CARBON MONOXIDE IN THE URBAN AREAS FROM CLUJ COUNTY

L. MUREŞAN, I0VANCA HAIDUC, S.M. BELDEAN GALEA

ABSTRACT. - Carbon monoxide in the urban areas from Cluj County. Carbon monoxide is mainly an anthropogenic pollutant and it is a result of incomplete combustion of fossil fuel. This study shows the seasonal variation of carbon monoxide levels in Cluj County urban areas, during six months in 2008 (since July till December). For this study, three different locations, from Cluj County, were selected: Cluj-Napoca, Turda and Huedin. In each of them, we chose city points with intense anthropic activities, and some reference points with a minor anthropic impact. In order to evaluate the diurnal variation of CO concentration, in situ determination were done for 8 hours a day (9,30-16,30 OVR respectively 8,30-15,30, OIR). The data show a slightly variation for the CO level from one area to other. In addition, there is no significant seasonal and diurnal variation for the CO level.

Key words: *urban CO, urban agglomeration, diurnal variation*

1. Introduction

Carbon monoxide is mainly an anthropogenic pollutant and it is a result of incomplete combustion of fossil fuel. Vehicle exhaust is a major source of air pollution in cities. Carbon monoxide (CO) is one of the major pollutants present in the exhaust gases (Clifford et al, 1997), and is produced from the partial oxidation of carbon-containing compounds, notably in internal-combustion engines. Carbon monoxide has adverse effects on human health by replacing oxygen in the bloodstream and forming carboxyhemoglobin when its concentration is greater than about 30 ppm (Kiely, 1997) (Eilert EJ 2005). Carbon monoxide also acts as a good tracer of other pollutants emitted from fossil fuel combustion. (www.epa.qld.gov.au)

2. Materials and methods

The measurement in situ of CO concentrations in urban air were done by using an non-dispersive infra red analyzers (NDIR), Horiba APMA 370 model, which is able to identify variations in the concentration of CO over a long period of time (that depends of hours) and are sensitive enough so that to indicate variations in the order of ppb.

The measurements were done in three location from Cluj-Napoca County (Cluj-Napoca, Turda and Huedin) (figure 1), during a period of six months, since July to December. In each location, we chose for measurements some city points with intense anthropic activities, and some reference points with a minor anthropic impact. (Chan L.Y. et al.) (Sung-Ok Baek 1999)

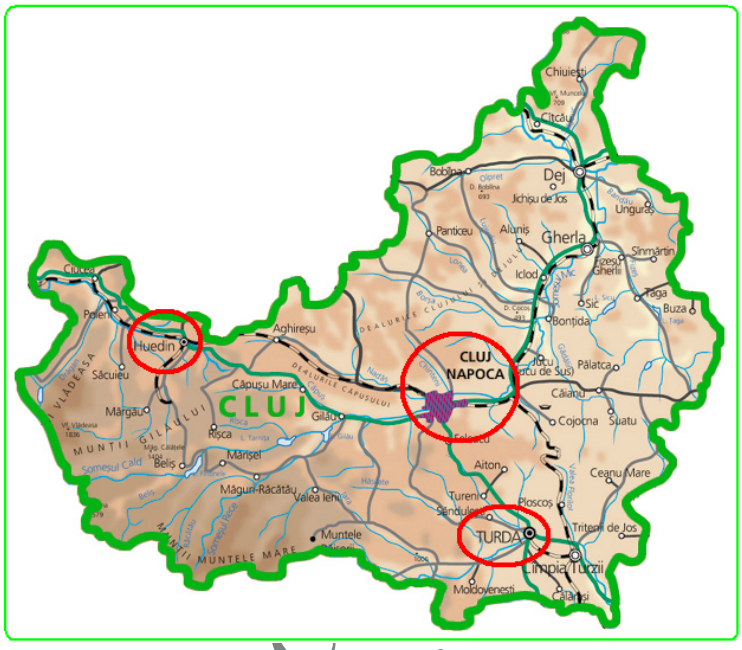

Fig.1. The location of the determination points.

The measurements were done at 2,0 m above the soil, during two seasons (summer and autumn), for 8 hours a day (9, 30-16, 30 OVR respectively 8, 30-15, 30, OIR) in each location.

To prevent the impact of meteorological factors (wind, rain, solar radiation) over the data, the measurements were performing in a meteorological shelter. Finally, the main value of 8-hour determination has been taken into account for comparing the influence of urban agglomeration over the CO concentration.

3.Results and disscussion

During the period of the six months of continuous determination, there were not registered significant variations regarding the CO level. During the

sampling period the CO, recorded values were situating generally between 0.02 and 0.4 mg/m^3, being lower than the limit value (10 mg/m^3) allowed in the urban air.

For Cluj-Napoca in the City point, the CO concentration was measured daily and the data showed a slightly seasonal variation which had an increasing trend since July to December (figure 2.). This can be explained by the influence of meteorological parameters (temperature, relative humidity (RH), wind speed etc) which strongly influence de dispersion and accumulation of CO into the atmosphere.

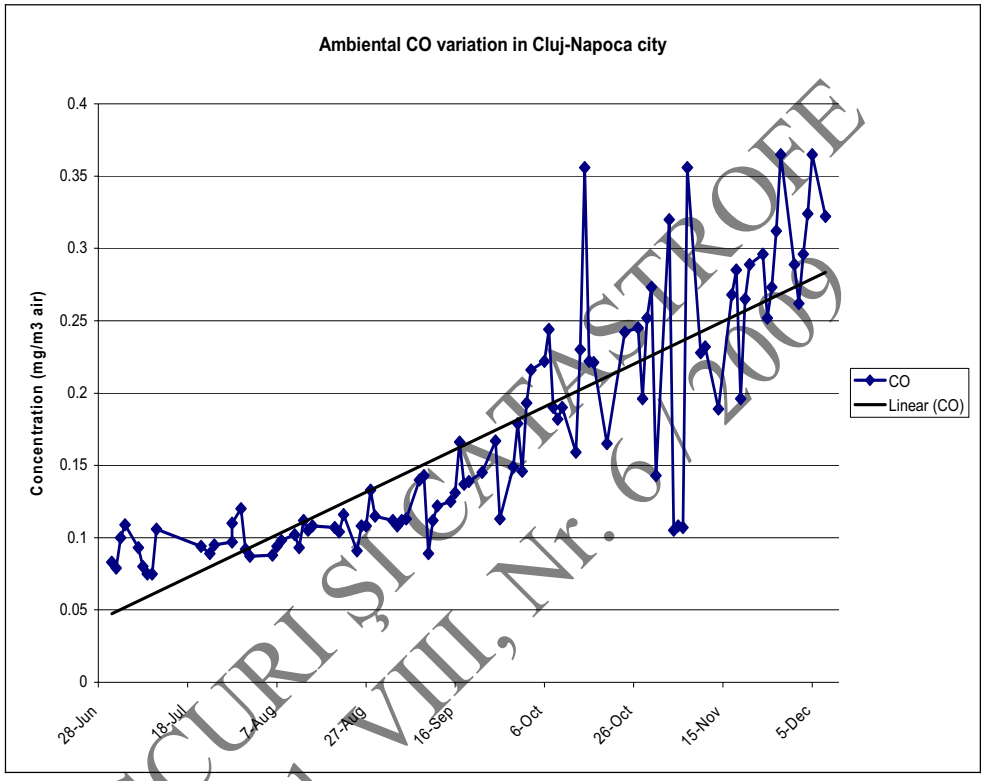

Fig.2. The CO variation in Cluj-Napoca.

With regard to the variation of CO concentration during 8 hours, one can notice that for Cluj–Napoca, in the City point, almost in each month, the highest concentrations were observed during 9.30-10.30 AM, compared to those from 10.30-12.30 AM when the CO level decreased. A new increasing level of CO in the afternoon between 01.30-04.30 PM was observed. (figure 3). This fact is due to

the influence of the temperature and the atmospheric inversion which strongly influence the dispersion and accumulation of CO into the atmosphere. Another reason could be the intensity of urban traffic which is more intense in that interval of time.

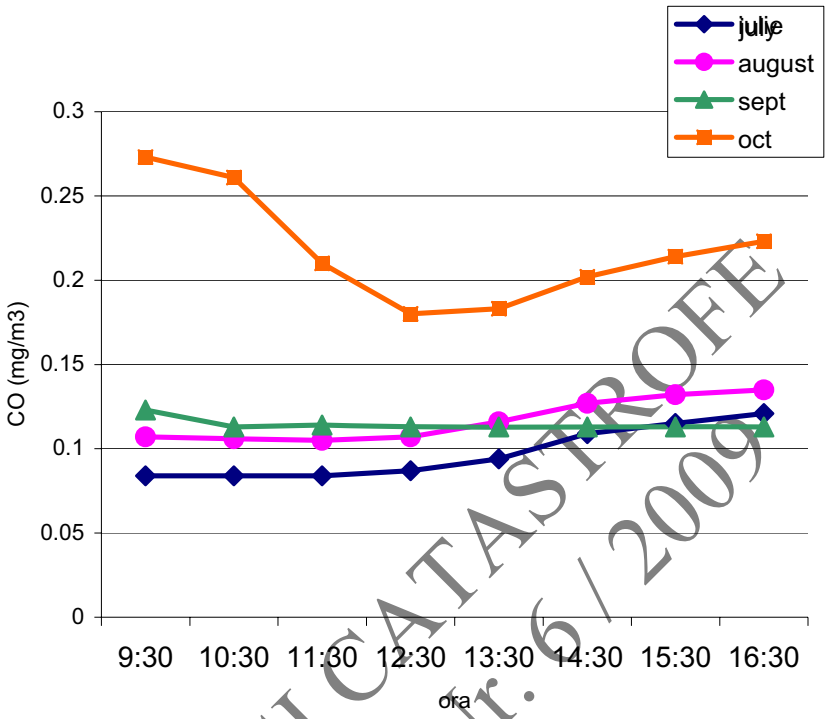

Fig. 3. 8 hours variation of CO in Cluj-Napoca.

Comparing, the measurements done in the three-selected location [Cluj-Napoca, Turda and Huedin, (City points)] one could be see that the highest CO level was register in Turda (0.084-0.326 mg/m^3), compared to Cluj-Napoca (0.097-0.265 mg/m^3 air) and Huedin (0.062-0.269 mg/m^3) (see figure 4).

A reason of these results could be the place of determination point chosen in Turda which is very close to the industrial park and to the main traffic route. Comparing the data one can notice that in each location the concentration of CO present an ascending trend from July to December being in connection with meteorological parameter (temperature, RH) which is in favor of the accumulation of CO in urban atmosphere.

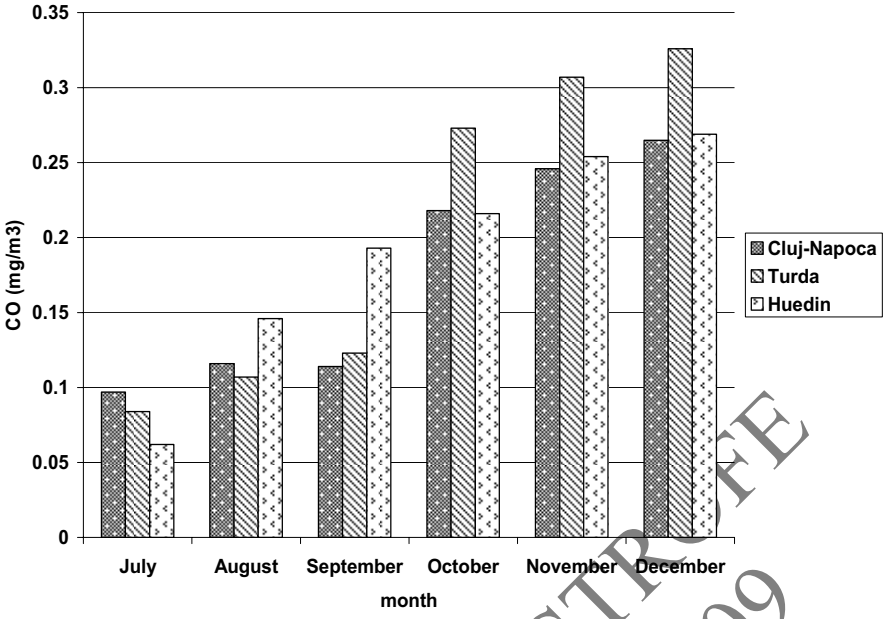

Fig.4. The monthly variation for CO (8 hours average values), in all the selected points.

As far as the CO concentrations is concerned, in the references point the results showed that in all locations (Cluj-Napoca, Turda, Huedin) the level of CO was situated under the limit of detection (0.02 ppm) of the instrument used for this study. Comparing the data registered in this study we can conclude that the results are comparable to the findings in literature (Chan L.Y et al., Cllifford, M.J., et al.) and that the carbon monoxide level increased after the human activity and the traffic fully occurred in the peak hour period.

4. Conclusions

Carbon monoxide does not record significant variations during the measurements; the values recorded are between 0.02 and 0.4 ppm, being far below the maximum allowed (10 ppm) in the urban air.

The diurnal variation shows that the highest concentrations were in the morning and the lowest during the afternoon and that this variation is in connection with traffic intensity and meteorological parameters.

Comparing the CO_2 values for the two seasons, in all the three studied areas, we can notice a significant increase of the concentration in autumn compared to summer.

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