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M. Nicolas

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# Scented candles and incenses as indoor air fresheners: health risk assessment from real emission measurements

G. Karr<sup>1,\*</sup>, A. Albinet<sup>1,\*</sup>, D. Buiron<sup>2</sup>, E. Quivet<sup>2</sup>, F. Maupetit<sup>3</sup> and M. Nicolas<sup>3</sup>

<sup>1</sup>INERIS (Institut National de l'Environnement et des risques), Parc Technologique Alata, BP 2, 60550 Verneuil-en-Halatte, France

<sup>2</sup>Aix-Marseille Université, CNRS, Laboratoire de Chimie de l'Environnement, UMR 7376, 13331 Marseille, France

<sup>3</sup>CSTB (Centre Scientifique et Technique du Bâtiment), Saint Martin d'Hères, France

\*Corresponding emails: [guillaume.karr@ineris.fr](mailto:guillaume.karr@ineris.fr); [alexandre.albinet@ineris.fr](mailto:alexandre.albinet@ineris.fr)

## SUMMARY

As part of the EBENE research project, a health risk assessment was performed for two types of widely used combustible air fresheners: scented candles and incenses. The assessment was based on physicochemical characterization of the particulate and gaseous emissions of 9 scented candles and 10 incenses, tested under real conditions in an experimental house MARIA (CSTB), combined with a national phone survey about household uses. Results obtained showed that chronic exposures could exceed usual health reference values for a reasonable-worst-case type scenario. Substances of concern included PM (particulate matter), benzene, acrolein and, to a lesser extent, formaldehyde, for incenses, and formaldehyde, acrolein and, to a lesser extent, PM, for scented candles. For all of these substances, exceedances were also identified for short term exposures (1 hour). These results suggest that good practice – use reasonably, ventilate the room after use, avoid direct inhalation of any smoke, etc. – and reducing the emissions of high-emissivity products could be necessary to insure a safe use.

## PRACTICAL IMPLICATIONS

These results could lead to health risk management actions, e.g. public information campaign, regulatory restriction on composition or emissions, label of emission levels.

## KEYWORDS

Health risk, Incense, Candle

## 1 INTRODUCTION

Air fresheners are one of the specific indoor emission sources of air pollutants. Potential associated health risks need to be further understood. As part of the EBENE research project, health risk assessment was performed for two types of widely used air fresheners - scented candles and incenses – in order to evaluate whether household uses could be of concern.

## 2 MATERIALS/METHODS

The emissions of 9 candles and 10 incenses were tested under real conditions, in an experimental house.

A detailed physicochemical characterization of the emissions was performed using on-line instrumentation (HR-AMS, SMPS, PTR-MS, TEOM, TEOM-FDMS, Aethalometer 7λ, ozone and NO<sub>x</sub> analyzers) and off-line chemical analysis for both, gaseous (PUF and adsorbent tubes) and particulate phases (filters). Targeted pollutants included PM (mass, chemical composition and size distribution), volatile organic compounds (VOCs), polycyclic aromatic

compounds (PACs including PAHs, nitrated PAHs and oxygenated PAHs), NO<sub>x</sub> and black carbon (BC).

Based on the available knowledge and on results from a national phone survey performed in 2014 about the French household uses (approximately 1 000 people), standard exposure scenarios were elaborated. They included a mean exposure scenario (mean usage in France) and a reasonable worst case scenario (reasonable increase of the mean exposure).

For each tested substance, existing toxicity reference values (TRV) were collected among international databases, for both short-term and long-term inhalation exposures.

Exposure assessment was discussed for each scenario, tested product and substance. The obtained exposures were compared to the chosen long-term TRV, to highlight potential chronic risks. The maximum 1h-exposure was also compared to the chosen short-term TRV.

### **3 RESULTS**

For each substance under the mean exposure scenario, no exposure exceeded the usual health reference values. Furthermore, multi-substances exposures did not exceed reference values either. Consequently, our results suggest that no situation of concern is expected.

For the reasonable-worst-case scenario, exposures could exceed usual health reference values. Substances of concern included PM, benzene, acrolein and, to a lesser extent, formaldehyde, for incenses, and formaldehyde, acrolein and, to a lesser extent, PM, for scented candles.

For the same substances, exceedances were also identified for short term exposures.

### **4 DISCUSSION**

These results give a complementary perspective to the results of the European project *EPHECT* (Trantallidi et al., 2015). Here, this study was focused on scented candles and incenses, specific to French uses, based on actual indoor air concentrations (experimental values instead of modeled concentrations), for a large set of substances and for health reference values selected under national standards.

These results suggest that good practice – use reasonably, ventilate the room after use, avoid direct inhalation of any smoke, etc. – and reducing the emissions of high-emissivity products could be necessary to insure a safe use.

### **5 CONCLUSIONS**

Substances of concern were identified for both incenses and scented candles, including PM, benzene, acrolein and formaldehyde. The same strategy, combining experiments in real conditions and a phone survey, could be implemented in order to assess the health risks of any other usual consumer product.

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