OC, EC, and SOA contribution to PM in Lombardy (Italy): results of three winter campaigns (2005-2007)

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The carbonaceous fraction (OC, organic carbon, ed EC, elemental carbon) represents one of the major components of atmospheric aerosol particulate matter. The new Air Quality Directive 2008/50/EC requires measurements of elemental and organic carbon at selected background sites in each Member State. Until now very scarce data were available for Northern Italy, one of the most polluted area in Europe. OC and EC quantification was carried out in the frame of PARFIL (Particolato Fine in Lombardia) project whose aim was to study air quality in Lombardy region. The study of the carbonaceous fraction allows from one hand to acquire information on sources contribution to PM and from the other hand to enhance the knowledge of health effects and implication on climate changes (EC is responsible of solar radiation absorption while OC plays an important role in the clouds formation).

PM10 and PM2.5 samplings campaigns were carried out, during the three years 2005-2007, in urban, background, rural and remote sites (Milan, Varese, Brescia, Cantù-CO, Boscofontana-MN, Mantova, Alpe S.Colombano-SO, Lodi) representative of the geographical differences present in the region. About 80 samples in total were collected for each site during each year.

TOT (Thermal Optical Transmittance) method was used for OC/EC quantification (Birch and Cary 1996).

Differences in OC and EC concentrations were singled out and were ascribed to the peculiar characteristic of the site (urban, remote-alpine or rural). Nevertheless, all the sites placed in the Po Valley show quite homogeneous values, especially during the warm season, confirming the hypothesis of pollutants dispersion on a regional scale. In figure 1 average OC and EC concentrations in PM10 samples collected during the investigated period (years 2005-2007) at the three types of sites examined (urban, rural and alpine) are shown.

It noteworthy that at urban sites OC is mainly present in PM2.5 representing on average 35 – 40% of the mass while it accounts for 15% - 35% in PM10. Also EC is mostly present in the fine fraction, representing on average 3% - 15% of the mass with higher values in sites affected by traffic.

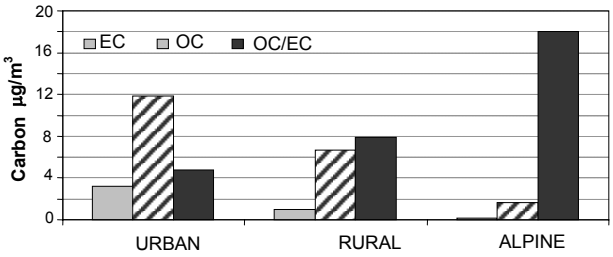

Figure 1- OC, EC and OC/EC in PM10 samples in different sites in Lombardy region as average for the years 2005-2007

The contribution of the biomass burning source was also estimated analyzing the tracer levoglucosan (Simoneit et al., 1999). Wood burning represents on average 15% of PM10 during winter time in urban sites, such as Milan, and 26% in Sondrio, an urban alpine site where the use of wood for residential heating is widespread.

Secondary organic aerosol (SOA) contribution was also quantified since the knowledge of this fraction is important in evaluating policies for PM reduction. In this study SOA was quantified applying the EC tracer method (Turpin et al., 1995) using $(OC/EC)_{prim}$ =1.34 for summer (Giugliano et al., 2005) and a value experimentally determined for winter ((OC/EC_{prim}) =1.58, Vecchi et al., in press). On average, secondary organic carbon represents about 50% and 70% of total carbon in urban and rural sites, respectively.

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