

P2-6 PM characterization in barbecue restaurants

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Grill/barbecue restaurants are very common in Portugal, often with a barbecue area open to the customers room. Most grill and barbecue appliances are operated with vegetable charcoal, which is a strong source of many pollutants, mainly particulate matter (PM). In order to assess and characterise the indoor air quality in these type of spaces, a survey of 2 weeks was performed in 3 restaurants in the Aveiro city that use charcoal. All the restaurants cooked fish and meat barbecued/grilled meals, and two of them are as well a take away service. In these two restaurants barbecue chicken is the main product.

Continuous recording of comfort parameters (temperature, relative humidity and light) and indoor pollutants (CO₂, CO, NO₂, TVOCs and PM₁, PM_{2,5}, PM₄ and PM₁₀) was performed, using portable equipment (GrayWolf and DustTrak™ II Aerosol Monitor 8530). Exposure assessment was carried out on one worker at each restaurant. A complementary gravimetric method was used, indoors and outdoors, only during the activity period, to quantify PM₁₀ total mass concentrations with an Echo-Tecora sampling equipment (quartz filters) in agreement with the reference method (EN 12341). Organic (OC) and elemental carbon (EC) in particles were then analysed by a thermo-optical method. Pre-backed quartz filters were used to reduce the carbon blank values.

Lunch and dinner times always showed peak concentrations of all pollutants, most of them coinciding with the intensification of charcoal barbecue combustion. The indoor protection limit (8 h average) for PM₁₀ (50 µg m⁻³) was exceeded in all restaurants, while the threshold for CO (9 ppm) was surpassed in only one restaurant (Ordinance n.º 353-A/2013).

A good linear correlation was obtained between the PM₁₀ gravimetric method and the continuous measurements with the DustTrak monitor ($PM_{DustTrak} = 0.93 PM_{gravimetric} + 13.3$, $R^2 = 0.87$). During the activity period (10 h – 22 h), the contribution of fine particles < 1 µm to PM₁₀ was >50%, attaining percentages larger than 80% most of the time. Frequently PM₁₀ concentrations above 400 µg m⁻³ were observed, with maxima that hit 1300 µg m⁻³. Indoor PM₁₀ was always higher than outdoor concentrations, with an average ratio PM_{in}/PM_{out} close to 3. The in/out ratio of total carbon (TC) was slightly lower, denoting a greater contribution of indoor sources of inorganic particles. The carbonaceous fractions of PM₁₀ were dominated by organic carbon, with OC/EC indoor ratios ranging 3 to 16, whilst the OC/EC outdoors varied between 3 and 7.