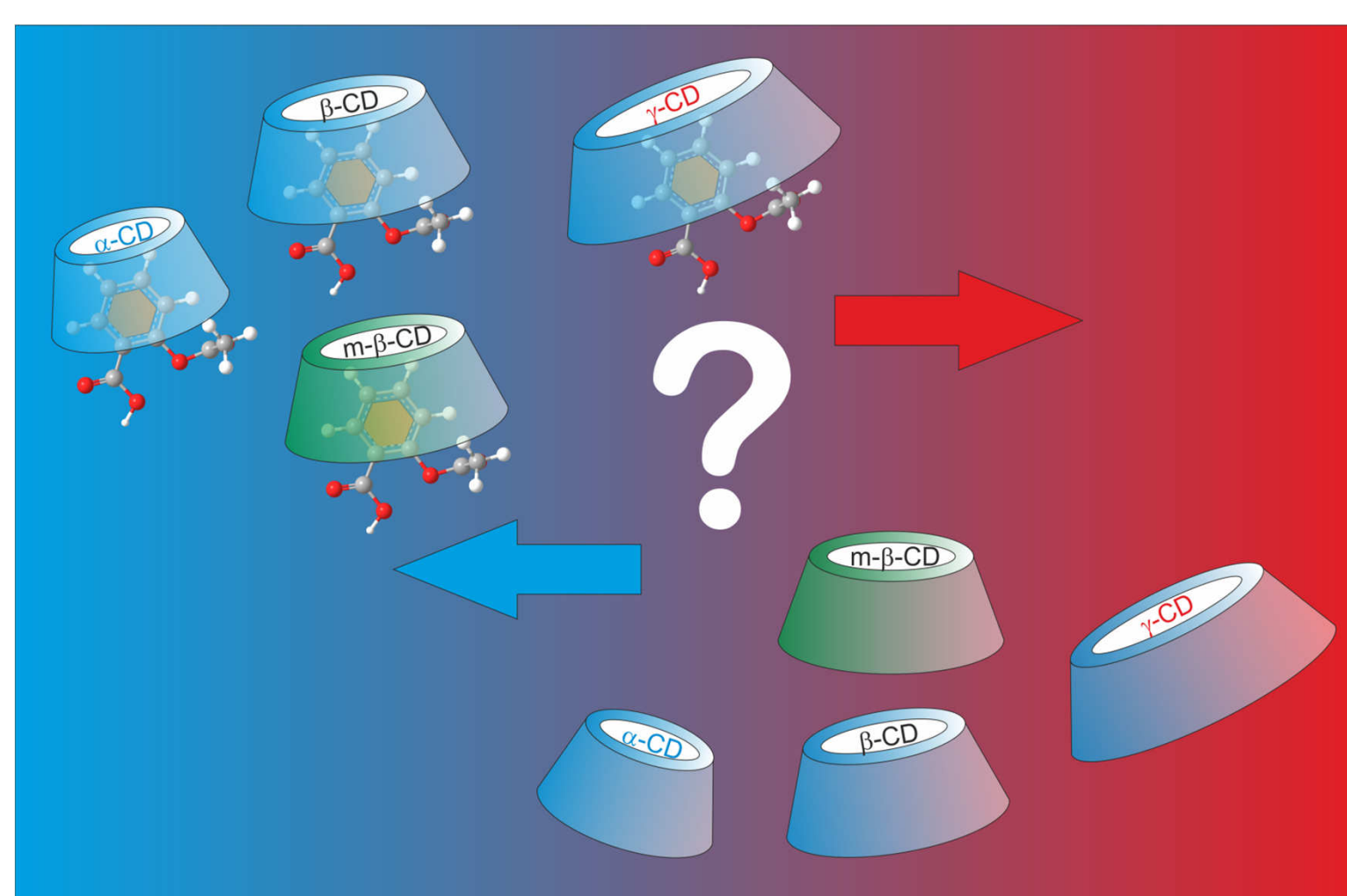
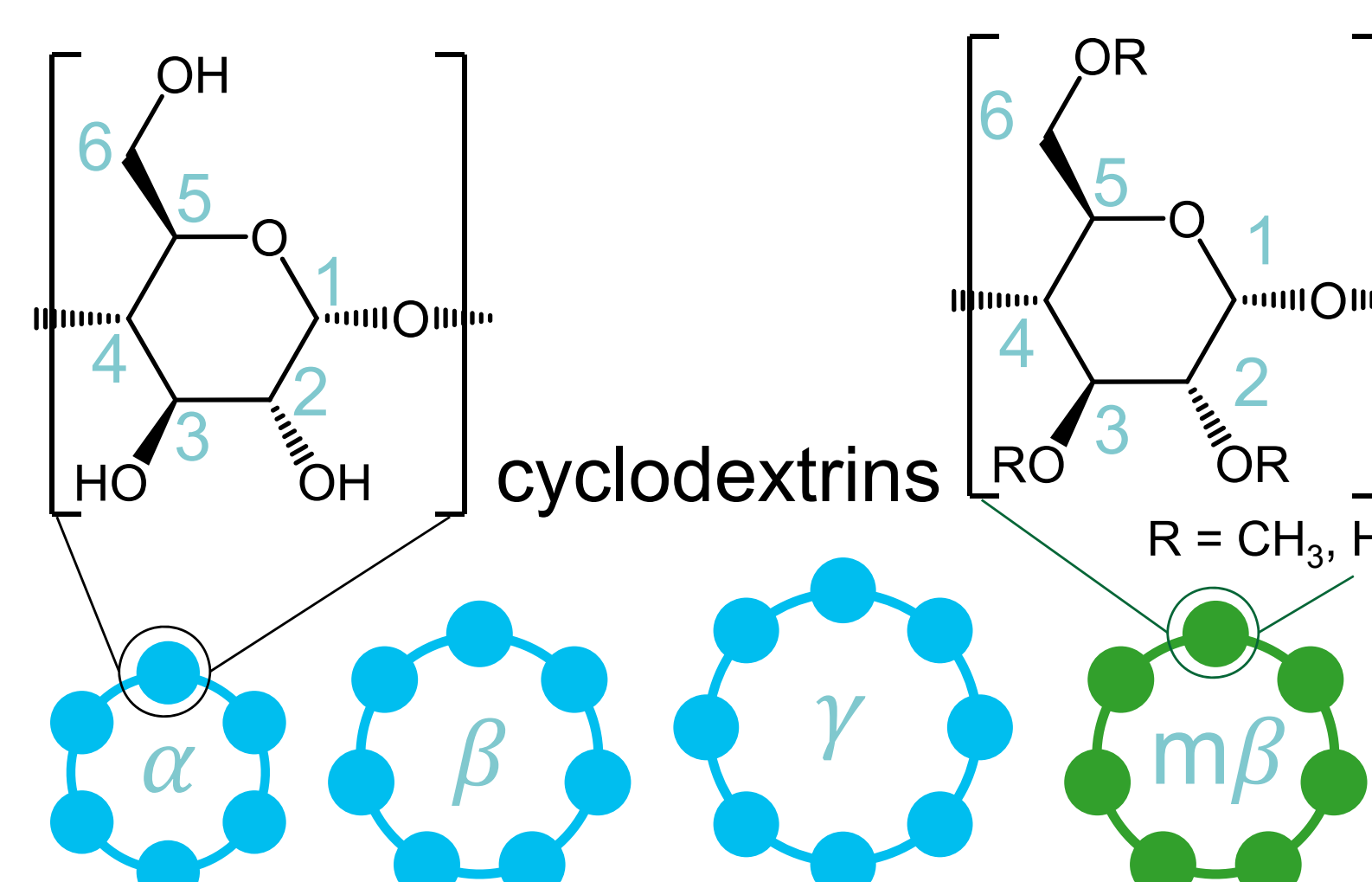


Motivation [1]

- Controlled movement of drugs into certain, e.g. inflamed, areas
- Check complex formation: α -, β -, γ - and methyl- β -cyclodextrin with aspirin by NMR
- investigation of thermophoretic behavior

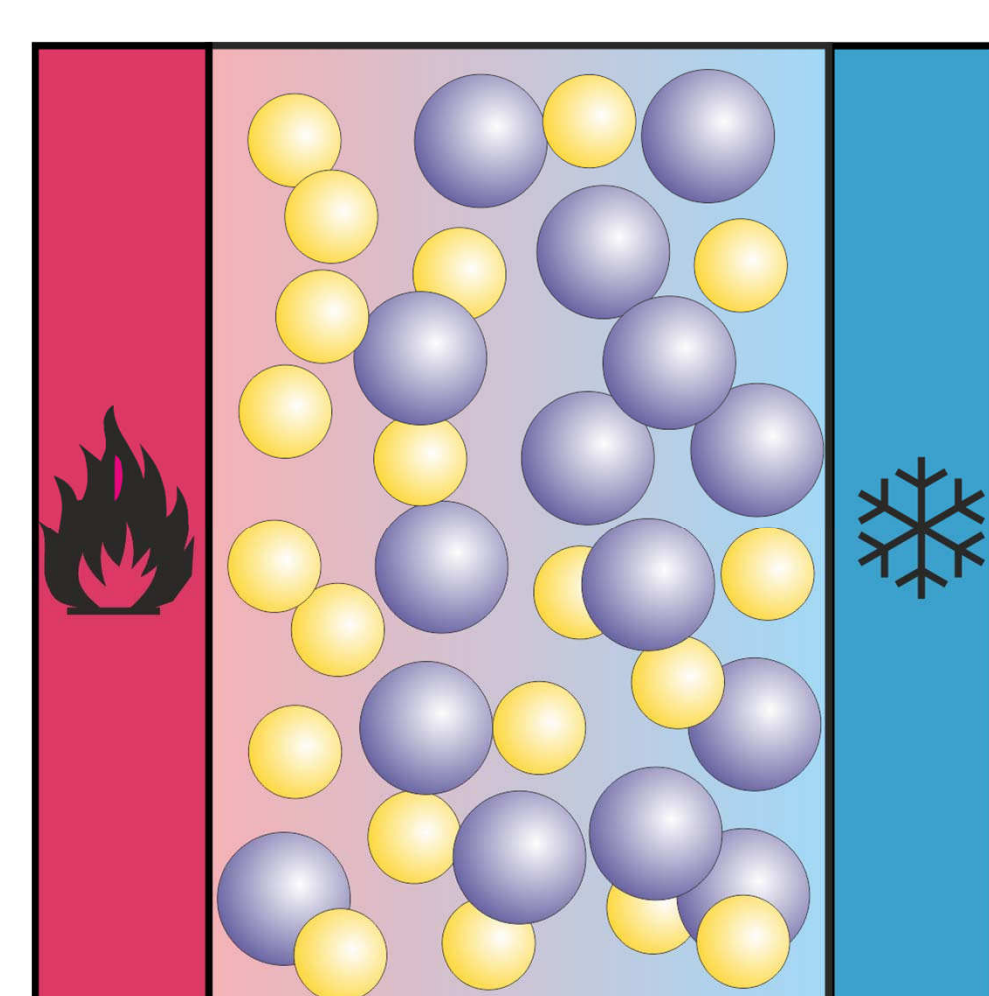


System



concentration: 1wt% CD
molar 1:1-ratio: CD:aspirin

Thermophoresis [2]



Flux $\vec{j}$ along a temperature gradient:

(1) thermal diffusion D_T along a temperature gradient ∇T

(2) Fickian diffusion D along the induced concentration gradient ∇c .

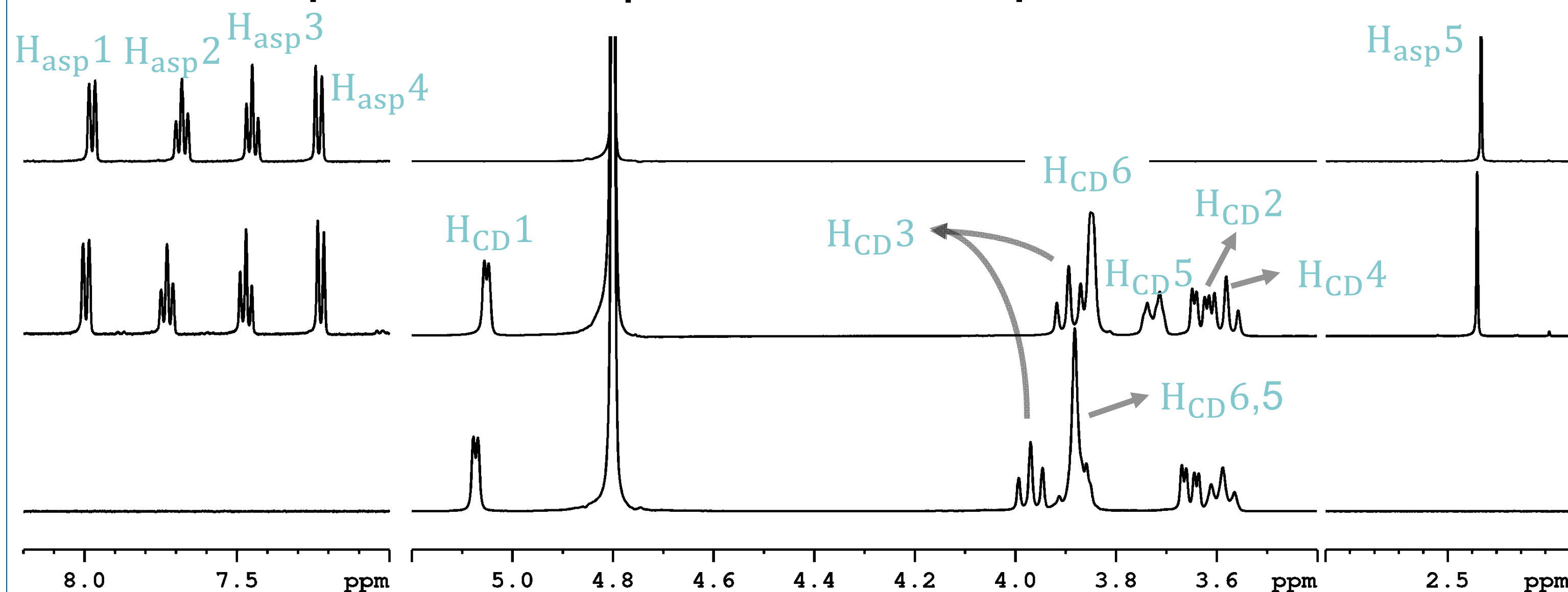
$$\vec{j} = -D\nabla c - c(1-c)D_T\nabla T$$

In the steady state ($\vec{j}=0$) the Soret coefficient S_T is defined

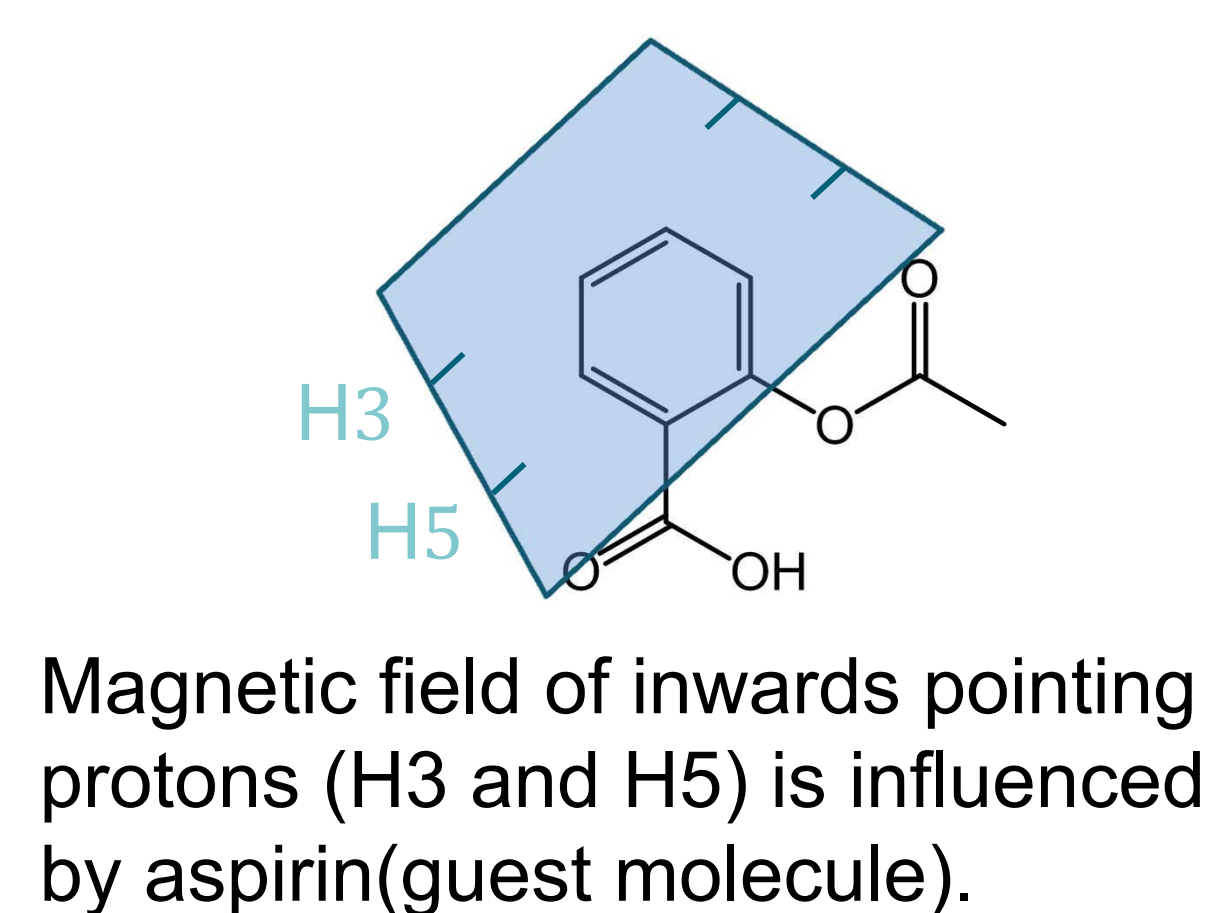
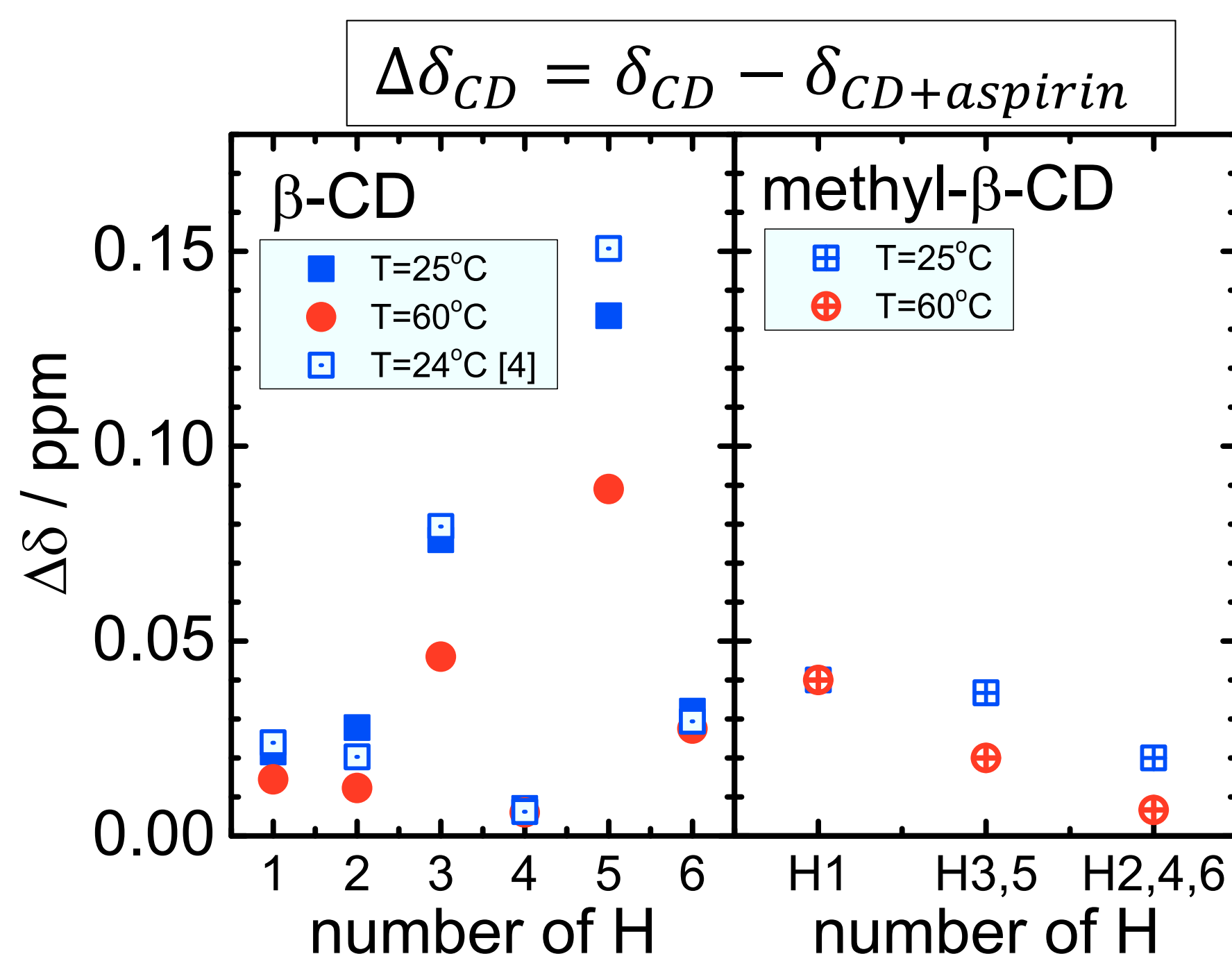
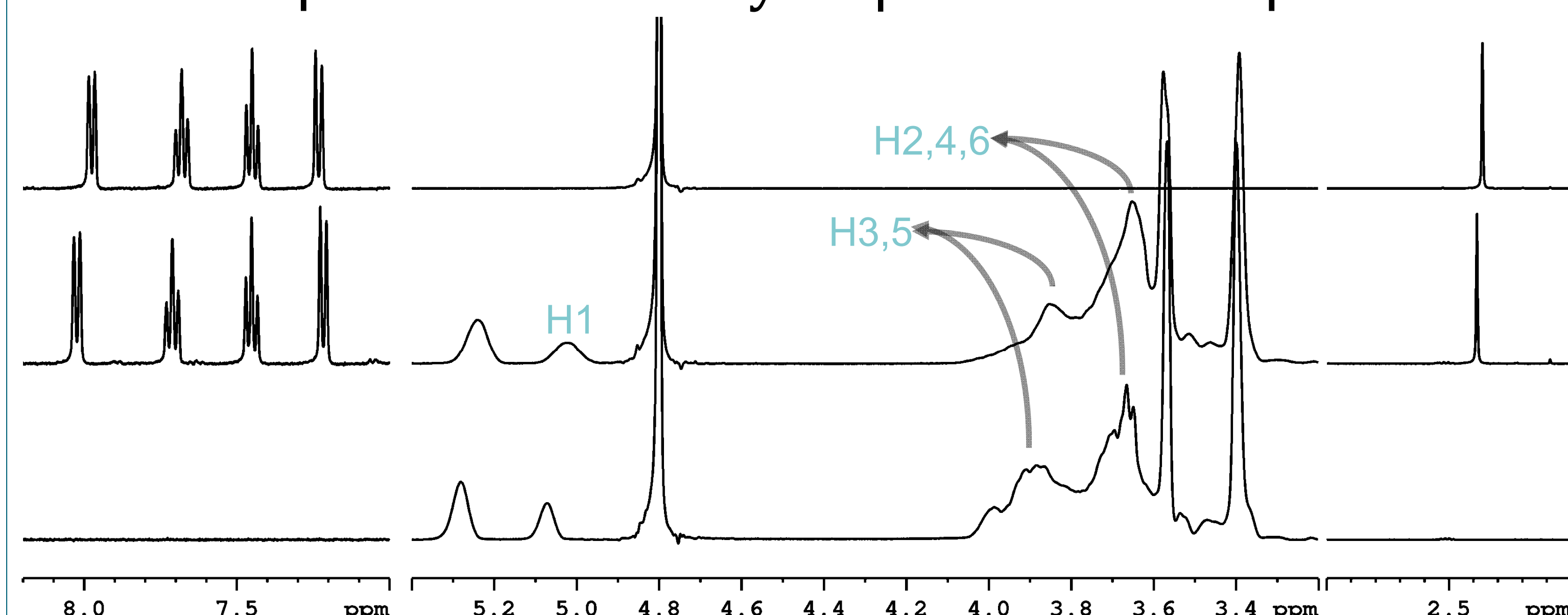
$$S_T \equiv \frac{D_T}{D} = -\frac{1}{c(1-c)} \frac{\Delta c}{\Delta T}$$

NMR measurements [4], [6]

¹H NMR spectrum of β -CD and aspirin 25°C



¹H NMR spectrum of methyl- β -CD and aspirin 25°C



β -CD

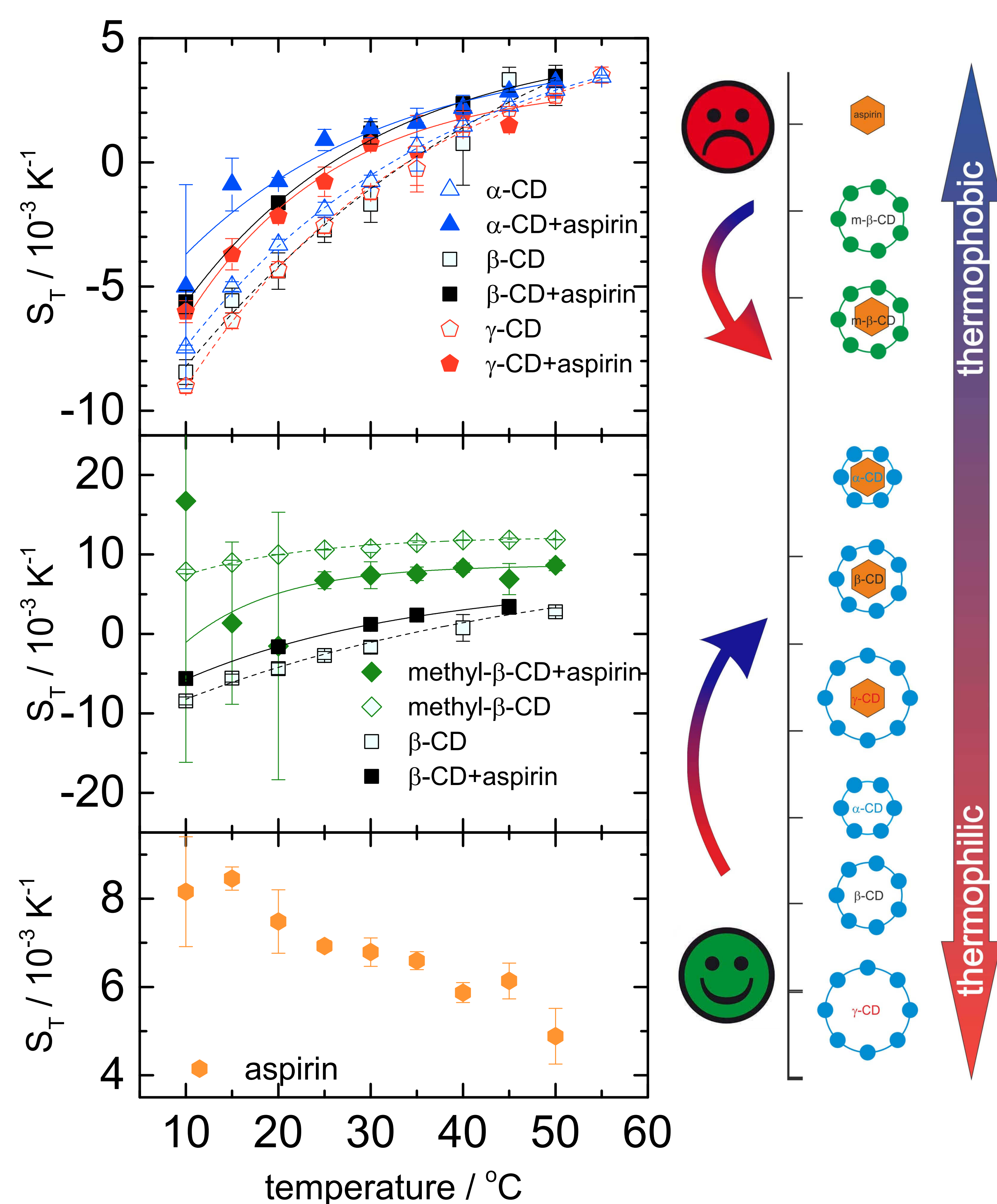
- large $\Delta\delta$ value is observed for H3 and H5 compared to the other protons.
- $\Delta\delta$ value of H3 and H5 is decreased by heating.

methyl- β -CD

- small $\Delta\delta$ value observed for H3,5 compared to β -CDs H3 and H5.
- $\Delta\delta$ value of H3,5 is decreased by heating.

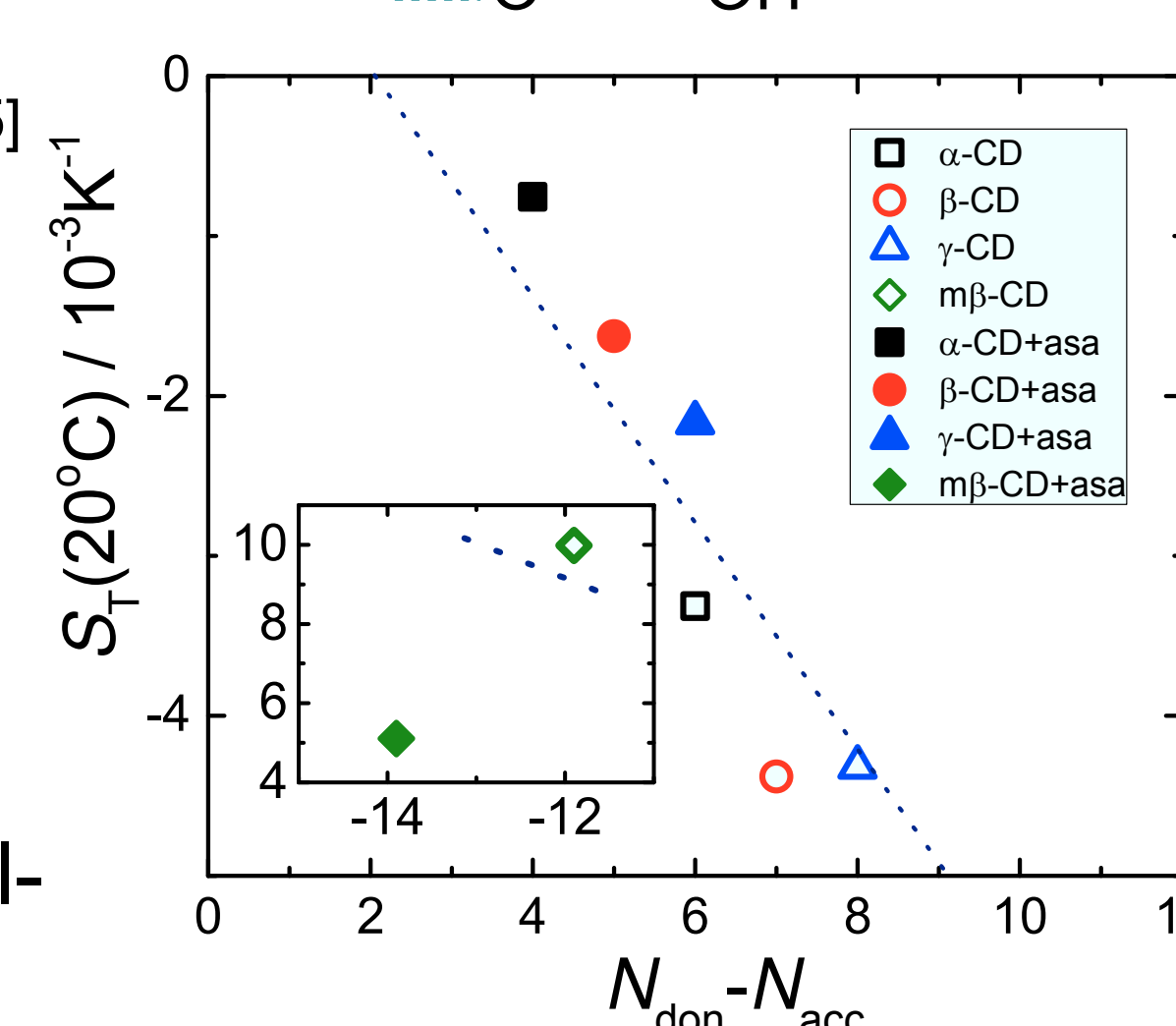
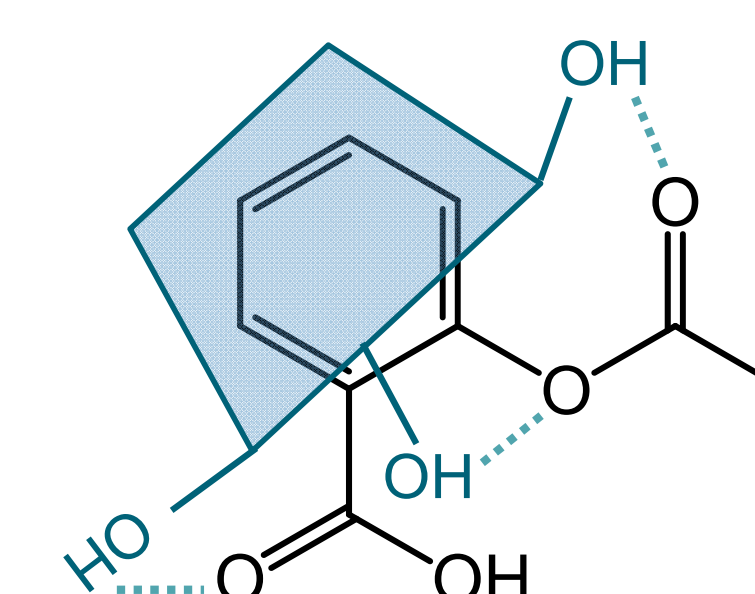
Inclusion complex is confirmed for both CDs.

TDFRS results [3]



Conclusion

- complexes formation are confirmed between CD and aspirin from NMR measurement
- At the high temperature the complex capability weakens
- behaviour of pure CDs and un-methylated CD-complexes fits donor-acceptor model^[5]
- fewer HB sites result in a higher S_T /stronger thermophobicity
- drug-complex of methyl- β -CD behaves different
- possible explanations are polarisation or charge effects
- more information about structure of methyl- β -CD-complex is needed



References

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- [3] Eguchi, K. *et al.*, Eur. Phys. J. E (2016) accepted
- [4] Loftsson, T. *et al.*, Eur. J. Pharma. Sci. **1** (1993) 95.
- [5] Maeda, K. *et al.*, J. Chem. Phys., **143** (2015) 124504
- [6] Wang, D.-W. *et al.*, Carbohydr. Polym., **93**(2013) 753