Assessment of indoor air quality in a beauty salon

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The products and treatment techniques used in beauty salons can put both the employees and clients at risk of exposure to high levels of pollutants and hazardous chemicals. A one week sampling campaign was conducted from 20th to 24th November 2017 in a hairdresser salon in the city of Léon, Spain. The salon is continuously open for 10 h from Monday to Friday. The number of customers was monitored for each sampling day, as well as the treatment of each one. Customers were either habitual or occasional, generally of both sexes, with a higher proportion of men. The space layout includes a reception and waiting area at the front, two hairstyling areas, a waxing room and a dispensary room in the back. Most hair care products are mixed in the dispensary and all most hairstyling products are stored there. The salon offers a wide range of services including manicures, pedicures, waxing services and hair styling/coloring. Temperature, relative humidity, CO_2, CO were continuously monitored with air quality probes inside (TSI, model 7545) and outside (Gray Wolf®, WolfSense IQ-610) the salon. Real-time laser photometric instruments (TSI, DustTrak DRX 8533) were used to record particulate matter concentration profiles over time in the indoor and outdoor environments, simultaneously. All the continuous monitoring instruments were operated with 1-min resolution. Simultaneous sampling with two PM_{10} high volume air MCV (model CAV-A/mb) instruments for gravimetric quantification was carried out. The equipment was operated at a flow of 30 m^3/h. Samples were collected during the opening hours, simultaneously indoors and outdoors. Nighttime samples were also taken in order to compare the PM levels during occupancy and non-occupancy periods. Particulate samples were collected on pre-weighed 150 mm quartz fibre filters (Pallflex®) for gravimetric and chemical analyses. The gravimetric quantification was performed with a microbalance (XPE105 DeltaRange®, Mettler Toledo). After gravimetric determinations, thermal-optical analysis of PM_{10} filters was performed to obtain the carbonaceous content. Samples for formaldehyde and acetaldehyde quantitative analysis were collected on Sep-pak® DNPH-silica cartridges (Waters) connected to a calibrated sampling pump to provide a volumetric airflow rate of 2 L/min. The samples were analyzed via HPLC. Three samples per day, covering the working hours, were collected in three different days of the sampling campaign.

Temperature readings recorded throughout the sampling campaign were not within the ASHRAE (American Society of Heating, Refrigerating, and Air-Conditioning Engineers) comfort zone (winter range), particularly in the morning hours. CO_2, a constituent of exhaled breath that can be used to evaluate if adequate quantities of fresh air are being introduced into a

building, showed an increasing level during the day, and decreasing levels during the night. The CO_2 concentrations correlated linearly with the total number of clients attending the salon (R^2 = 0.721). There was a strong linear relationship between the photometric and gravimetric PM measurements (R^2 = 0.9271). From gravimetric measurements, average PM_{10} concentrations of 89 ± 39, 22.8 ± 2.1 μg/m^3 and 50 ± 12 were recorded indoors during the occupancy and non-occupancy hours, and outdoor air, respectively. Although PM_{10} concentrations were not correlated with the total number of clients, good correlation was found with the number of female customers in the salon (R^2 = 0.8052). The average PM_{10} indoor to outdoor ratio was 1.97. Total carbon account for 34.1 ± 2.2, 27.3 ± 3.0and 25.0 ± 5.2 %wt. of the PM_{10} mass indoors during the occupancy and non-occupancy hours, and outdoor air, respectively. Indoor formaldehyde concentration was 11.5 ± 3.5 μg/m^3, which is below the short-term guideline recommended by WHO to prevent sensory irritation in general population. Acetaldehyde concentration was 9.0 ± 4.7 μg/m^3.