Toxic Methanol Detection by Handheld Filter–Sensor Device

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Toxic Methanol

Methanol is poisonous when ingested or inhaled, resulting in devastating consequences including organ failure, blindness and death.[1] This is a potential hazard in applications where it is used as a solvent, renewable energy carrier,[2] but also in laced alcoholic beverages resulting in thousands of victims each year.[3] Here, we present a low-cost and handheld methanol detector, promising for measuring methanol concentration in indoor air, in the headspace of beverages or even breath.
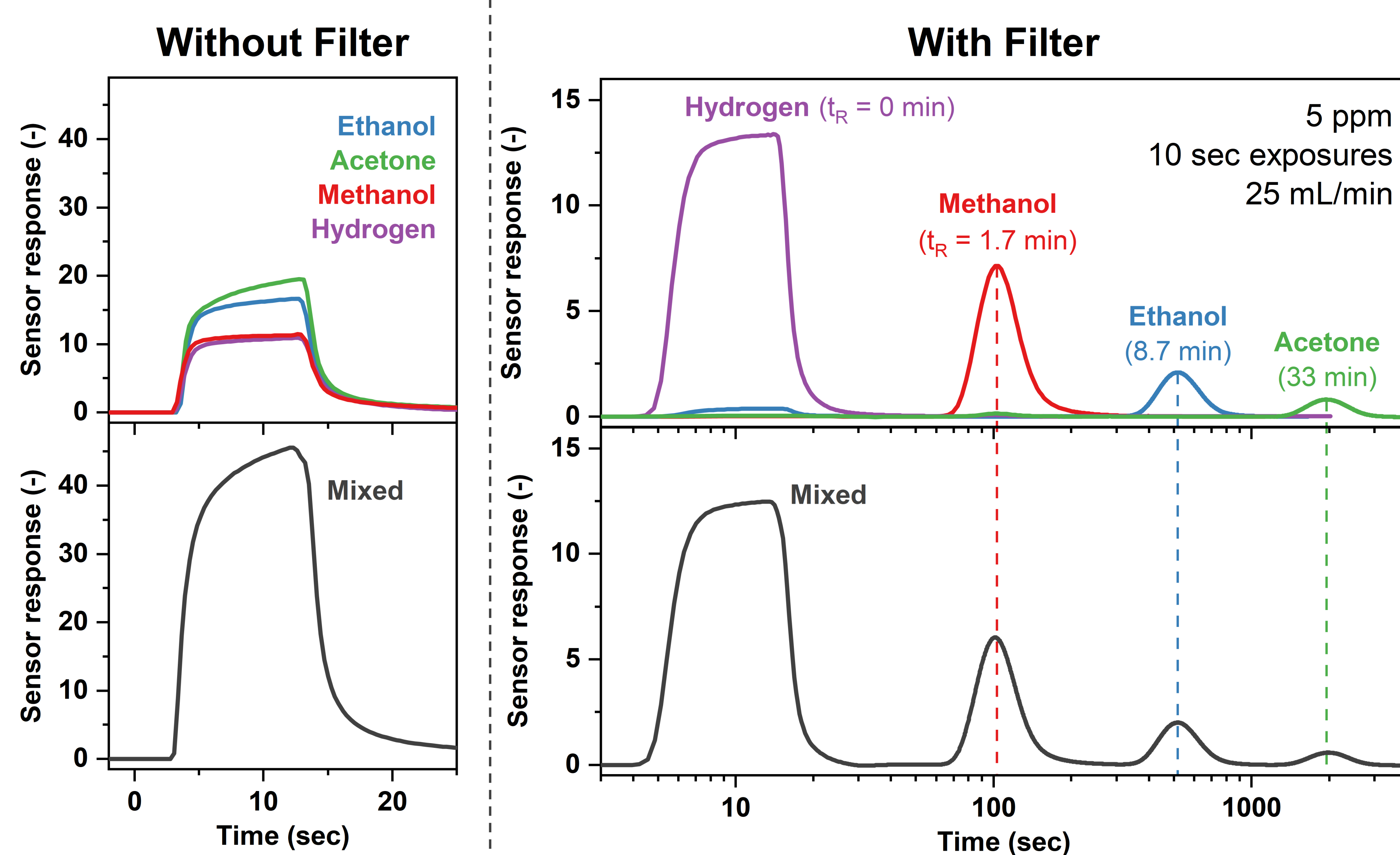
Detector Concept

The detector (a) consists of a packed bed filter of polymer adsorbent (b, c) and a flame-made gas sensor of Pd-doped SnO_2 (d–f).
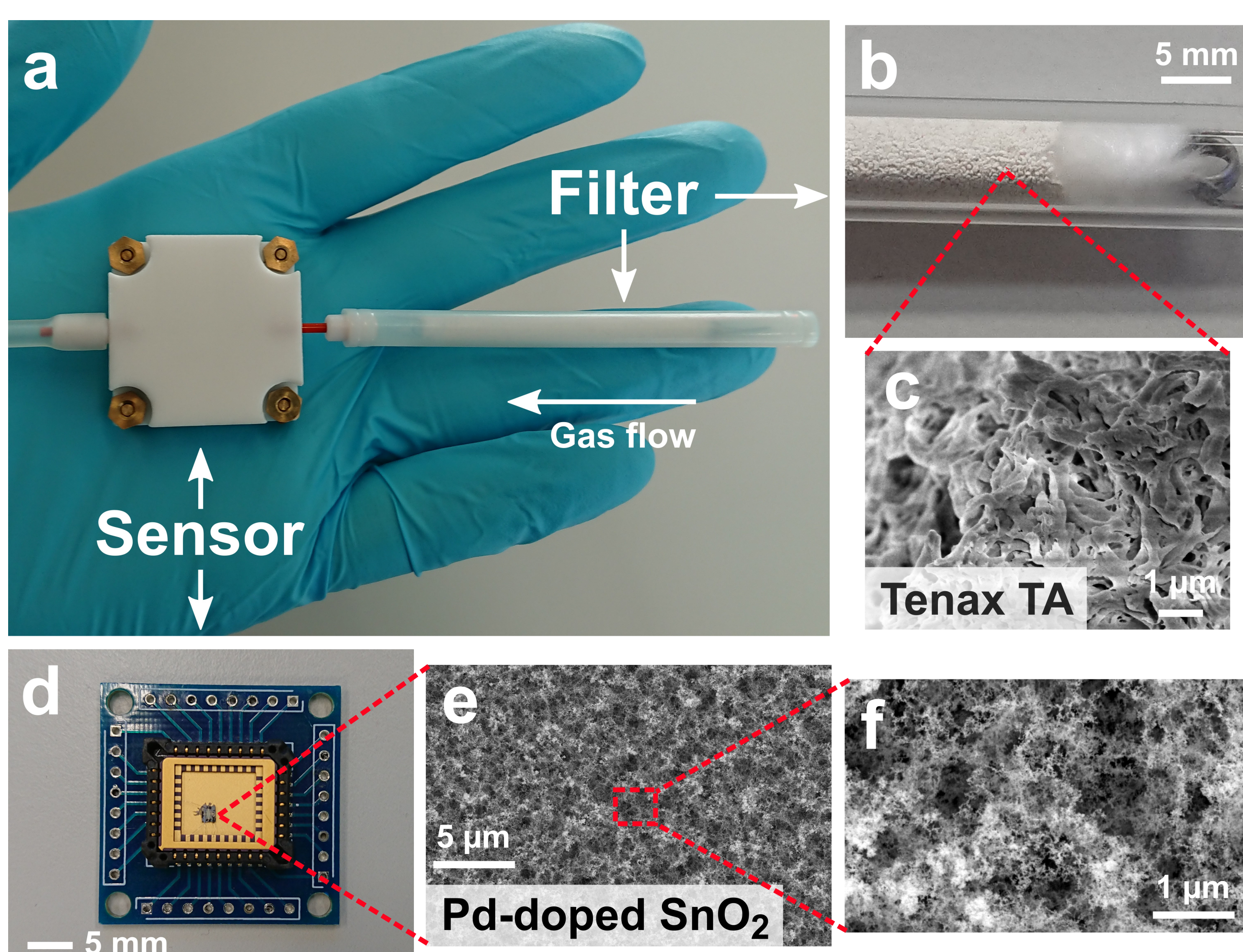
The filter separates methanol from ethanol and other interferants, similar to a gas chromatographic column.

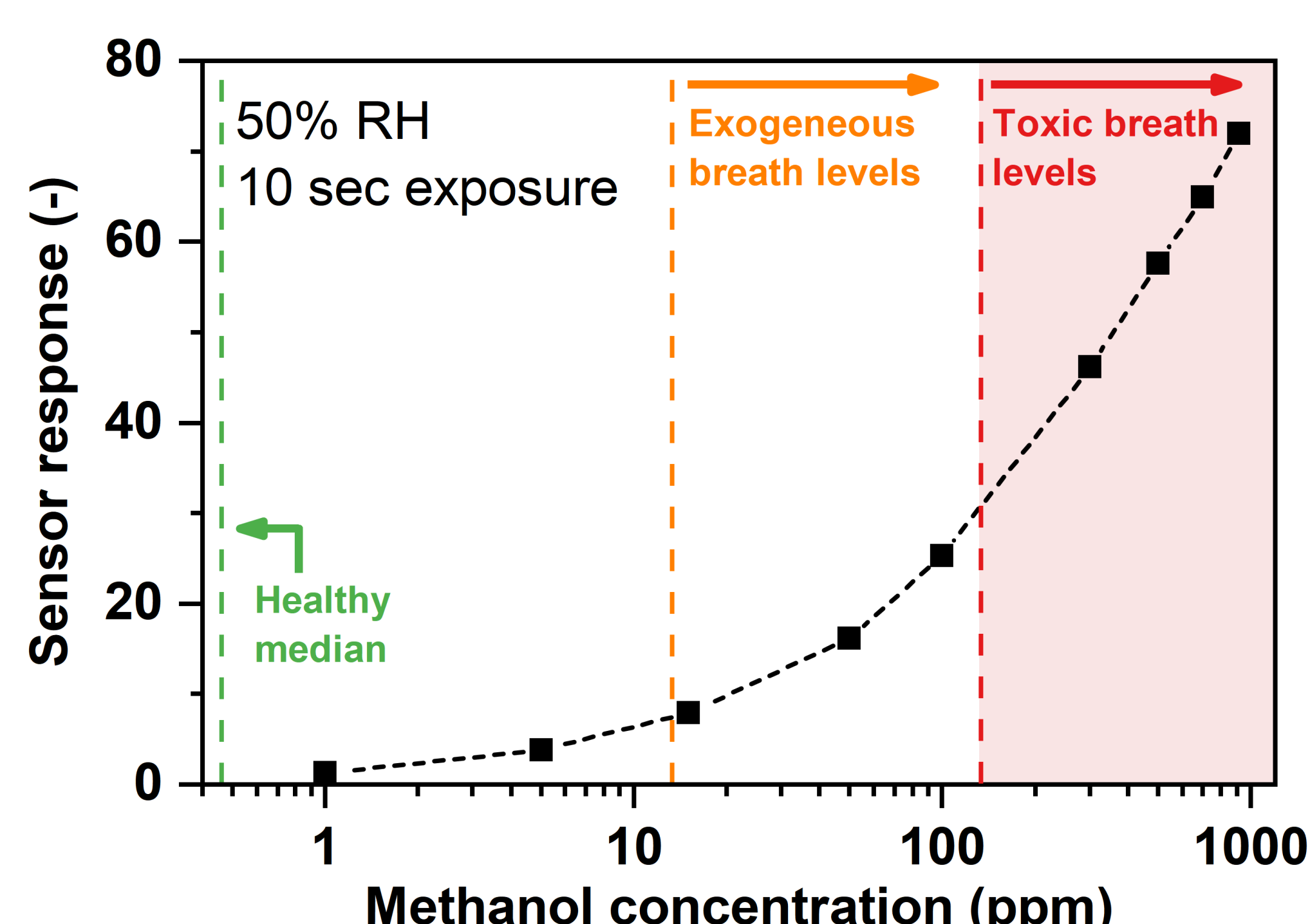**The sensor** detects methanol with high sensitivity.

Selectivity

*Without filter,* the sensor cannot measure methanol selectively in the presence of other analytes.

With filter, the analytes are separated and detected by the sensor at their specific retention time t_R. As a result, methanol is detected selectively in gas mixtures.
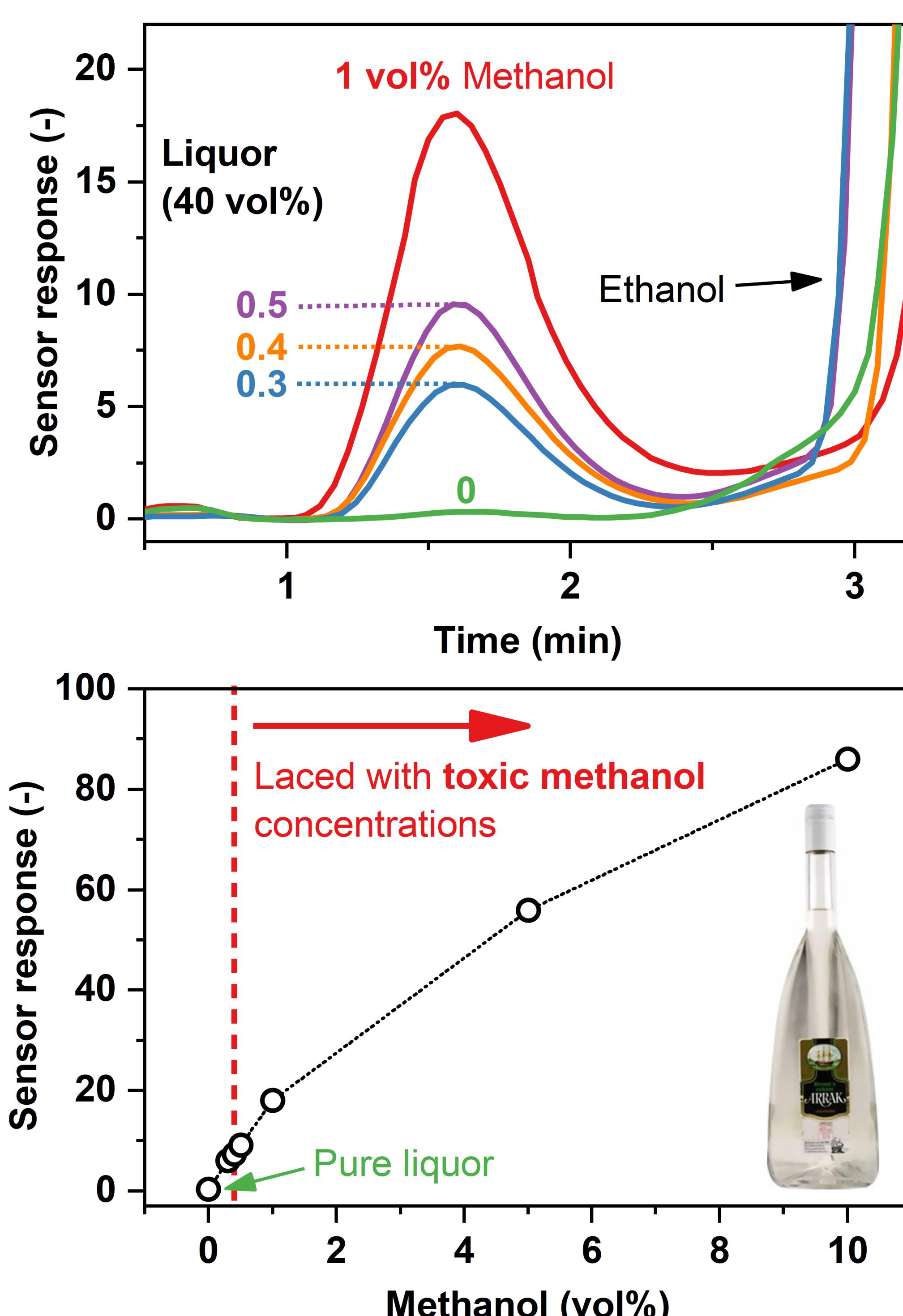
Dynamic Range

The detector clearly distinguishes toxic from non-toxic methanol levels and even detects low concentrations of 1 ppm with signal-to-noise ratio >100.

Breath
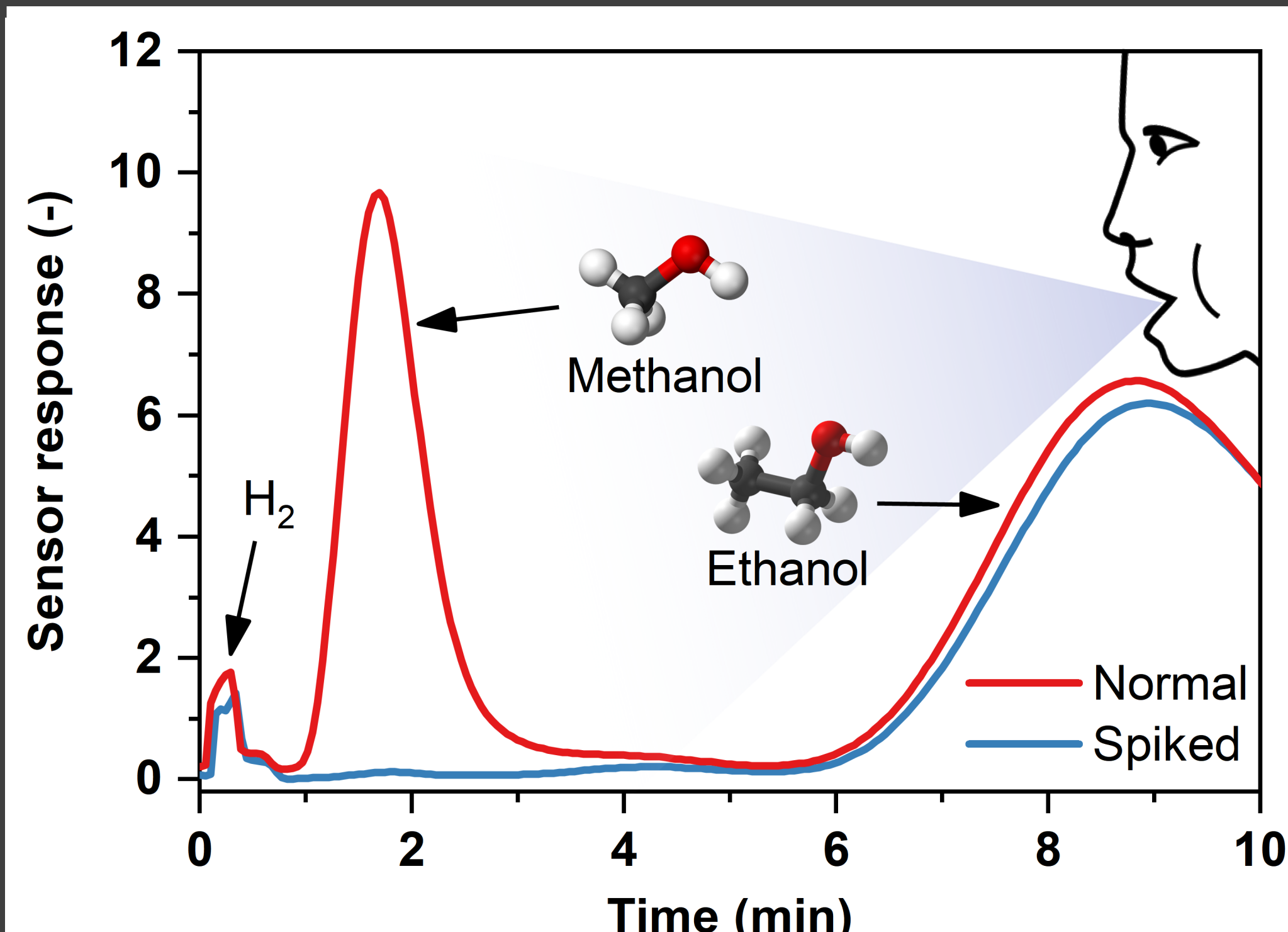
Toxic methanol concentrations (135 ppm) are detected clearly in spiked breath of a drunken volunteer (0.54 ‰) and differentiated from the normal sample.

Liquor

Pure Arrack (40 vol%) is clearly differentiated from that laced with toxic methanol levels with good resolution (<0.1 vol%) and repeatability (<15% variation).

Conclusions

- **Low-cost** and **handheld** methanol detector based on filter–sensor system.
- Detection of methanol **without interference** of much higher ethanol (>62'000 ppm) concentration.
- Promising for **fast** and **non-invasive screening** of methanol intoxication from **breath**.
- Detection of toxic amounts of methanol in **liquids** by testing their **headspace**.

References

[1]   Kraut JA, Kurz I, *Clin J Am Soc Nephrol.* 2008, **3**, 208-225
[2]   Feng Y, Liu H, Yang J. *Sci Adv.* 2017, **3**, e1700580.
[3]   Hovda KE, Hunderi OH, Tafjord AB, Dunlop O, Rudberg N, Jacobsen D. *J Intern Med.* 2005, **258**, 181-190
[4]   **van den Broek J, Abegg S, Pratsinis SE, Güntner AT. *Nat. Commun.* 2019 (accepted)**