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OMICS Group International is a pioneer and leading science event organizer, which publishes around 400 open access journals and conducts over 300 Medical, Clinical, Engineering, Life Sciences, Pharma scientific conferences all over the globe annually with the support of more than 1000 scientific associations and 30,000 editorial board members and 3.5 million followers to its credit.

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Analytica Acta-2014

Sampling gaseous compounds of heating essential oil using solid phase microextraction devices

Department of Occupational Safety and Hygie

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Introduction

Essential oils, which are the metabolism by-product
aromatic herbs, and are mainly produced by evaporation, ch
pressing and extraction by solvents or by supercritic
procedures.

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Because of their very low molecular weights, essential oils ar
easily absorbed into human body through skin; or inhaled vi
the respiratory tract.

When the chemical compounds of essential oils excite th
human nerve system, the release of neurotransmitters initiate
several physiological effects, like excitation, calm, c
relaxation, etc. (Kao and Hung, 2012).

Aromatherapy is the therapeutic use of essential oils i
massage, bath and inhalation of spray at specific dosages fo
purposes of recuperation, emotional balance and care o
health.

Of all methods of using essential oils, thermal evaporation o
essential oils via diffusers for diffusion of the aromat
molecules in the indoor atmosphere is most frequently used.

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Chiang et al. (2010) and Chiu et al. (2009) used Tedlar bags t
collect samples of exhaust streams produced by heating fiv
essential oils: lavender, lemon, rose, rosemary and tea tree.

Thermogravimetric analysis was used to maintain heatin
rates of 2–15°C/min to final temperatures of 190–300°C. Th
carbonyl compounds obtained under poorly ventilate
conditions included formaldehyde, acetaldehyde, acetone an
propylaldehyde at concentrations of 34–170 ppb.

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When the final temperature of heating progress was 40°C, th
VOCs were aromatic compounds, including toluene (around
ppm), 1,2,3-trimethylbenzene, 1,2,4-trimethylbenzene, p
diethylbenzene, and m-diethylbenzene (5–6 ppm).

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Su et al. (2007) diluted 300 µL quantities of three essential oi
(lavender, eucalyptus and tea tree) in 50 mL water and the
indirectly heated the three dilutions in glass dishes.

Experimental comparisons between two indoor environments
a bedroom (21.6 m^3, air exchange rate 1.8 hr^{-1}) and an offic
(28.2 m^3, air exchange rate 1.3 hr^{-1})..

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The experimental results indicated that the concentrations o
indoor air pollutants increased because of heating essentia
oils:

CO (1.48 vs. 0.47 ppm, hereinafter, values are given a
heating concentration vs. background concentration), CO
(543 vs. 435 ppm) and total VOCs (0.74 vs. 0.48 ppm), whic
shows that heating essential oils reduces the air quality bu
does not substantially increases particulate matters.

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The above studies of heated essential oils reported tha concentrations of VOC by-products ranged from a few ten ppb to thousands ppb.

To date, studies of essential oils have used different types brands or purity of essential oils and have used distinct heatin procedures, which have resulted in widely varying a pollutants and concentration distributions.

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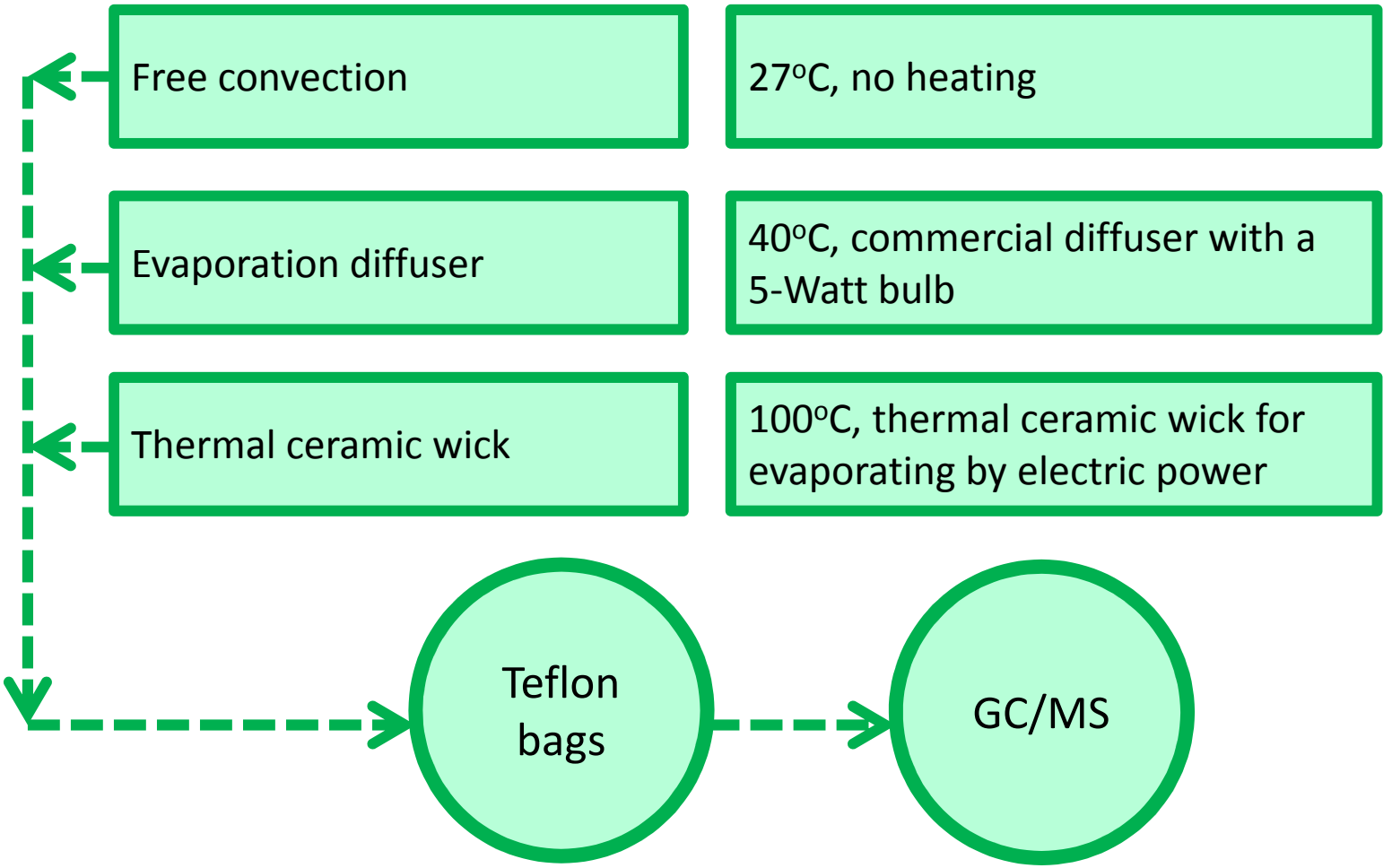
This study effectively sampled trace VOCs by using a sel fabricated solid phase microextraction (SPME) device, needl trap samplers (NTS). The target essential oil was only tea tre oil, which was evaporated in three modes: free convectio evaporation diffuser and thermal ceramic wicks. After samplin and analysis of VOC by-products, the extraction performance of NTS were compared to those of commercial SPME fibe samplers.

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Diffuser with a 5-Watt bulb

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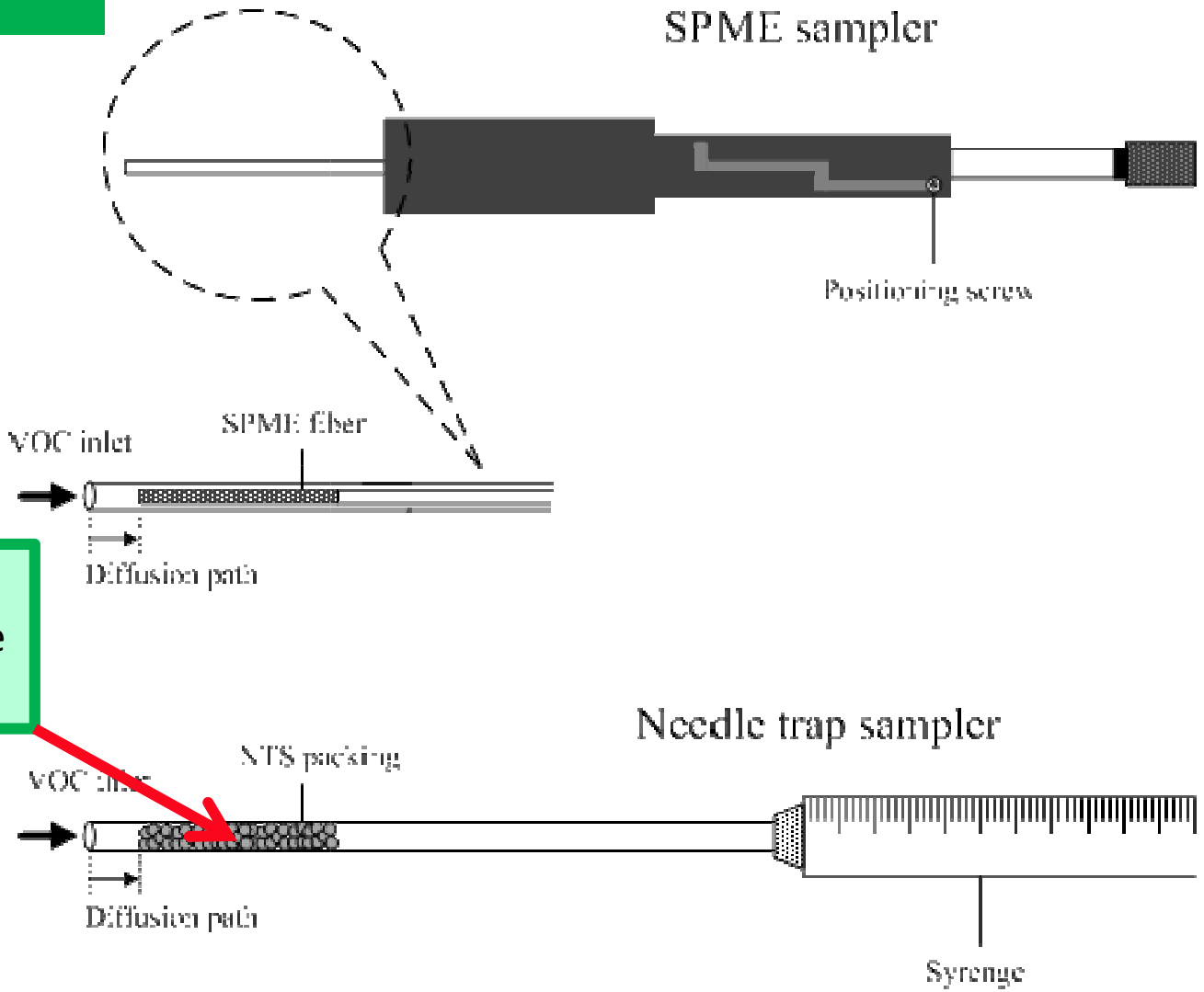
thermal ceramic wick



Methods

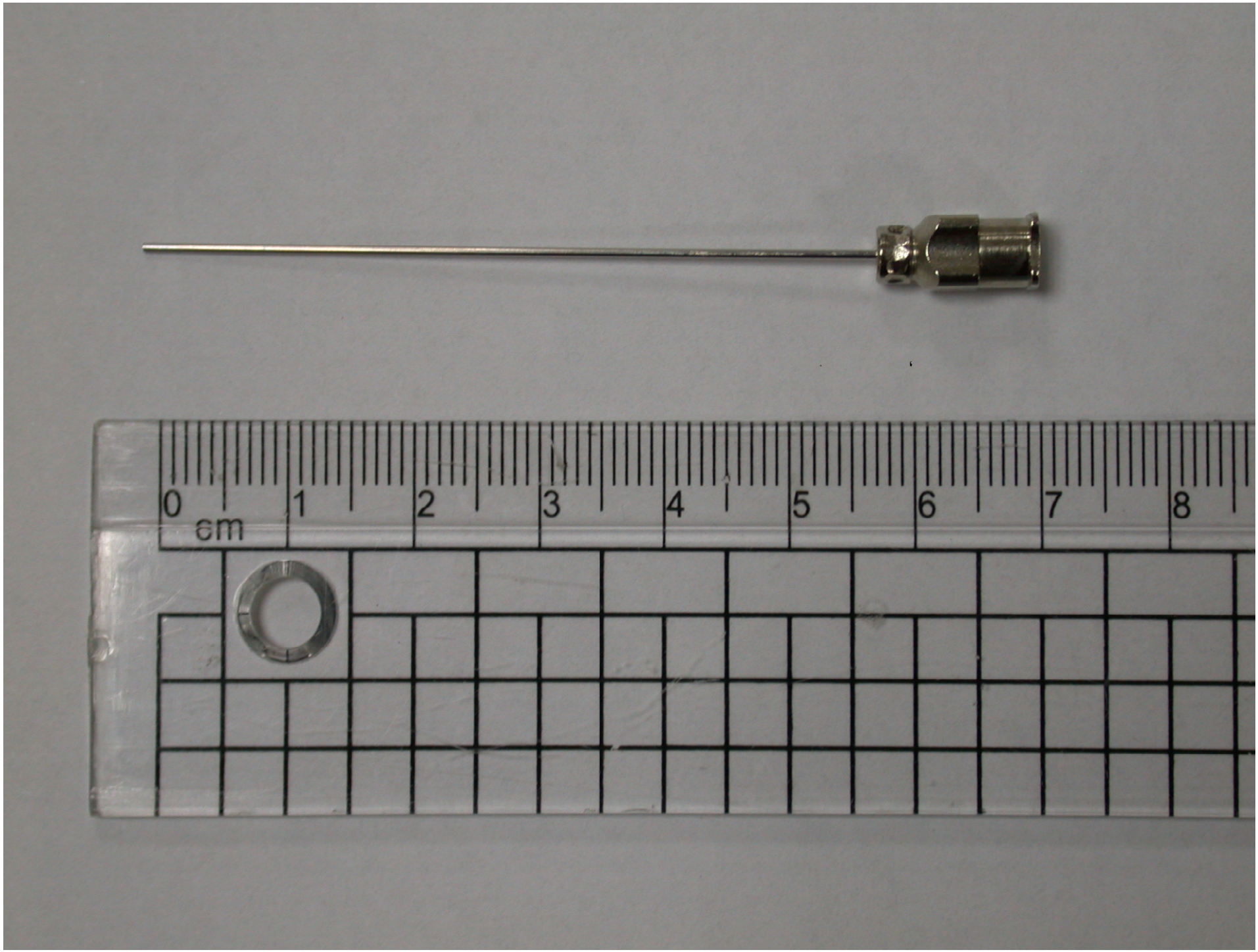
Thermal ceramic wick

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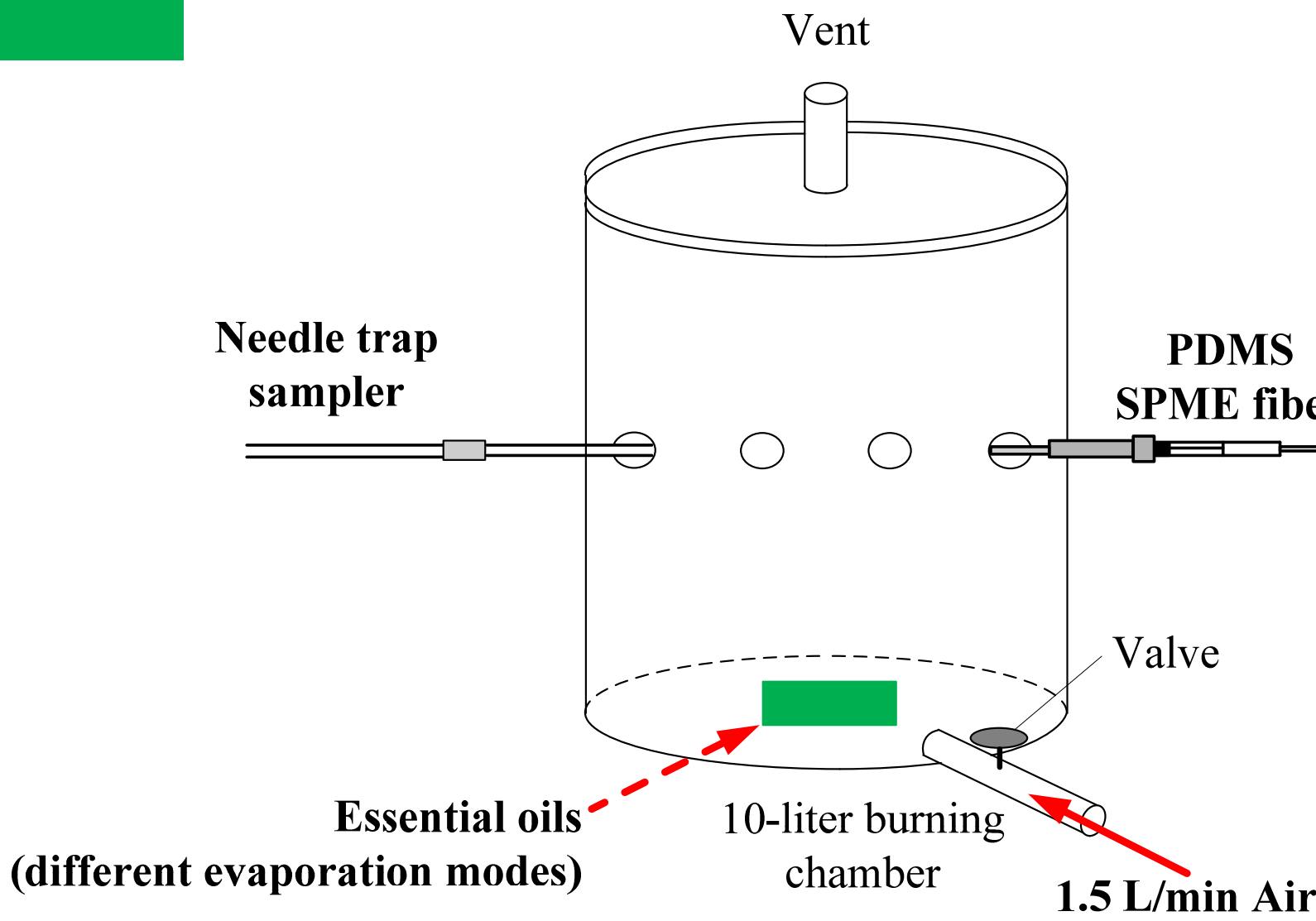
Adsorbent:
80–100 mesh divinylbenzene (DVB) particles

Methods


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cm
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2
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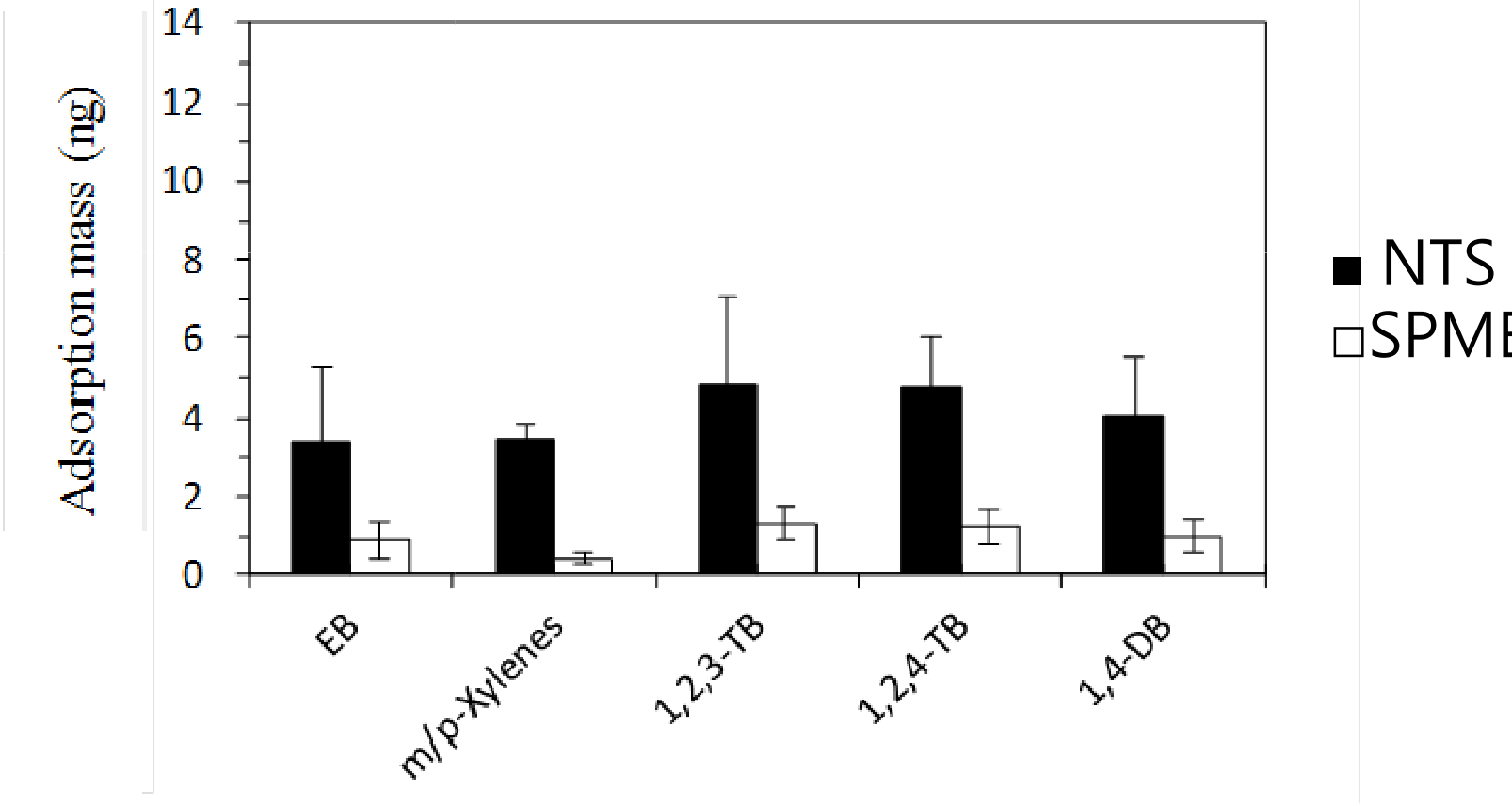
Main air by-products of tea tree essential oil by different evaporation modes

Chemicals	Free convection	Evaporation diffuser	Thermal ceram
Ethylbenzene	2.7 ng (0.73 ng)	4.5 ng (1.20 ng)	5.6 ng (1
m/p-Xylene	3.2 ng (1.10 ng)	5.5 ng (1.44 ng)	6.8 ng (1
1,2,3-Trimethylbenzene	1.8 ng (0.57 ng)	3.3 ng (1.06 ng)	28.8 ng (
1,2,4-Trimethylbenzene	4.2 ng (1.4 ng)	5.3 ng (1.83 ng)	21.6 ng (
1,4-Diethylbenzene	1.6 ng (0.56 ng)	3.3 ng (1.24 ng)	28.6 ng (

1,2,4-Trimethylbenzene	4.2 (1.4)	5.3 (1.83)	21.6 (6.31
1,4-Diethylbenzene	1.6 (0.56)	3.3 (1.24)	28.6 (9.02
Others			
Acetone	3.6 (0.23)	11.8 (4.65)	18.4 (3.97

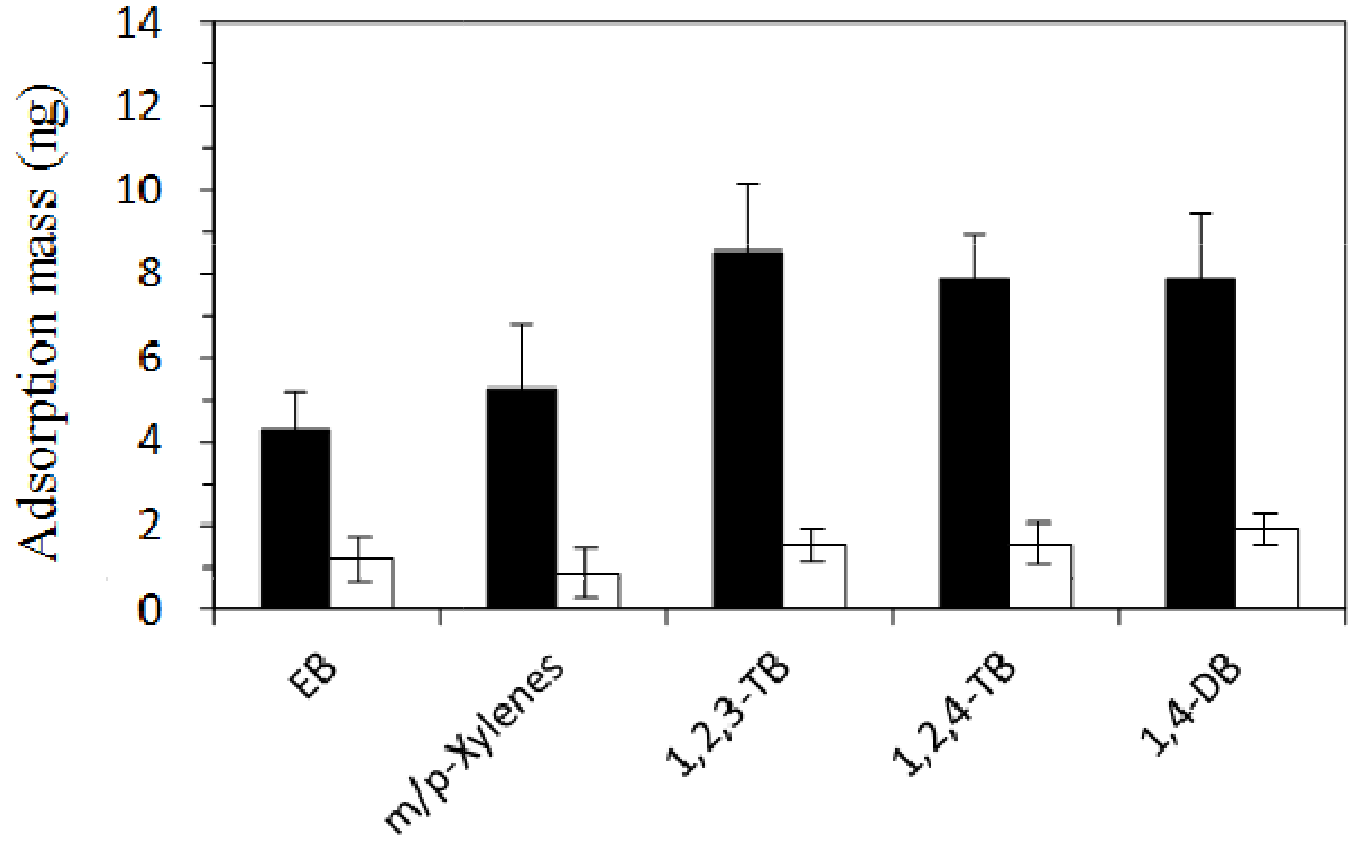
NTS *vs.* SPME fiber

Free convection



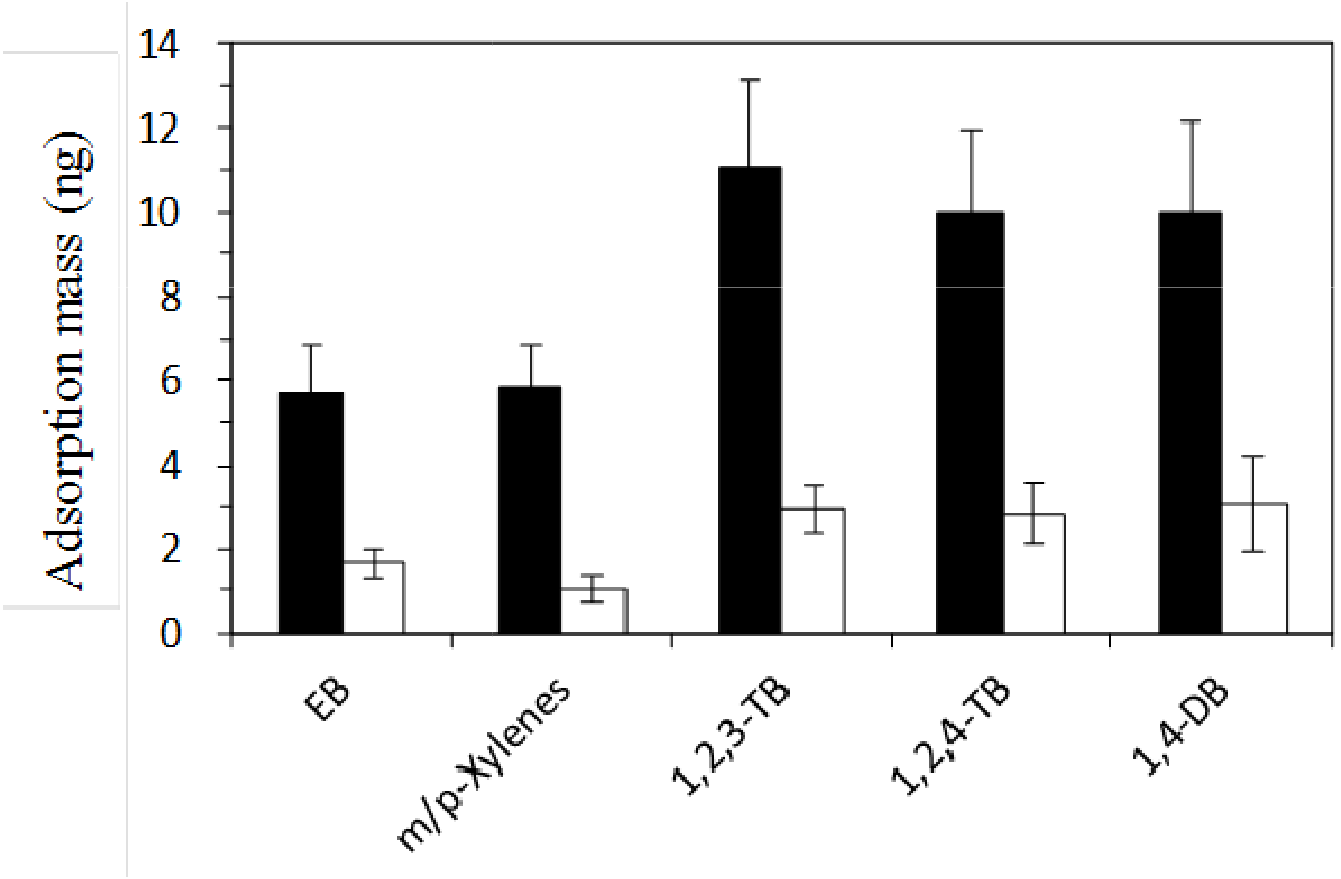
NTS *vs.* SPME fiber

Evaporation diffuser



NTS *vs.* SPME fiber

Thermal ceramic wicks



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Thanks for your attention!