVOC emission, reduced to toluene) of soft PVCs were much higher than those from other polymers such as PE, PET and we focused on the emission from soft PVCs with different properties. The major VOCs emitted from soft PVC were phenol, 2-ethylhexanol, DEHP and aliphatic hydrocarbons. DEHP is intentionally added to PVC as a plasticizer and 2-ethylhexanol was supposed to be a product of dissociation of DEHP. The emission rate of each component showed a time change as well as temperature dependency. The emission of phenol decreased with time and that of DEHP decreased at first 3 weeks but increased after 4 weeks. The temperature dependence of the emission rates can be expressed by the Arrhenius type equation and the apparent activation energy was determined. These results could be useful for the evaluation of life-cycle risks caused by the use, recycle and reuse of polymeric materials used in commercial products.

Biography

Miyuki Noguchi is a Research Scientist working at Seikei University, Tokyo, Japan. She also teaches classes in the university as a Lecturer. She has obtained her PhD at the University of Tokyo for Environmental studies. She is an expert in the Environmental Chemistry, especially in the field measurements of VOCs and SVOCs in the air and evaluation of the air quality.

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