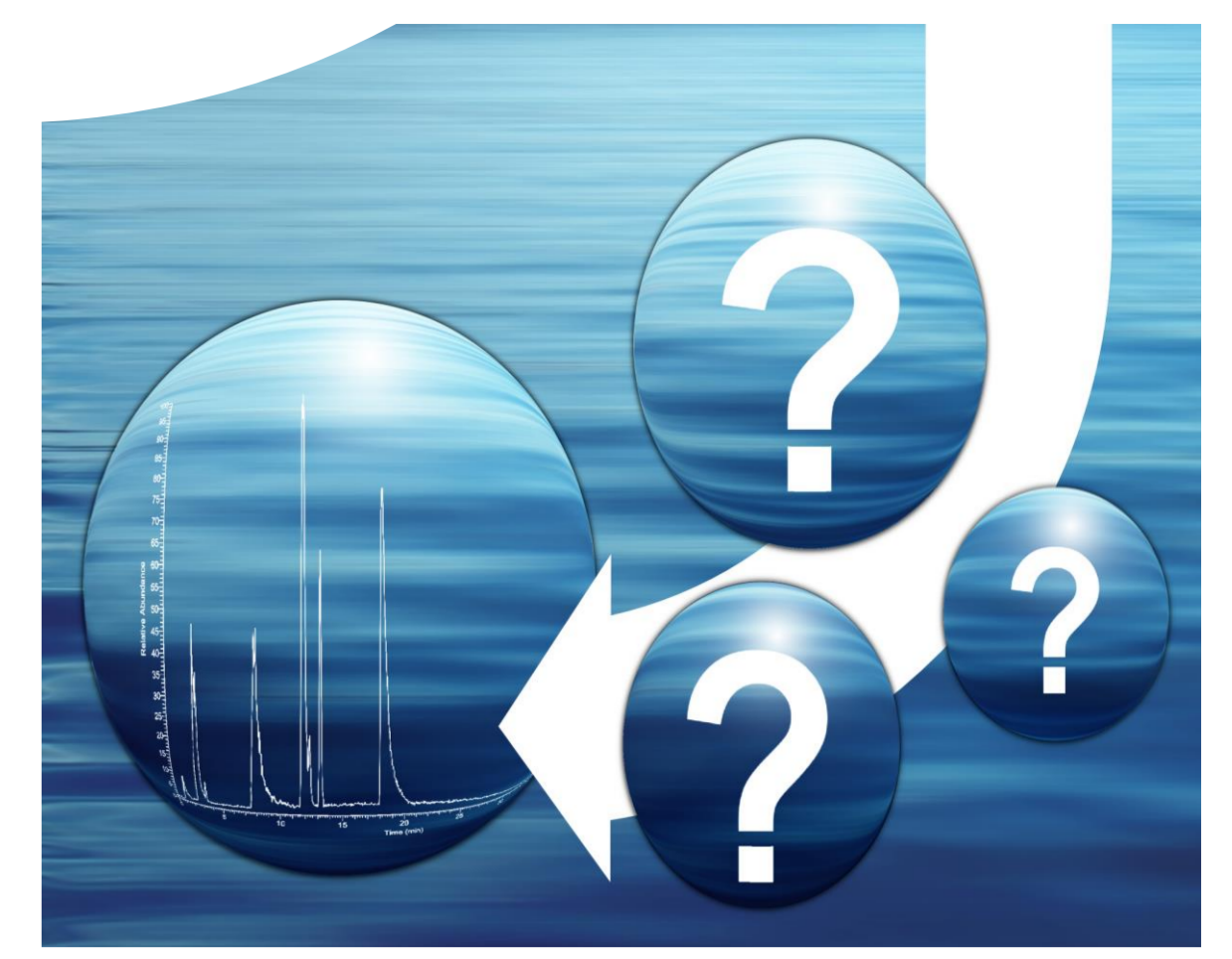


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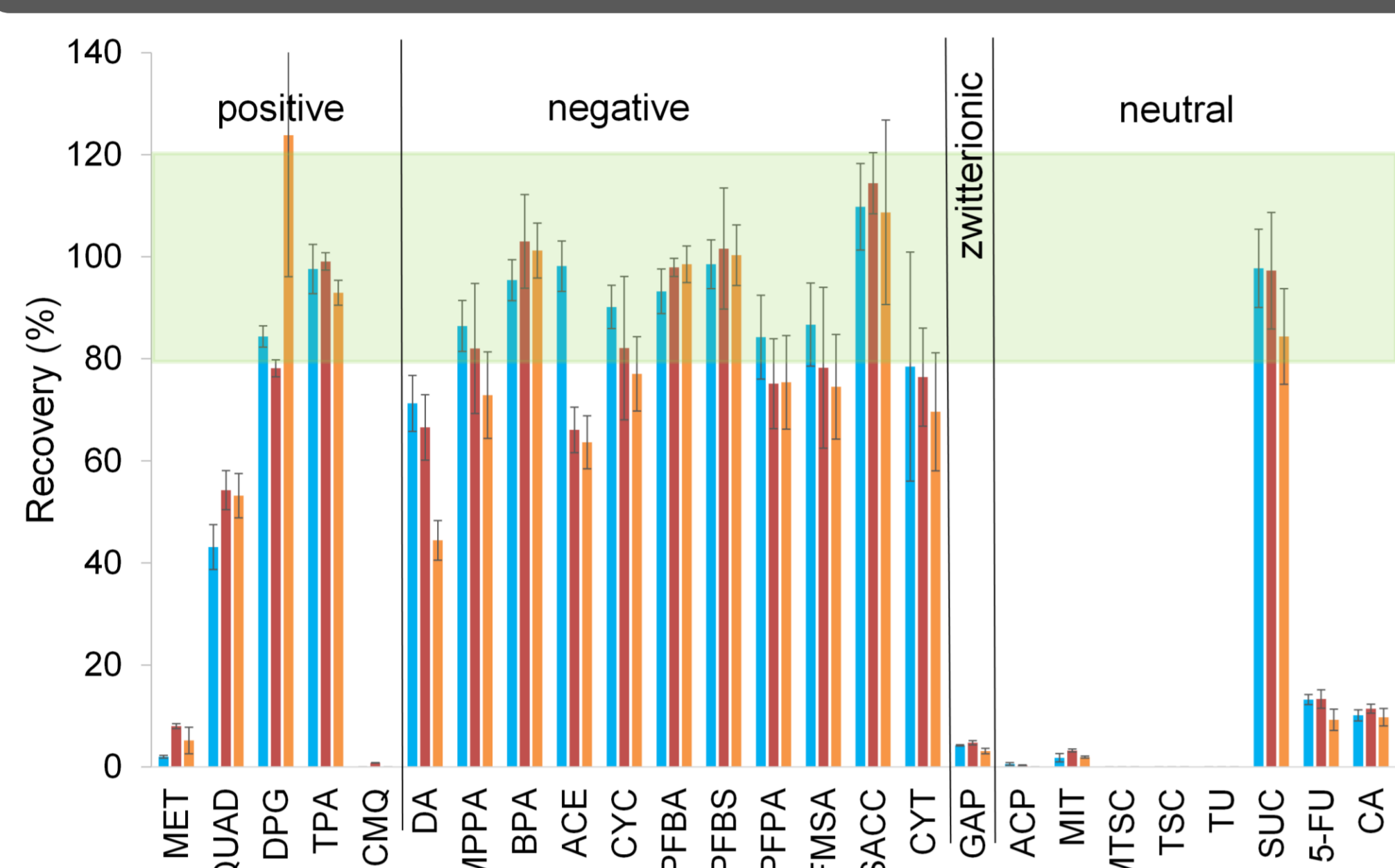
## Introduction



Highly polar organic contaminants are mobile (MOCs) in the water cycle because they are able to pass natural and artificial barriers. If they are persistent (PMOCs), dilution is the only way of concentration reduction, and thus these substances may reach raw and drinking waters in significant concentrations<sup>[1]</sup>. When PMOCs are present in high concentrations or toxic<sup>[2]</sup>, their presence in the water cycle may have adverse effects in the aquatic environment or on human health.

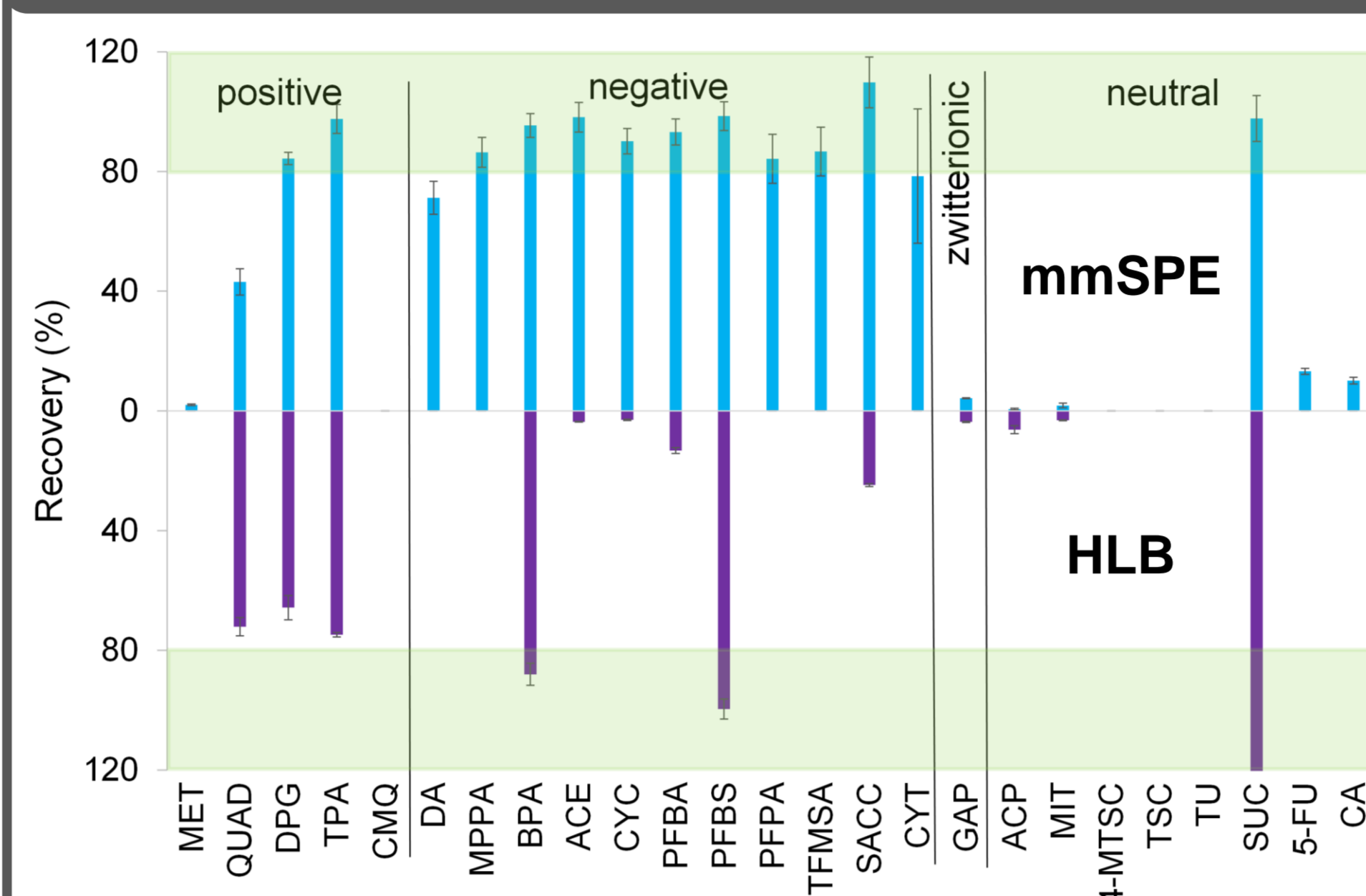
The analysis of MOCs is exacerbated by the same physico-chemical properties<sup>[3]</sup> that facilitate their mobility (e.g. low molecular mass and high polarity). The lack of suitable enrichment methods for MOCs from aqueous samples is a major problem in their trace analysis, and thus two independent methods, a multimodal solid phase extraction method (mmSPE) and an evaporation method, were developed to facilitate the analysis of MOCs.

## Recovery of mmSPE method



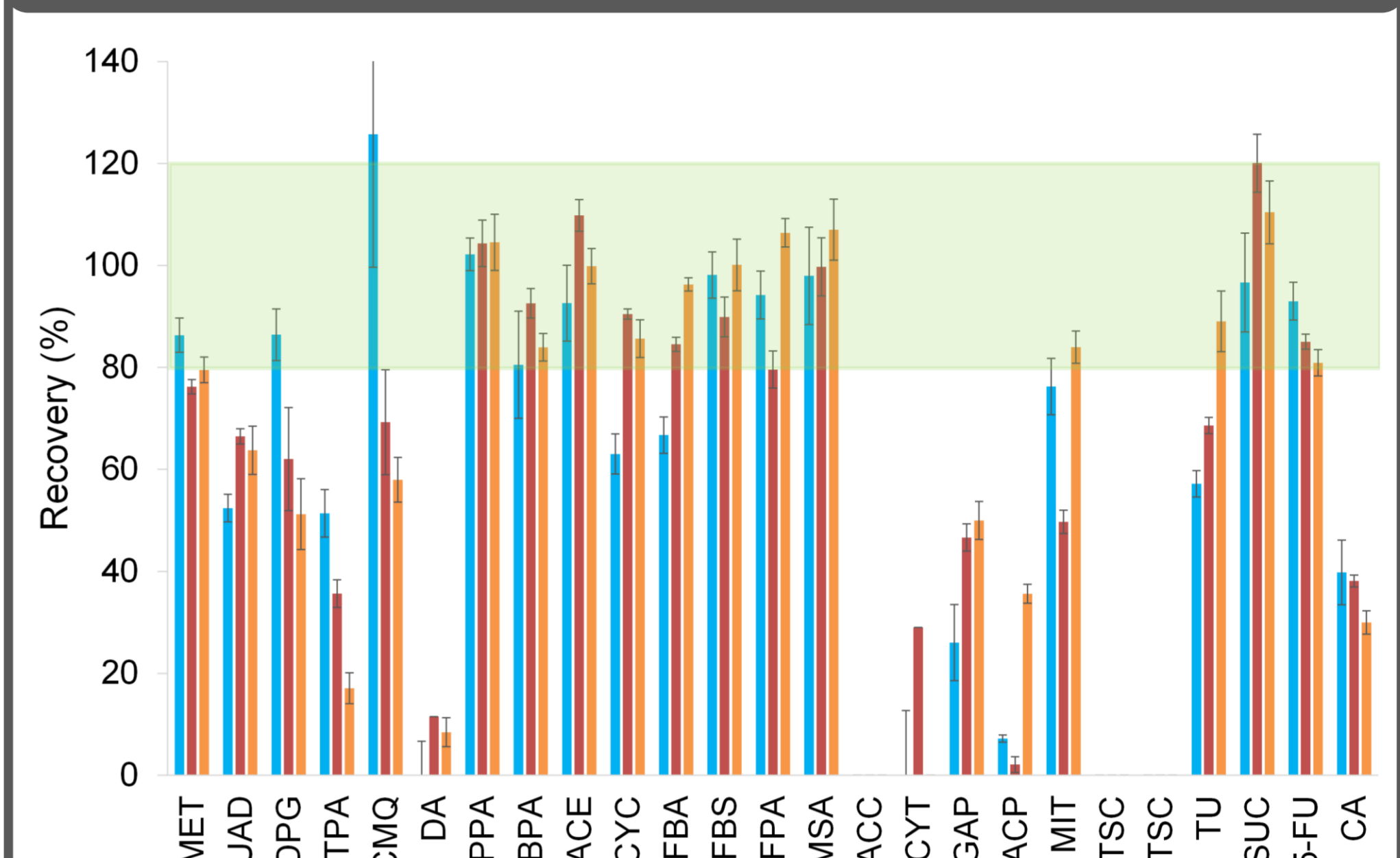
- Successful enrichment of 15 of 25 model substances with a recovery above 40%
- MET, CMQ, GAP, ACP, MIT, 4-MTSC, TSC, TU, 5-FU and CA could be identified as critical substances
- MET and CMQ may undergo transformation since their recovery is above 80%, when enriched from milliQ H<sub>2</sub>O (data not shown)
- Nearly no interactions of TU, TSC and 4-MTSC with the solid phase material, which led to no enrichment

## Comparison of mmSPE with HLB



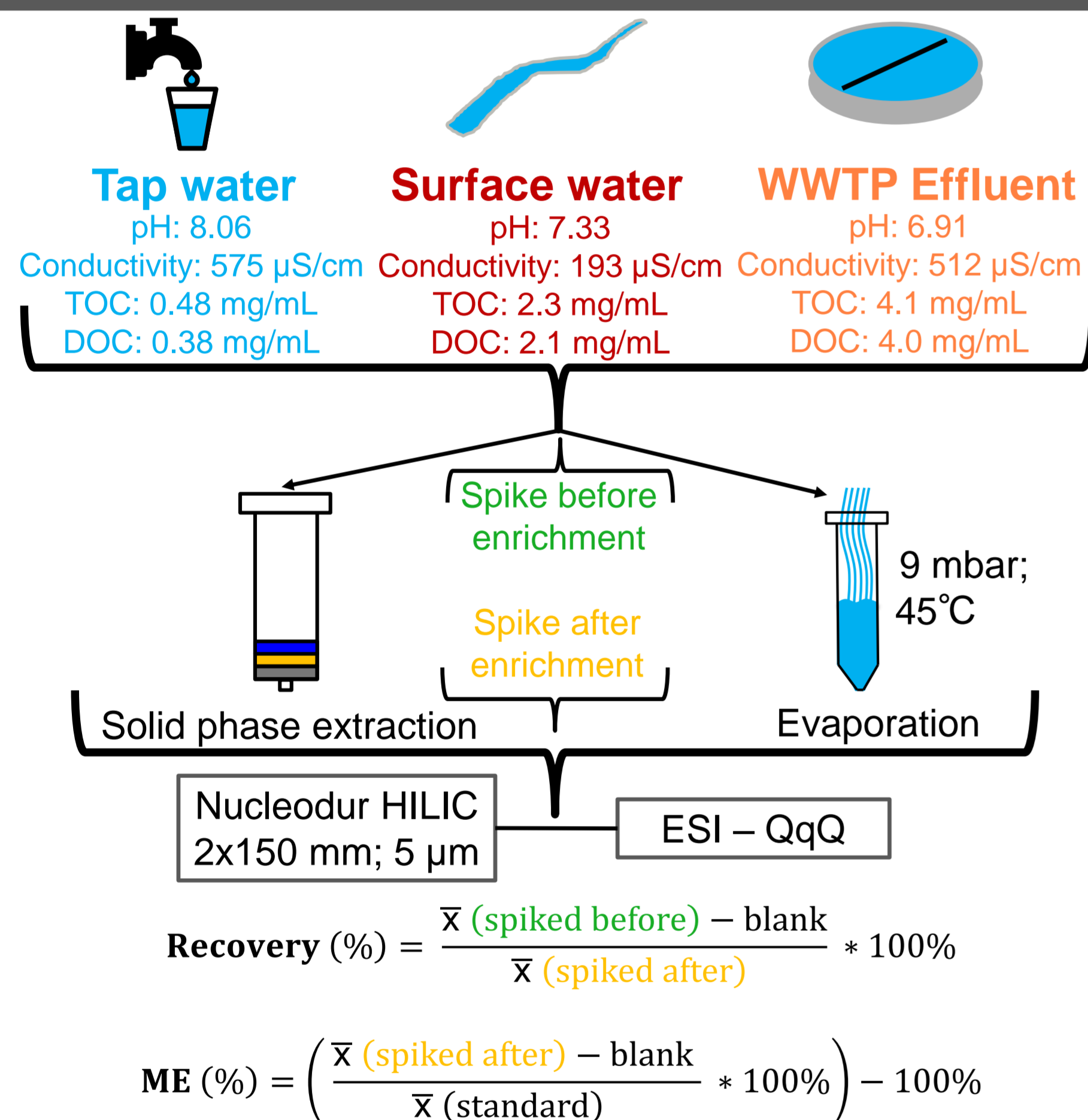
- Generic hydrophilic and lipophilic balanced (HLB) method was compared to the mmSPE method with tap water as matrix
- The mmSPE method shows higher recoveries for 15 substances, similar recoveries for 1 substance (SUC) and lower recoveries for 1 substance (QUAD)
- The mmSPE method was more suitable for the enrichment of highly polar organic substances from aqueous matrices, compared to the generic HLB method

## Recovery of evaporation method

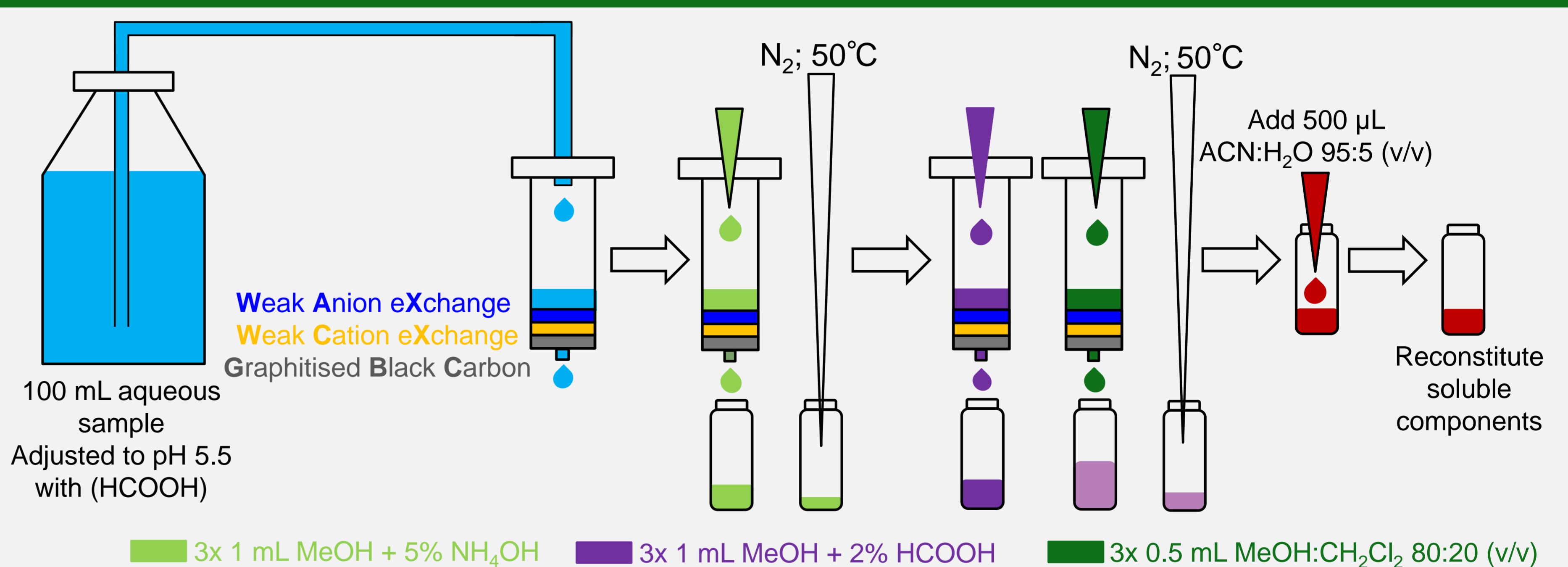


- Successful enrichment of 18 of 25 substances with a recovery above 40%
- Compared to the mmSPE method, GAP, MIT, CMQ, MET, 5-FU, CA and TU showed acceptable recoveries
- DA, SACC, ACP, 4-MTSC and TSC were the most critical substances in terms of enrichment
- Possible hydrolysis of 4-MTSC and TSC during 48 h evaporation process (data not shown)

## Procedure



## Conclusion



- The mmSPE method offers adequate recoveries for many highly polar organic contaminants (15 of 25 with recoveries above 40%)
- The mmSPE method shows less matrix effects than the evaporation method, and thus allows realisation

- of higher enrichment factors
- Enrichment of neutral substances is still problematic with the mmSPE method, which can be attributed to little interaction of these substances with the solid phase materials

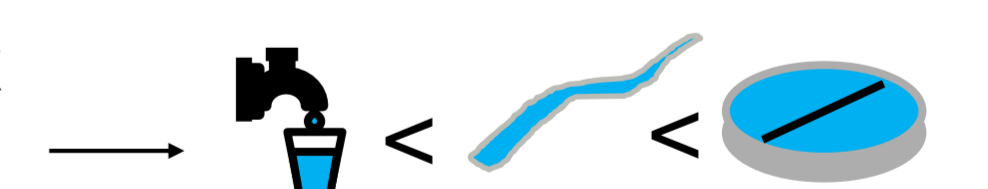
## Matrix effects of mmSPE and evaporation method

- Low matrix effects for 17 of 25 substances for the evaporation method. Only DA, SACC and SUC show significant matrix effects with more than 70 % ion suppression
- An increased enrichment factor leads to significantly more pronounced matrix effects for the evaporation method
- mmSPE method allows realisation of higher enrichment

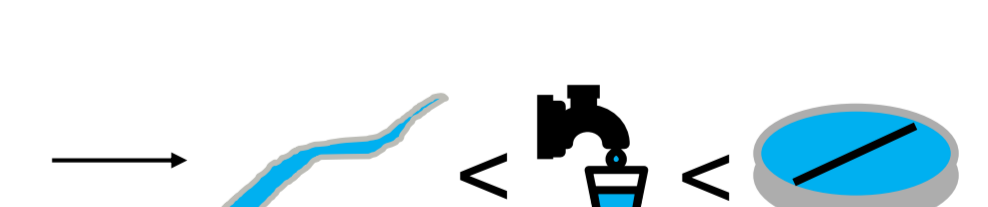
factors before matrix effects become critical

- It is assumed that TOC and DOC influence the matrix effects of the mmSPE method more significantly than dissolved salts
- For the evaporation method, the salt content seems to influence the matrix effects more strongly than the TOC and DOC

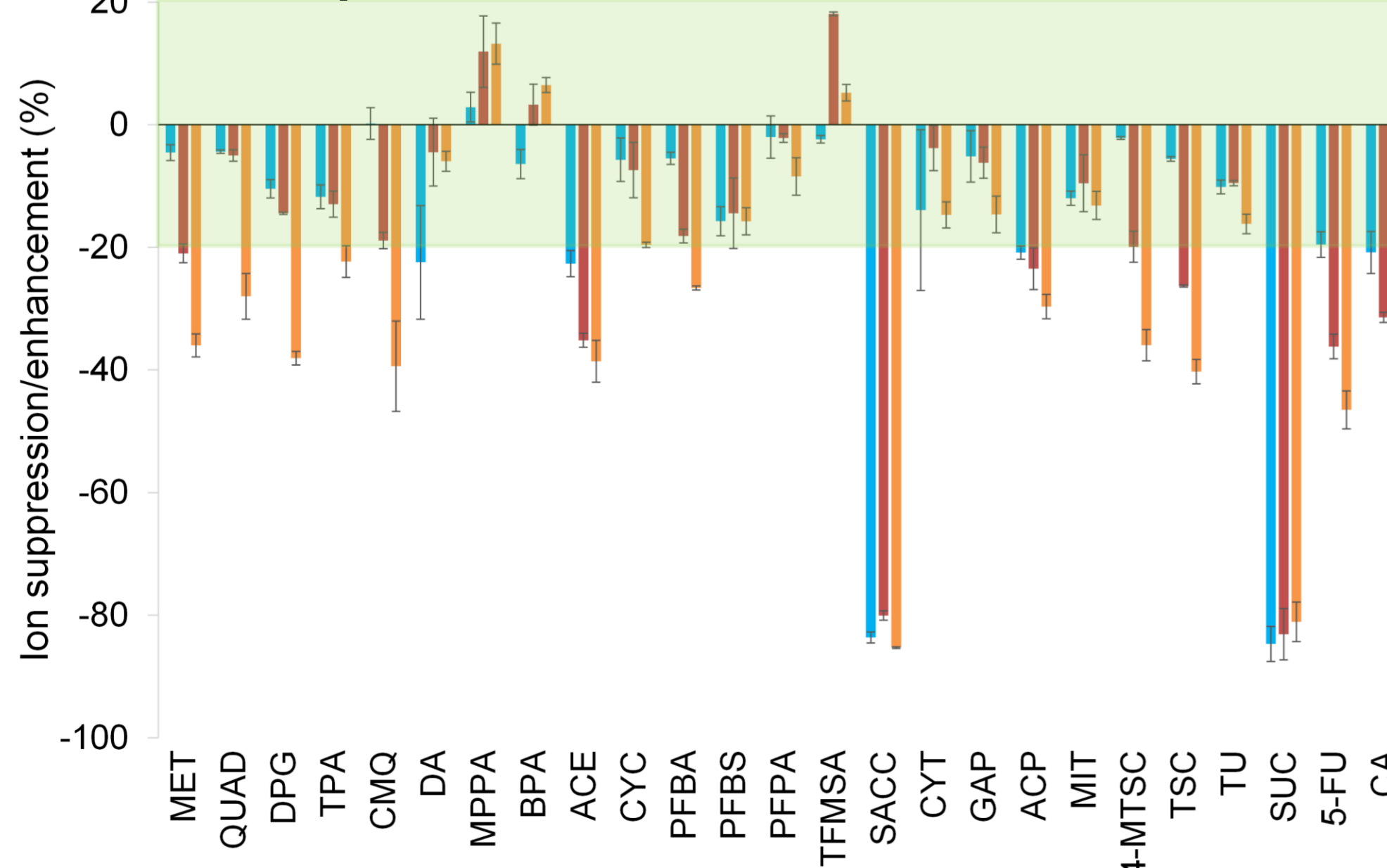
Significance of matrix effects for the mmSPE method



Significance of matrix effects for the evaporation method



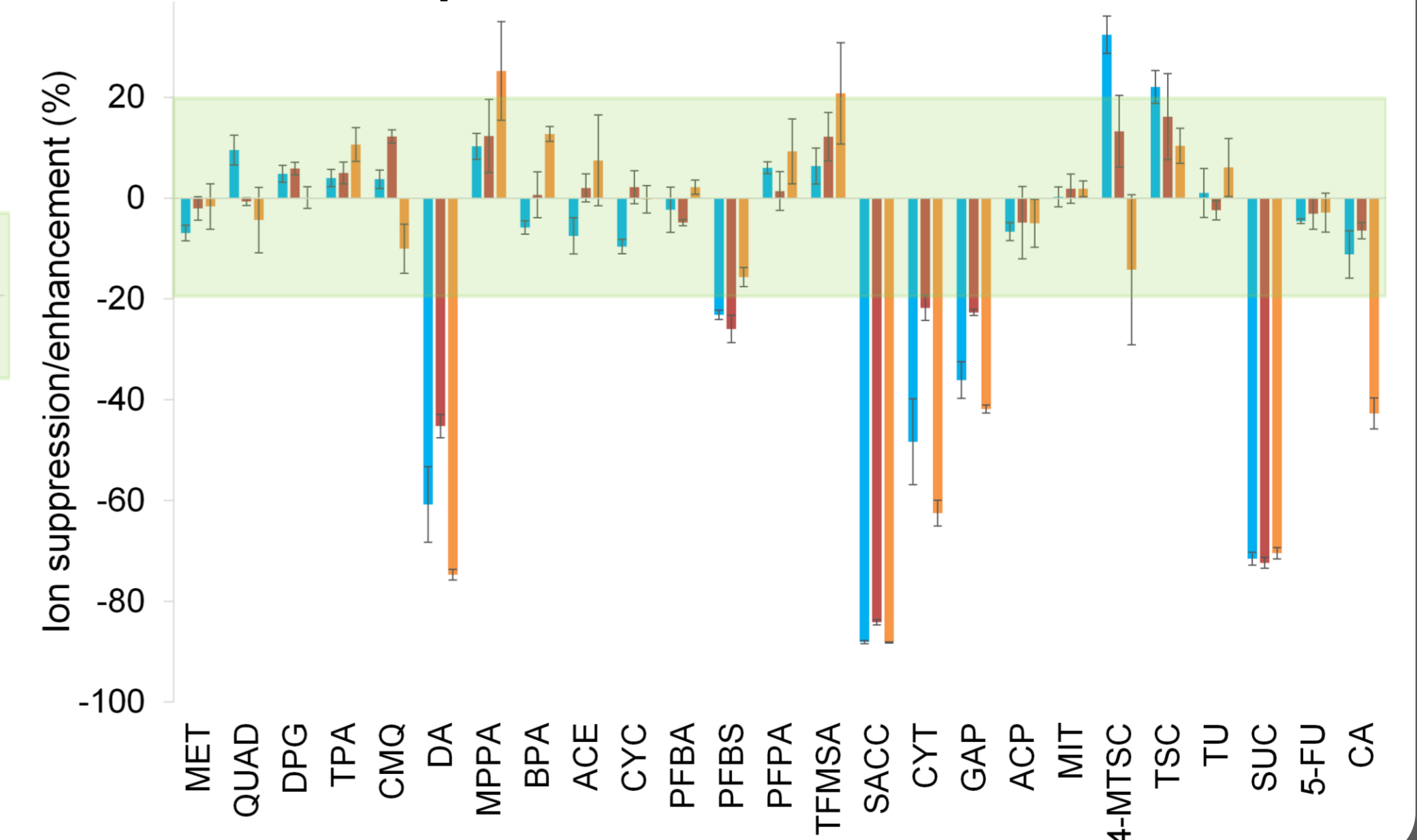
### Solid phase extraction enrichment factor 200



### Evaporation enrichment factor 50



### Evaporation enrichment factor 10



## Acknowledgement:

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## References:

- [1] Reemtsma, T. et al. *Environmental Science & Technology* **2006**, 40, 5451-5458
- [2] Schmidt, C. K.; Brauch, H.-J. *Environmental Science & Technology* **2008**, 42, 6340
- [3] www.promote-water.eu; 12.05.2016