The effect of the tramway track building on the aerosol pollution in Debrecen, Hungary

E. Furu[1,2], I. Katona-Szabo[2], A. Angyal[1], Z. Szoboszlai[1,] Zs. Török[1,2], and Zs. Kertész[1]

[1]Institute of Nuclear Research of the Hungarian Academy of Sciences, Laboratory of Ion Beam Applications, H-4001 Debrecen, P.O. Box 51, Hungary
[2]University of Debrecen, H-4032 Debrecen, Egyetem tér 1, Hungary
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Presenting author e-mail: furu.eniko@atomki.mta.hu

In this study atmospheric aerosol concentration and composition were investigated along the tramway track construction in Debrecen, Hungary. Aerosol samples were collected with personal samplers between 21. and 30. 09. 2011 - four hours a day, during working hours. The sample collection was made by walking on the pavement next to the building. The weather was dry and warm on the sampling days.

Nuclepore two-stage samplers equipped with Nuclepore polycarbonate filters of 8 μm and 0.4 μm pore diameter were used. Mass concentrations and elemental composition were determined separate for coarse (particles with aerodynamic diameter larger than 2.5 μm) and fine size fractions (particles with aerodynamic diameter smaller than 2.5 μm). The elemental composition ($Z \geq 13$) was determined by particle induced X-ray emission (PIXE) analytical method. The concentration of particulate matter (PM) was measured by gravimetry using a microbalance.

The measured PM10 and PM2.5 concentrations are shown in Table 1. PM10 concentrations were compared with the data of the Hungarian Air Quality Network (http://www.kvvm.hu/olm/index.php?lang=en). In every case the PM10 concentration were 8-20 times higher along the building than the data of the Hungarian Air Quality Network. In the second week the weather was rather windy which explains the increased PM10 level along the tramline building.

Table 1. PM2.5 and PM10 concentration data along the tramline track construction and at the AQ monitoring stations of the Hungarian Air Quality Network

Date	tramline building PM2.5 (μg/m^3)	tramline building PM10 (μg/m^3)	Hungarian Air Quality PM10(μg/m^3) average data
21.09.11	24	292	26
22.09.11	36	291	49
23.09.11	36	232	37
26.09.11	39	322	38
27.09.11	51	647	48
28.09.11	43	408	42
29.09.11	33	617	22
30.09.11	40	559	30

The elemental concentration of the samples which were collected along the building were compared with the elemental concentration of samples from our urban background station (garden of Atomki), which is situated ~ 500 m from the new tramline track building. For comparison we show data from September 2010 (no building), and from September 21-30. 2011 (Table 2). For both size fractions significant increase were observed from 2010 to 2011. In the case of PM2.5 the concentration of all measured elements increased by a factor between 8 and 15 in the garden of Atomki. The elemental concentrations measured along the tramline construction were 1.5-5 times higher than at the Atomki. In the case of the coarse fraction the increase from 2010 to 2011 were only around a factor of 2 at the garden of Atomki. However, along the tramline constructions we measured 10-100 times higher elemental concentration values than 500 m away.

Table 2. Average elemental concentrations in the coarse fraction at an urban background station in 2010 and 2011 (A) and along the tramway track construction (B)

	Coarse fraction		
	A(2010) ng/m^3	A(2011) ng/m^3	B(2011) ng/m^3
Al	395	415	5360
Si	650	1250	35400
P	30	15	190
S	120	155	780
Cl	25	20	645
K	115	205	3795
Ca	275	480	17700
Ti	16	34	700
V	0.5	1.6	25
Cr	0.6	60	90
Mn	4.7	13.4	210
Fe	285	535	8200
Co	<0.8	4.5	30
Ni	1.0	18	14
Cu	3.4	4.3	48
Zn	7.9	6.6	125
Br	1.0	0.6	8.6
Sr	<1.9	5.1	90
Ba	6.2	13.7	310
Pb	1.9	4.1	125

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