## Investigating the effect of cooling solid phase microextraction fiber and membrane on the extraction efficiency



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Objective: To demonstrate the effect of cooling and high surface area geometry of the extraction phase for high sensitivity using two novel SPME devices

Sample temperature vs extraction amount of Acenaphthene Membrane temperature vs extraction amount of Limonene Sample matrix: PAHs spiked silica gel Sample matrix: standard gas Concentration: 100 ng PAHs in 0.5 g silica gel 60.0 Concentration: 0.635 ppb 50.0 Sampling time: 20 min 40.0 Sampling time: 30 min Extraction phase temperature: 40 °C 30.0 20.0 Sample temperature:  $23 \pm 0.5$  °C 23 °C 10 °C 5°C 0 °C -4.8°C 140°C 160°C 180°C 200°C sample temperature (°C) Cold fiber SPME Cooling membrane (h) Plunger and coating support Cooling source: liquid carbon dioxide Sampling chamber Cooling source: Peltier cooler Geometry: Fiber → Outlet (b) Protecting tubing Geometry: Membrane (i) Thermocouple (f) PTFE Ferrule (g) Barrel **Advantages:** (j)CO<sub>2</sub> tubing **Advantages:** • High sensitivity for high temperature (h) Plunger and coating support High sensitivity due to the cooling effect sampling. High extraction rate due to high large • Easy automation results from fiber surface—to-volume ratio of the extraction geometry Cooling Fan Stick for pushing the (i) Thermocouple (j) CO<sub>2</sub> tubing phase. (k) Cement Picture from literature Extraction efficiency of Cold fiber vs PDMS Linearity of membrane size vs extracted amount for Limonene Sample matrix: spiked water solution Sample matrix: Standard gas Concentration: 50 ppb Concentration: 0.635 ppb y = 0.186x + 3.3364 $R^2 = 0.9963$ Extraction time: 40 min Sample temperature:  $23 \pm 0.5$  °C Sample temperature: 60 °C for PDMS; 90 °C for Membrane temperature:  $23 \pm 0.5$  °C cold fiber. Sampling time: 30 min

Conclusion: Low extraction phase temperature results in higher distribution coefficient  $(K_T)$ ; Large temperature gap between coating and sample matrix enhanced the extraction amount  $(\Delta T)$ ; Large surface area extraction time.