ATMOSPHERIC CONCENTRATIONS AND SPATIAL DISTRIBUTION OF GASEOUS INORGANIC AIR POLLUTANTS BY PASSIVE SAMPLING IN KUTAHYA, TURKEY


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Kutahya, a Turkish city, has a population of 248,000 and having serious air pollution problems because of two thermal power plants. In this study, gaseous inorganic air pollutants: nitrogen dioxide (NO₂), sulfur dioxide (SO₂) and ozone (O₃) were measured at 110 points covering an area of 130 km x 120 km within Kutahya, for winter and summer seasons by using passive samplers. The aim of the study was to investigate the effects of different sources (thermal power plants, domestic heating, traffic etc.) on air quality of the city. Winter and summer sampling campaigns were performed for two weeks in 2014.

Ambient NO₂, SO₂ and O₃ concentrations were determined by using tailor-made passive samplers. Two different types of passive samplers developed by the research group from Anadolu University Environmental Engineering Department were used. O₃ and NO₂-SO₂ passive samplers were made from delrin and Teflon, respectively. Samplers were compared and validated by using different commercial passive samplers before the study. Samples were analyzed by using DIONEX 2500 Ion Chromatography equipped with GP 50 gradient pump, LC 25 column oven and a conductivity detector. Atmospheric concentrations of the pollutants of concern were then determined by using Fick’s first law of diffusion.

In winter season, highest SO₂ concentrations were measured around the city center, and also the sampling points around the power plants. The highest SO₂ concentration was 139.1 µg/m³ and average value was 69.3 µg/m³. The highest NO₂ concentration was 56.9 µg/m³, obtained in the city center, too. The average value was 12.8 µg/m³. Contrary to NO₂, O₃ concentrations were found to be lower around the city center, and higher at the rural points. The highest ozone concentration was 133.8 µg/m³ and average value was 55.9 µg/m³. Spatial distribution of the pollutants were investigated by a geographical information software (ARCGIS 10) and the pollution profile of the city was mapped. Effect of the power plants on air quality was obviously seen by spatial analysis after mapping.

KEYWORDS: Air quality, Nitrogen dioxide, Sulfur dioxide, Ozone, Passive Samplers, Ion chromatography.