

COAL COMBUSTION EMISSIONS: IMPACT ON AIR QUALITY IN NW SPAIN

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Emissions from coal combustion represent a serious environmental problem. In some megacities of China, an increase in the concentrations of NO_x, SO₂, CO₂ and toxic trace elements has been observed, which negatively impact human health and the ecosystem (Xie et al., 2006). For many years, León (Spain) has been the principal producer of primary energy from coal in Castilla y León (Antolín, 1996). According to the Junta de Castilla y León, in 2016, León produced 20.6 % of the total national coal-based energy. Furthermore, in 2014, 22% of the total energy consumption in the region came from coal combustion, increasing in 2015 to 24%. The emissions from coal burning increase during coldest months due to the use of domestic heating devices. Thus, the aim of this study was to carry out a deep study of a local event of coal combustion, through the evolution of gases and aerosol particles, highlighting the behavior of the main coal combustion markers (As, Se and S).

The sampling campaign was carried out in the Campus of the University of León, at León city, Spain (42° 36' N, 05° 35' W and 838 m a.s.l.) between 01/12/2016 and 30/01/2017. The 24-h PM₁₀ sampling was performed using a high volume sampler (CAV-Mb, 150 mm diameter quartz filters) and a low volume sampler (TECORA, ECHOPM, 47 mm diameter Teflon filters). PM₁₀ samples were analyzed for: organic (OC) and elemental (EC) carbon, water soluble inorganic ions and major trace elements. Furthermore, the aerosol size distributions were determined by a high resolution nanoparticle sizer (SMPS Model 3938). Additional data provided by the regional air quality network (www.medioambiente.jcyl.es) related to SO₂ was also taken into account. An automatic weather station located in the sampling site recorded temperature, wind speed and direction and relative humidity. The evolution of the mixing-layer thickness was also analyzed, by using the data from NOAA database (<https://www.ready.noaa.gov/READYamet.php>).

As and Se concentrations showed a negative correlation with the temperature ($r < -0.4$, $p < 0.01$), and a positive correlation with the relative humidity ($r > 0.2$, $p < 0.01$). High concentrations of As and Se were obtained between 22 and 31 December, with a maximum of 0.004 ng/m³ for As and 0.023 ng/m³ for Se registered on 26 December 2016, coinciding with a slight decrease of the temperatures in León. An increase in the EC concentrations during the same period was also observed, going from 0.88 µg/m³ to 2.70 µg/m³. A simultaneous enhancement of the SO₂ values was recorded in the urban air quality station LE01 (urban station), from 8 µg/m³ to 24 µg/m³, indicating that León city is highly affected by coal combustion emissions during the coldest months.

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