Determination of Polycyclic Aromatic Hydrocarbons in Drinking Water by Liquid-Solid Extraction and High Performance Liquid Chromatography with Ultraviolet Detection
Abstract

In this application brief, Polycyclic aromatic hydrocarbons (PAHs) are determined in drinking water by Liquid-Solid extraction and High Performance Liquid Chromatography with Ultraviolet detection.

Introduction

Polycyclic aromatic hydrocarbons (PAHs) are one of the most wide-spread organic pollutants. PAHs are made up of fused aromatic rings and are formed during the combustion of carbon based fuels (wood, coal, diesel), as well as being present in crude oil. The United States Environmental Protection Agency (US EPA) has classified seven PAH compounds as being potentially carcinogenic including benz[a]anthra-cene, benzo[a]pyrene, benzo[b]fluoranthene, benzo[k]fluoranthene, chrysene, dibenz[a,h]anthracene, and indeno[1,2,3-cd]pyrene.

Experimental

HPLC conditions

Instrument: Waters Alliance HPLC system with PDA and fluorescence detectors

Eluent: Water/acetonitrile (Table 1)

Column: Waters PAH 4.6 x 250 mm (part no. 186001265) @ 30 °C

Injection: 20 μL of Supelco Standard EPA 610 (#48743) diluted 1:50 in 40:60 water/acetonitrile
Flow Rate: 1.2 mL/min

Detection: UV @ 254 nm and fluorescence using timed programmed wavelengths

Data: Waters Empower software

Sample preparation
Extract with C_{18} cartridge, elute with MeCl₂

Eluent preparation
Filter and degas through a 0.45 μm filter.

A: Water
B: Acetonitrile

Eluent gradient

<table>
<thead>
<tr>
<th>Time</th>
<th>Flow</th>
<th>%A</th>
<th>%B</th>
<th>Curve</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial</td>
<td>1.2</td>
<td>40</td>
<td>60</td>
<td>-</td>
</tr>
<tr>
<td>12</td>
<td>1.2</td>
<td>0</td>
<td>100</td>
<td>9</td>
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<tr>
<td>23</td>
<td>1.2</td>
<td>40</td>
<td>60</td>
<td>11</td>
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</table>
## Results and Discussion

<table>
<thead>
<tr>
<th>Analyte</th>
<th>UV Max (nm)</th>
<th>EX (nm)</th>
<th>EM (nm)</th>
<th>Detection Limit (ppb)$^1$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Naphthalene</td>
<td>220</td>
<td>277</td>
<td>330</td>
<td>0.14</td>
</tr>
<tr>
<td>Acenaphthylene</td>
<td>229</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Acenaphthene</td>
<td>227</td>
<td>270</td>
<td>323</td>
<td>0.01</td>
</tr>
<tr>
<td>Fluorene</td>
<td>261</td>
<td>265</td>
<td>310</td>
<td>0.03</td>
</tr>
<tr>
<td>Phenanthrene</td>
<td>251</td>
<td>252</td>
<td>365</td>
<td>0.02</td>
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<tr>
<td>Anthracene</td>
<td>252</td>
<td>250</td>
<td>402</td>
<td>0.01</td>
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<tr>
<td>Fluoranthene</td>
<td>236</td>
<td>284</td>
<td>467</td>
<td>0.02</td>
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<td>Pyrene</td>
<td>240</td>
<td>332</td>
<td>378</td>
<td>0.01</td>
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<tr>
<td>Benzo(a)anthracene</td>
<td>287</td>
<td>284</td>
<td>390</td>
<td>0.01</td>
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<tr>
<td>Chrysene</td>
<td>267</td>
<td>270</td>
<td>367</td>
<td>0.04</td>
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<tr>
<td>Benzo(b)fluoranthene</td>
<td>256</td>
<td>298</td>
<td>436</td>
<td>0.09</td>
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<tr>
<td>Benzo(k)fluoranthene</td>
<td>307</td>
<td>303</td>
<td>432</td>
<td>0.01</td>
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<tr>
<td>Benzo(a)pyrene$^2$</td>
<td>296</td>
<td>280</td>
<td>410</td>
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<tr>
<td>Dibenzo(a,h)anthracene</td>
<td>297</td>
<td>294</td>
<td>398</td>
<td>0.01</td>
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<td>Benzo(g,h,i)perylene</td>
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<td>290</td>
<td>420</td>
<td>0.03</td>
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<tr>
<td>Indeno(1,2,3-cd)pyrene</td>
<td>250</td>
<td>305</td>
<td>480</td>
<td>0.49</td>
</tr>
</tbody>
</table>

$^1$ Fluorescence mode used for detection limit determination, no pre-concentration. Seven replicates per 40 CFR pt. 136 App. B.

$^2$ Regulated compound; action level 0.17 ppb.
PAH target analytes.

Standard chromatogram, UV @ 254 nm, 1-20 ppm PAH analytes.
Standard chromatogram, fluorescence/programmed wavelengths, 1-20 ppm PAH analytes.

Featured Products

Alliance HPLC System <https://www.waters.com/534293>
Empower 3 Chromatography Data Software <https://www.waters.com/10190669>
2475 Fluorescence (FLR) Detector <https://www.waters.com/514434>
2998 Photodiode Array (PDA) Detector <https://www.waters.com/1001362>

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