Investigation of Air Quality in Three Transdanubian Cities

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INTRODUCTION – In the European Union there are guidelines in place to restrict immission values of certain pollutants in order to reduce impacts on human health. On renewal of Hungarian air quality regulation (Regulation of the Rural Development 4/2011) were effected in accordance with the EU regulations guidelines.

The aim of this study is to determine the diurnal, monthly variations of air pollutants NO, NO_2, CO in Sopron, Szombathely and Székesfehérvár, to determine statistical relationships of air pollutants in each city, furthermore to analyse their relation to meteorological parameters.

Figure 1. Mobile air testing equipment for immission analysis

MATERIALS AND METHODS

The air quality has been monitored by a mobile air testing equipment applying diurnal sampling by methods recommended by directives (MSZ ISO 7996, MSZ 21456/5). CO concentration was measured by nondispersive infrared photometry, NO_x content by chemiluminescence (Horiba APNA-370). Measurements were performed monthly, continuously, in cyclical repetition between March 2011 and Jan 2012 at selected locations in each city. Such monitoring sites were choosen, which represent the main type of urban structure (downtown, residental area, green belt, industrial area).

RESULTS – The mean diurnal CO, NO and NO_2 concentrations were below the ambient air quality limit values at all sites over the entire period under review. The average diurnal variations of air pollutants showed similar tendencies for all three cities. In general, two maximum values were obtained in the daily profiles of air pollutants during workdays correspond to rush hours. Results indicate that vehicular traffic is the principal source of these pollutants. The distributions of the hourly values of pollutants are very different for workdays, Saturdays and Sundays. The highest hourly measured values were of 4571 µg/m^3 for CO and 62.8 µg/m^3 for NO_2 in Székesfehérvár, which were below the 1-h Hungarian standard. The concentrations of CO and NO_x correlate strongly during the measurement period.

Table 1. Ambient air quality limit values (Regulation of the Rural Development 4/2011)

Compound	Interval	Hungarian Standard (µg/m^3)
Carbon monoxide (CO)	1 year	3000
	24 h	5000
	1 h	10000
Nitrogen dioxide (NO_2)	1 year	40
	24 h	85
	1 h	100

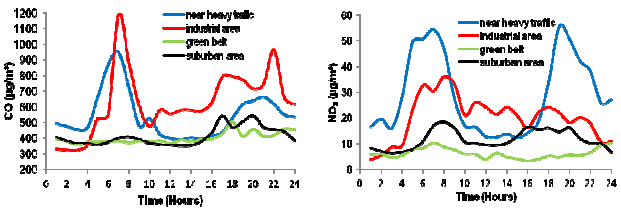

Figure 2. Typical day CO and NO_2 curves at selected locations in Sopron in October 2011

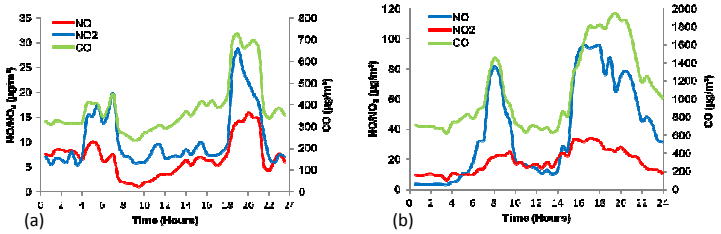

Figure 4. Concentration of CO, NO, NO_2, represented as 30-minute averages, measured at busy street in Szombathely (a) on 12 May 2011, (b) on 28 November 2011

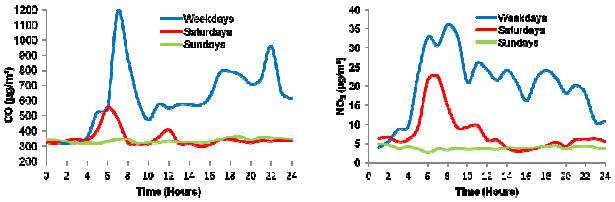

Figure 3. Typical day CO and NO_2 curves at busy street in Sopron in October 2011

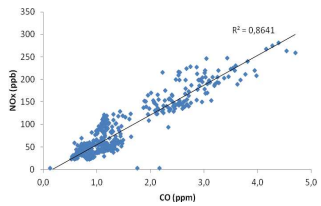

Figure 5. Concentration of CO versus NO_x for November 2011 measured in Székesfehérvár

CONCLUSION – Air quality in cities is getting worse as the population, traffic, industrialisation and energy use increase. Urban air pollutants show typical diurnal and seasonal cycles. Seasonally separated data indicated a maximum in compound concentrations over the winter period. The relatively high wind speed and the geography of the cities do not allow the accumulation of pollutants during most days. The differences in the pollutant characteristics among cities can come from the different city structure, traffic structure, difference in topography.

These air pollution measurements represent the part of a complex, integrated urban ecological research.

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