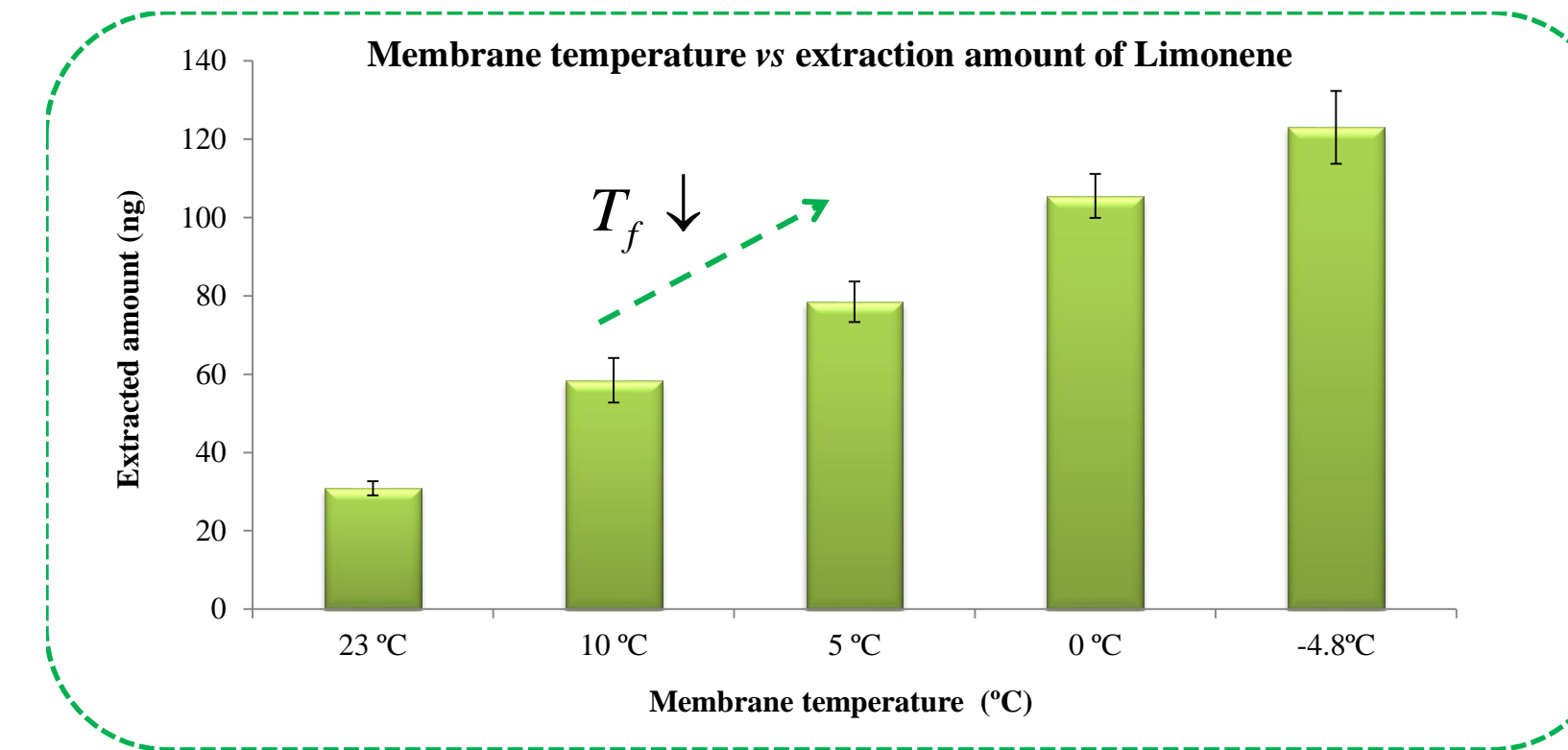
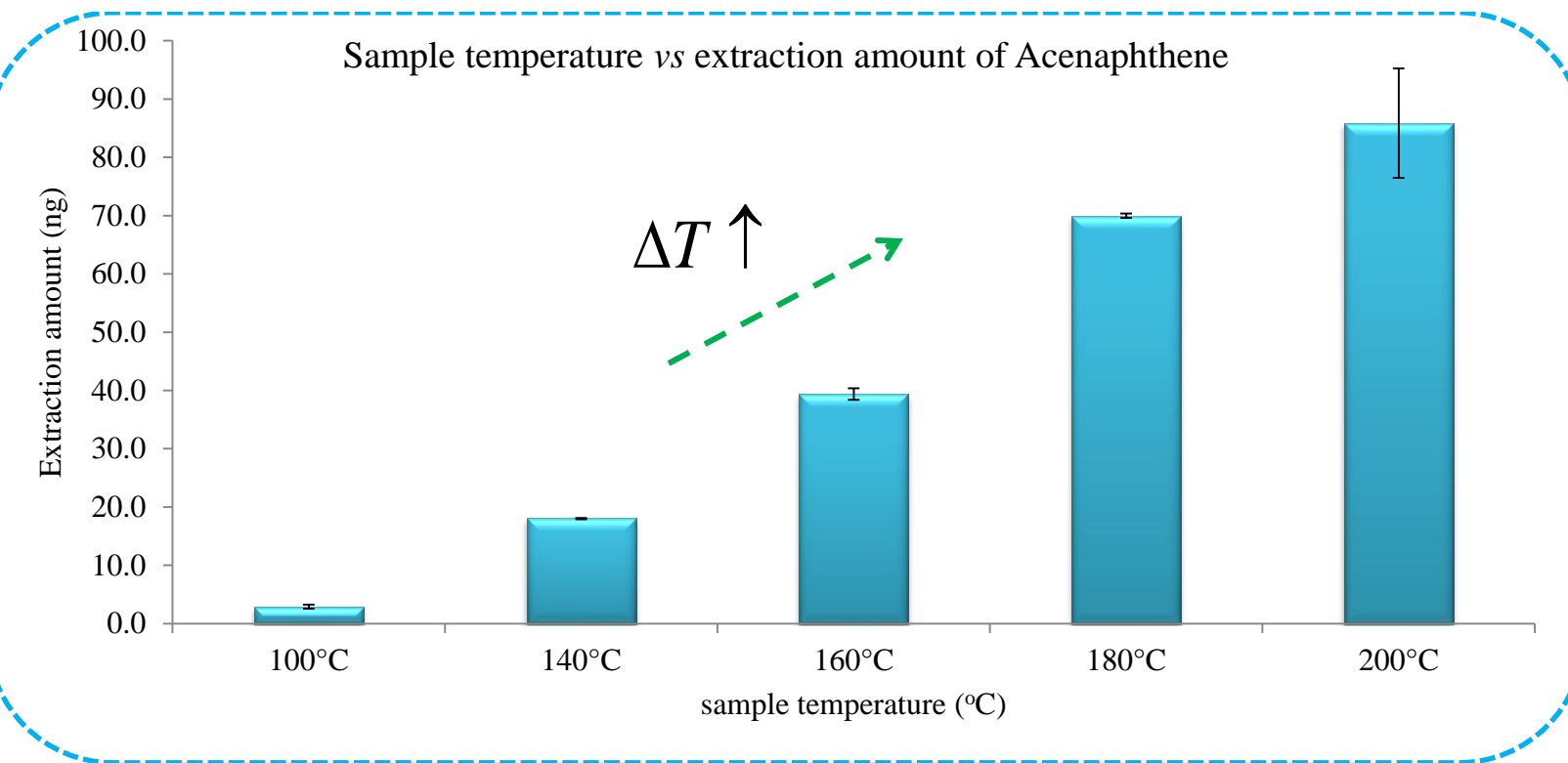


Investigating the effect of cooling solid phase microextraction fiber and membrane on the extraction efficiency

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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

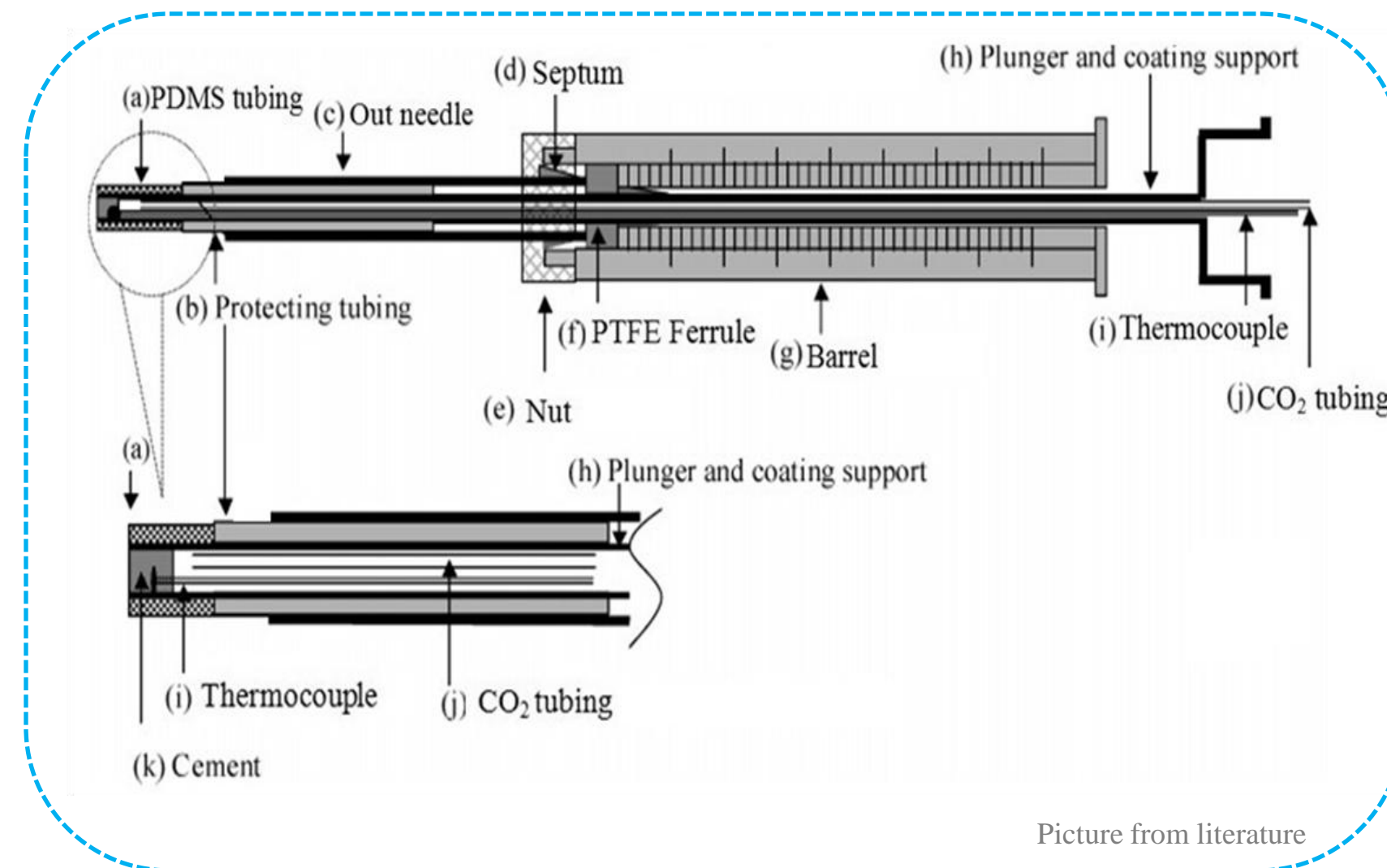


Sample matrix: PAHs spiked silica gel
Concentration: 100 ng PAHs in 0.5 g silica gel
Sampling time: 20 min
Extraction phase temperature: 40 °C

Sample matrix: standard gas
Concentration: 0.635 ppb
Sampling time: 30 min
Sample temperature: 23 ± 0.5 °C

Cold fiber SPME

- Cooling source: liquid carbon dioxide
Geometry: Fiber
Advantages:
- High sensitivity for high temperature sampling.
 - Easy automation results from fiber geometry



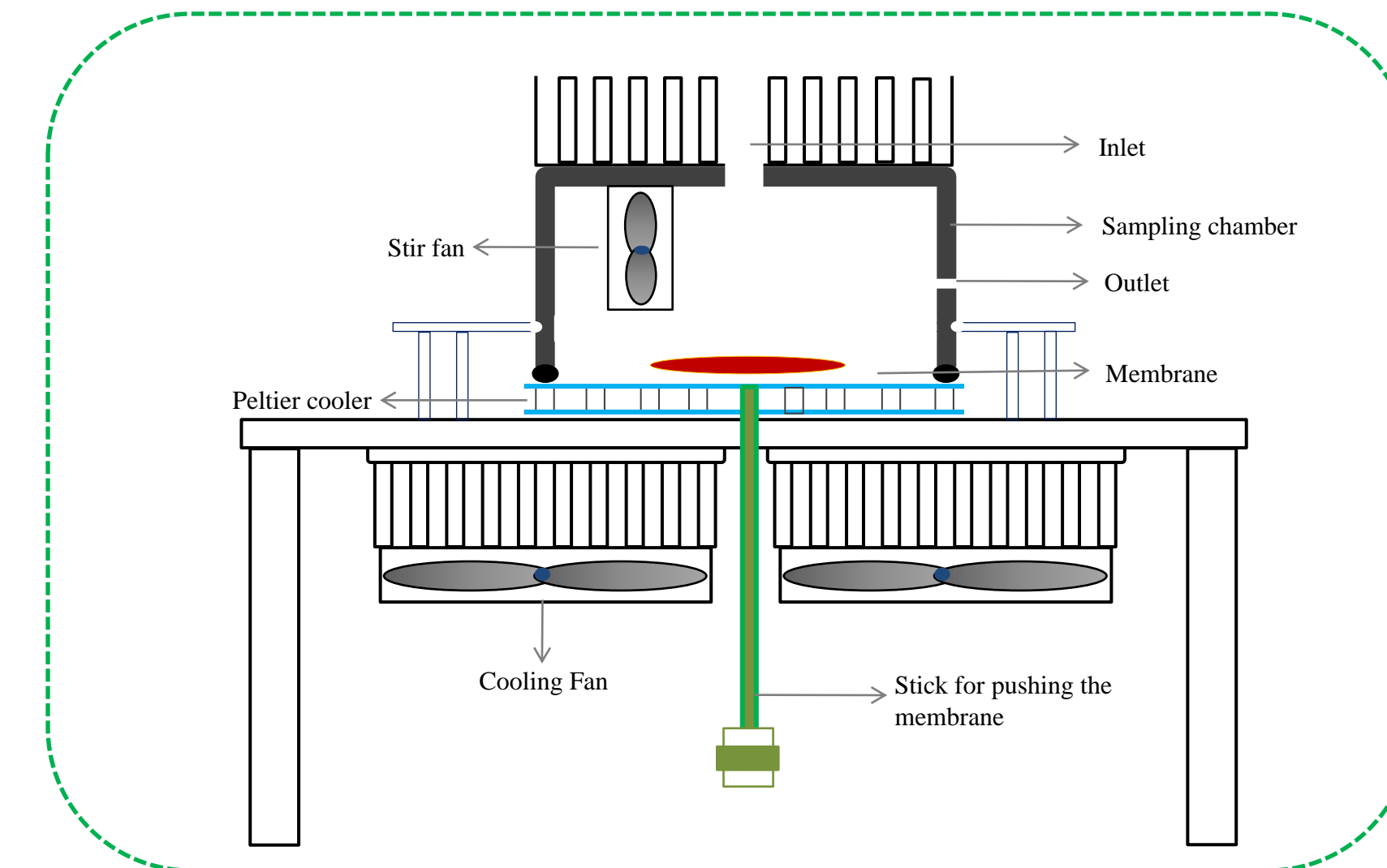
$$n = \frac{K_{fs} V_f V_s}{K_{fs} V_f + V_s} C_0$$

$$K_T = K_0 \frac{T_s}{T_f} \exp\left[\frac{C_R}{R} \left(\frac{\Delta T}{T_f} + \ln \frac{T_f}{T_s}\right)\right]$$

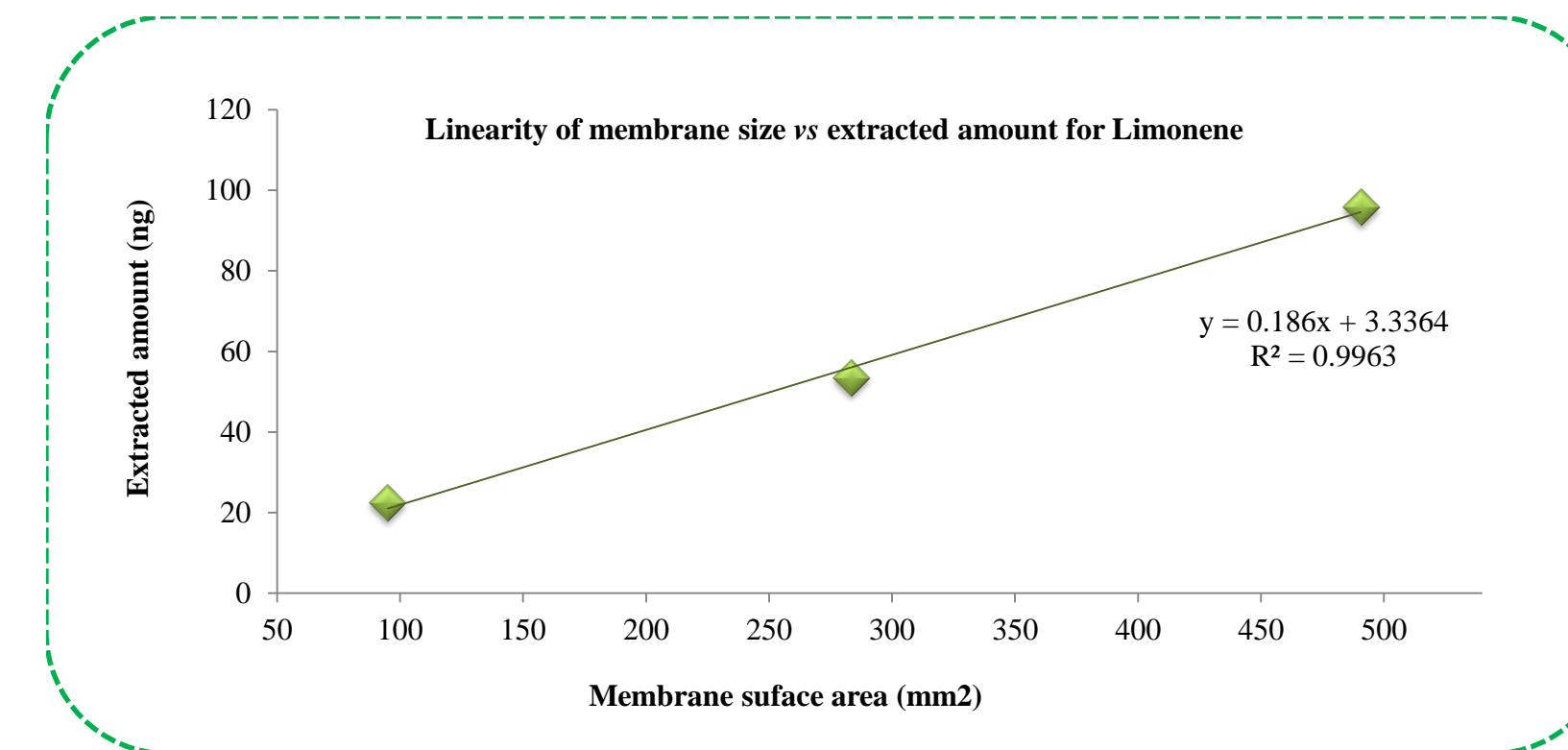
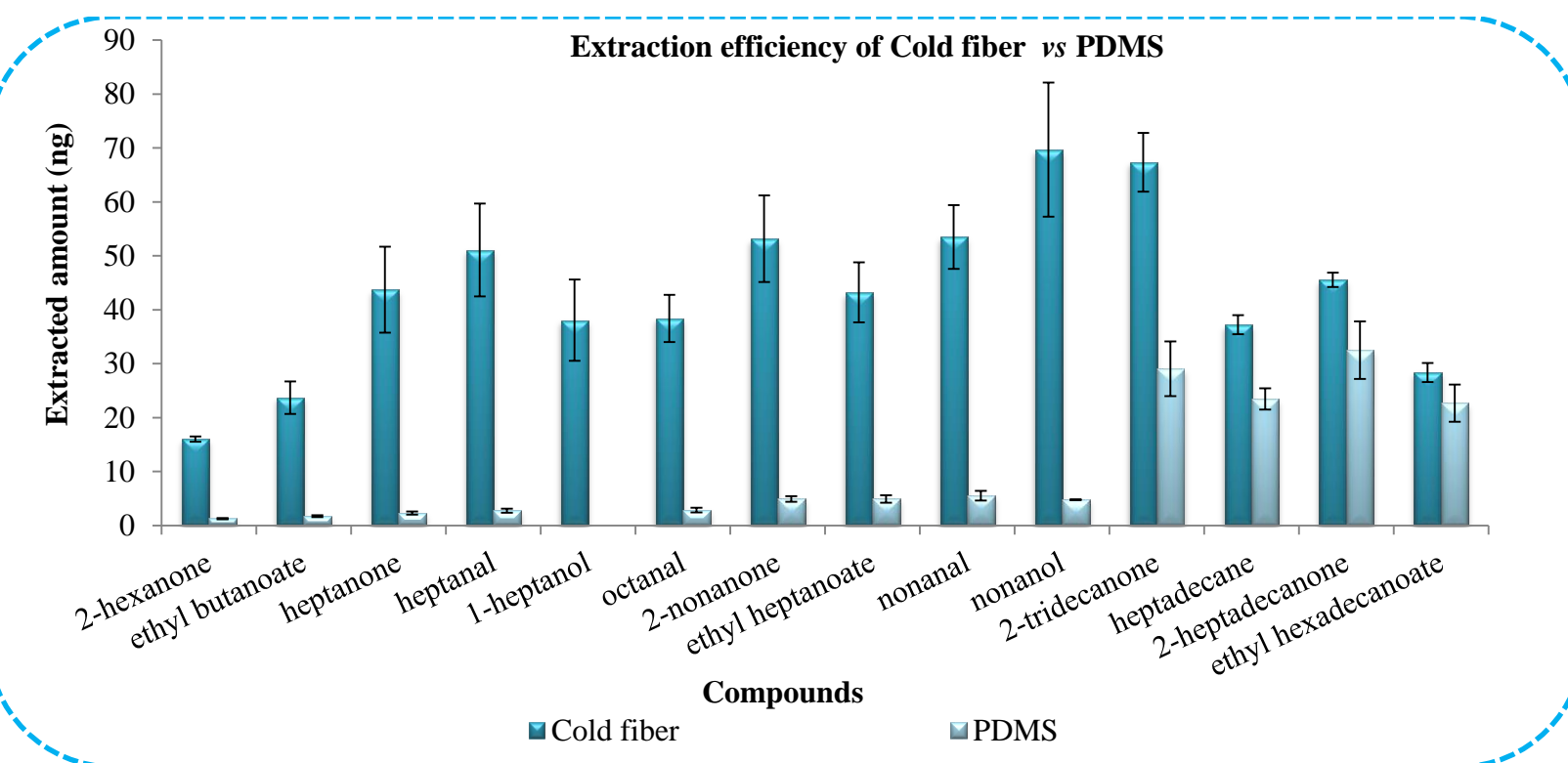
$$\Delta T \uparrow, T_f \downarrow \rightarrow K_T \uparrow \rightarrow n \uparrow$$

Cooling membrane

- Cooling source: Peltier cooler
Geometry: Membrane
Advantages:
- High sensitivity due to the cooling effect
 - High extraction rate due to high large surface-to-volume ratio of the extraction phase.



Sample matrix: spiked water solution
Concentration: 50 ppb
Extraction time: 40 min
Sample temperature: 60 °C for PDMS; 90 °C for cold fiber.



Sample matrix: Standard gas
Concentration: 0.635 ppb
Sample temperature: 23 ± 0.5 °C
Membrane temperature: 23 ± 0.5 °C
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 (ΔT); Large surface area extraction phase enhanced the extracted amount without compromising the extraction time.