

# Distinguishing Total and Solid Particle Emissions from Household and Office Devices using a Catalytic Stripper

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## Background

People spend most of their time indoors, where they are exposed to a very complex mixture of aerosol. Their size and chemical composition depends on various factors. Especially household appliances which produce heat, such as toasters, hair driers (Schripp et al. 2011), and printers (He et al. 2007), are prone to generate a large number of particles. Most of the ultra-fine particles (UFPs) produced are semi-volatile organic compounds (SVOCs) (Schripp et al. 2011), but, e.g., a toaster can be seen as a hot wire generator, which also produces solid (metal) particles.

A **Catalytic Stripper (CS)** can separate the volatile and semi-volatile fraction of the aerosol from the solid aerosol part (Swanson and Kittelson, 2010). This simple distinction between volatile and solid particles might be an important factor for health and mitigation strategies for indoor aerosol studies. Here we present the particle emissions of different household and office devices measured without and with a **Catalytic Stripper**.

## Experimental Setup

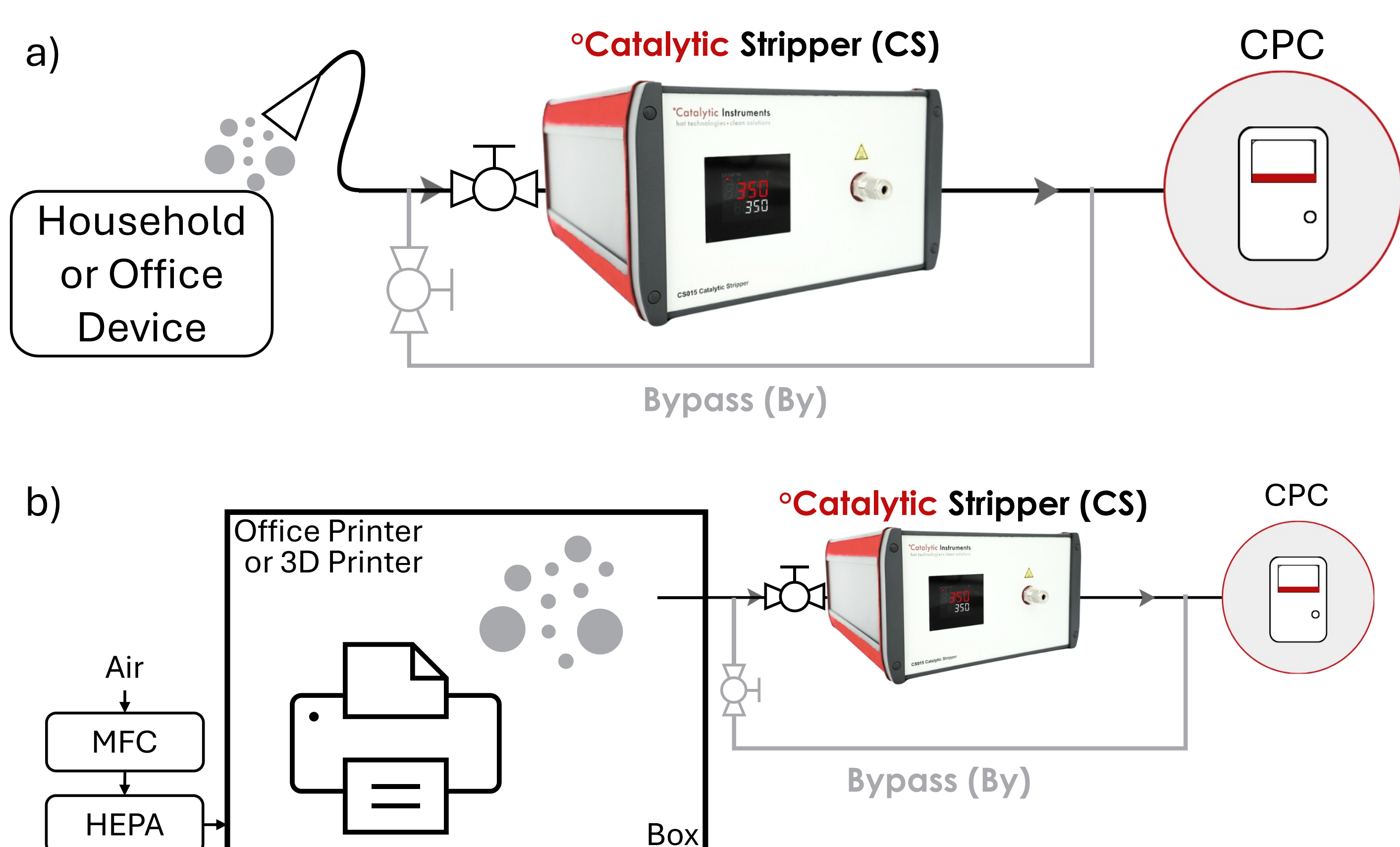


Fig. 1: Sketch of the experimental setup for measuring the total or solid particle emission of various household and office devices either by direct sampling (a) or by sampling from a box (b). The particle number concentration was measured with a TSI 3776 Condensation Particle Counter (CPC). The total particle concentration were analyzed when switched to Bypass (By). With the **Catalytic Stripper (CS)** the volatile and semi-volatile compounds were removed, and only solid particle were counted.

## Conclusions

- Successfully sampled the solid and total particle emissions of various household and office devices with a **Catalytic Stripper**.
- Most household or office devices under test emitted a high number of total particles (Bypass)  $> 10^5 / \text{cm}^3$ .
- The solid fraction (CS/By Fraction) ranged from 2 – 98 %. Most devices under test released at least 20 % of solid particles.

## References

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Schripp, T., Kirsch, I., and Salthammer, T. (2011). *Sci. Total Environ.* 409 (13):2534.  
Swanson, J. and Kittelson, D. (2010). *J. Aerosol Sci.* 41 (12):1113.

## Results

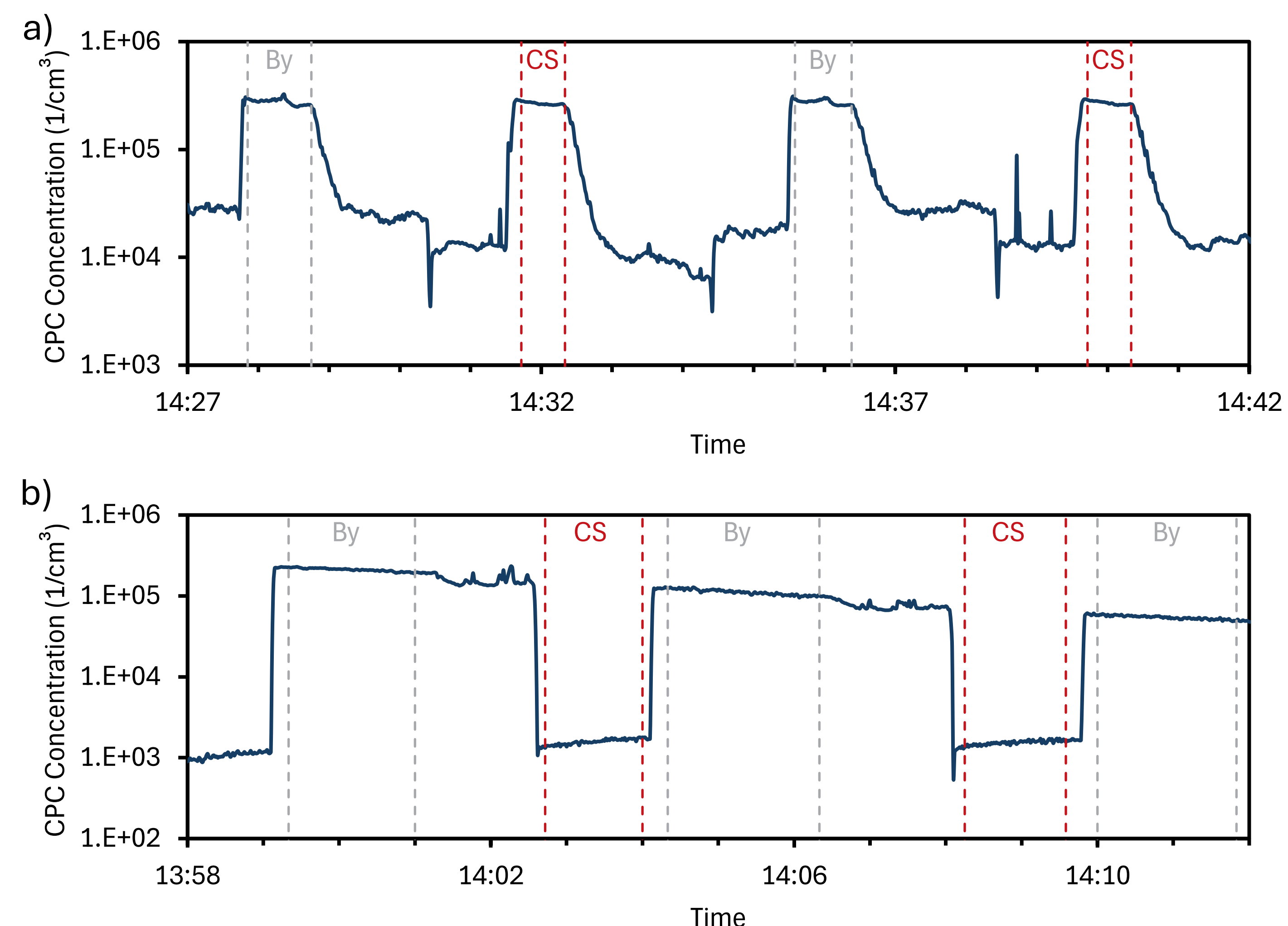


Fig. 2: Timeseries of the particle concentration measured from (a) a toaster and (b) from an office printer in a box. The dashed lines indicate the data analysis sections for Bypass (By) and **Catalytic Stripper (CS)**. (a) The toaster was used without bread and generated similar emissions for each run. (b) Several pages were printed at the beginning of the experiment and then the particles from the box were sampled.

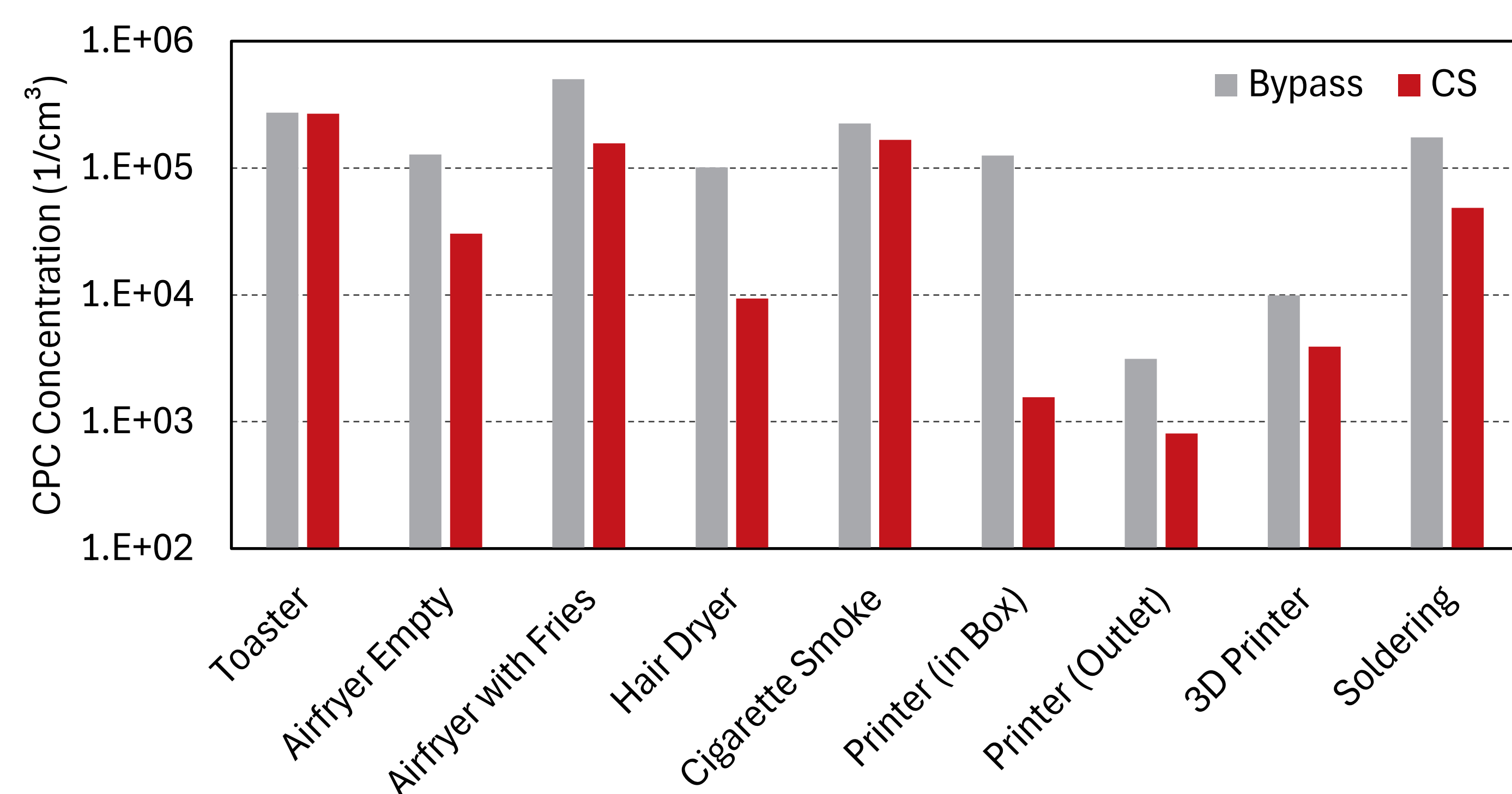


Fig. 3: Results of the measured particle concentration measured for various household and office devices for Bypass (By) and **Catalytic Stripper (CS)**. The “Printer (in Box)” and the “3D Printer” were measured with setup (b) of Fig. 1. All other emissions were directly sampled (Fig. 1a). Most devices emitted a high number of total particles (Bypass)  $> 10^5 / \text{cm}^3$ .

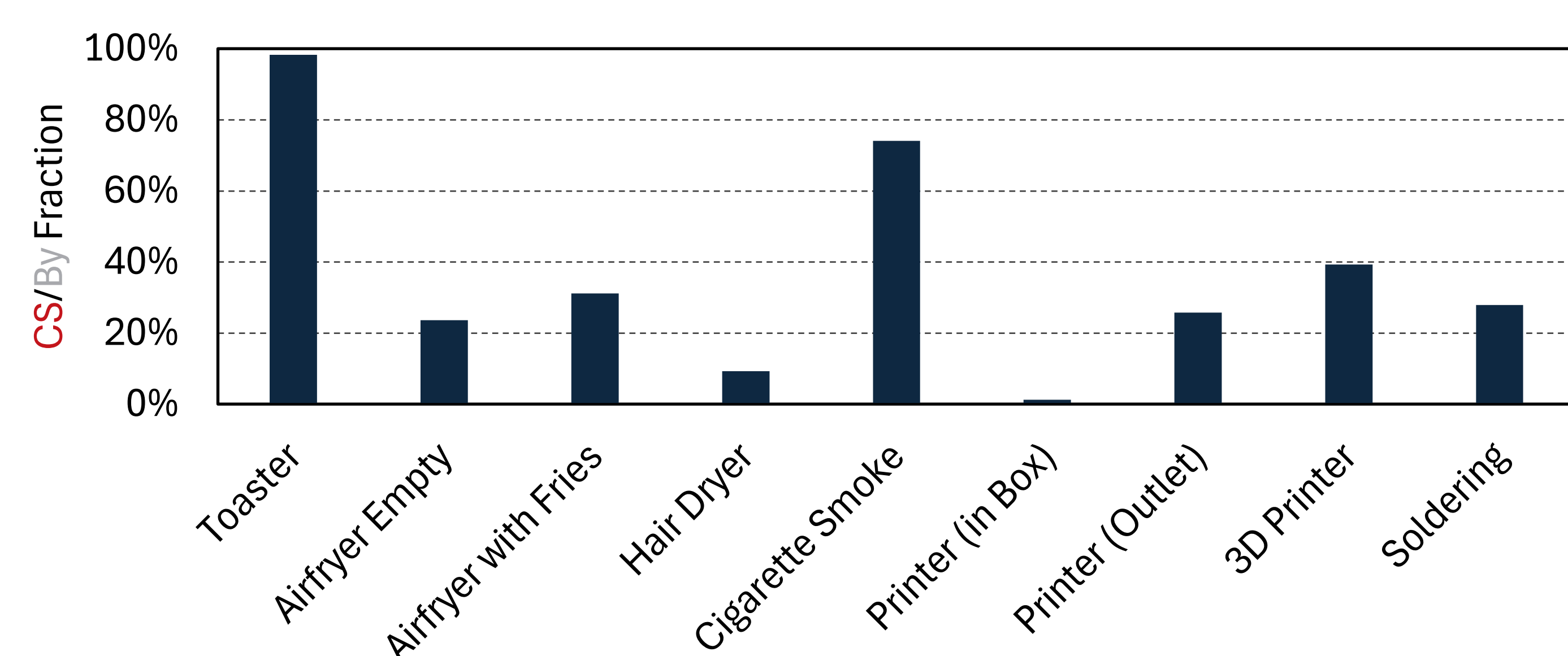


Fig. 4: Fraction of solid/total particle number concentrations from Fig. 3. Most of the devices release at least 20% solid particles. The Printer (Outlet) and the Printer (in Box) shows about 20% difference in the solid particle fraction. This might come from volatile particle formation within the box, since there is almost no increase in the CS concentration.

