

Estimate of roadside air pollution with a biomonitoring method

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Abstract

Though air pollution due to atmospheric particulate matter has been a serious problem in Japan, it is difficult to measure atmospheric particulate matter in widely roadside areas with the limited number of the stations. Therefore we focused on biomonitoring technique with ginkgo leaves. Ginkgo leaves were collected along major arterial roads in spring, summer and autumn in 2014, 2015 and 2016. The particles retained on leaves were removed by ultrasonic cleaning into ethanol solution. The ethanol solution including particles was suctioned by an aspirator. Particles were collected on PTFE filter. Particles on filter were quantified by Particle Induced X-ray Emission (PIXE) analysis. The total mass and the total element mass (20 elements: Na, Mg, Al, Si, P, S, Cl, K, Ca, Ti, V, Cr, Mn, Fe, Ni, Cu, Zn, Sr, Zr, Pb) on leaves increased in turn on autumn, summer and spring. It suggested that atmospheric particulate matter accumulated on leaves day by day. Particle on leaves were affected by yellow sand in spring, and by traffic related sources in summer and autumn. The weight rate of elements of road dust and brake wear dust were nearly equal to those of particles on leaves in all seasons and at all locations. The weight rate of elements of particle on leaves were not so equal to those of SPM measured by roadside monitoring station, because particle more than 10 μm can attach to leaves and the water soluble particles on leaves are easily washed out by rain. The weight rate of elements of particle on zelkova leaves were nearly equal to particle on ginkgo leaves. It suggested that biomonitoring technique can be applied to other species of plants. These results showed that biomonitoring technique is the effective method to assess roadside air pollution.