

A Simple Olfactometer for Odour and Lateralization Thresholds of Chemical Vapours

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Abstract : A simple inexpensive olfactometer was constructed to enable valid measures of detection threshold of low concentrations of vapours of chemicals. The delivery system consists of seven syringe pumps, each connected to a Tedlar bag containing a predefined concentration of the test chemical in the air. The seven pumps are connected to a 8-way mixing valve which in turn connects to a birhinal nose piece. Chemical vapor of known concentration is generated by injection of an appropriate amount of the test chemical into a Tedlar bag with a known volume of clean air. Complete vaporization is assured by gentle heating of the bag from the outside with a heat flow. The six test concentrations are obtained by adding different volumes from the starting bag to six new Tedlar bags with known volumes of clean air. One bag contains clean air only. Thus, six different test concentrations and clean air can easily be tested in series by shifting the valve to new positions. Initial in-line measurement with a photoionization detector showed that the delivery system quickly responded to a shift in valve position. Thus 90% of the desired concentration was reached within 15 seconds. The concentrations in the bags are verified daily by gas chromatography. The stability of the system in terms of chemical concentration is monitored in real time by means of a photoionization detector. To determine lateralization thresholds, an additional pump supplying clean air is added to the delivery system in a way so that the nostrils can be separately and interchangeably be exposed to clean air and test chemical. Odor and lateralization thresholds were determined for three aldehydes; acrolein, crotonaldehyde, and hexanal in 20 healthy naïve individuals. Aldehydes generally have a strong odour, and the selected aldehydes are also considered to be irritating to mucous membranes. The median odor thresholds of the three aldehydes were 0.017, 0.0008, and 0.097 ppm, respectively. No lateralization threshold could be identified for acrolein, whereas the medians for crotonaldehyde and hexanal were 0.003 and 0.39 ppm, respectively. In conclusion, we constructed a simple, inexpensive olfactometer that allows for stable and easily measurable concentrations of vapors of the test chemical. Our test with aldehydes demonstrates that the system produces valid detection among volunteers in terms of odour and lateralization thresholds.

Keywords : irritation, odour delivery, olfactometer, smell

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