Supplementary Material

Fast analysis of nine PAHs in beer by Ultrasound-Vortex-Assisted Dispersive Liquid-Liquid Micro-Extraction coupled with Gas Chromatography-Ion Trap Mass Spectrometry

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Table 1. PAH recoveries (%) using different volumes of dichloromethane as extraction solvent. Sample: hydroalcoholic solution (pH 4 and 5 alc vol^{-1}) spiked with 50 µL of a PAH mix (20 µg mL^{-1} each) and 5 µL of I.S. (500 µg mL^{-1}).

PAH	Recovery		
	200 µL	**250 µL**	300 µL
Fluorene	30.3	**94.6**	76.9
Phenanthrene	69.0	**97.9**	85.2
Anthracene	70.4	**96.7**	88.5
Fluoranthene	91.5	**100.7**	91.8
Pyrene	90.6	**102.0**	96.7
Crysene	85.4	**97.6**	79.7
Benzo(b)fluoranthene	79.0	**90.8**	77.4
Benzo(a)pyrene	76.2	**88.7**	58.0
Benzoperylene	71.9	**89.7**	85.3

Table 2. PAH recoveries (%) using different volumes of chloroform as extraction solvent. Sample: hydroalcoholic solution (pH 4 and 5 alc vol^{-1}) spiked with 50 µL of a PAH mix (20 µg mL^{-1} each) and 5 µL of I.S. (500 µg mL^{-1}).

PAH	Recovery				
	75 µL	100 µL	**150 µL**	200 µL	250 µL
Fluorene	70.4	89.2	**102.5**	107.5	83.4
Phenanthrene	72.9	82.8	**104.6**	97.7	77.3
Anthracene	69.4	803	**100.7**	95.0	75.7
Fluoranthene	74.0	78.5	**98.7**	97.0	75.6
Pyrene	71.7	77.2	**96.3**	92.6	72.1
Crysene	71.1	78.4	**90.2**	88.9	99.5
Benzo(b)fluoranthene	67.2	78.1	**92.9**	83.6	51.9
Benzo(a)pyrene	63.5	67.8	**86.3**	29.5	31.0
Benzoperylene	56.3	61.9	**80.2**	44.6	35.7

Table 3. PAH recoveries (%) using different volumes of carbon tetrachloride as extraction solvent. Sample: hydroalcoholic solution (pH 4 and 5 alc vol^{-1}) spiked with 50 µL of a PAH mix (20 µg mL^{-1} each) and 5 µL of I.S. (500 µg mL^{-1}).

PAH	Recovery			
	100 µL	150 µL	200 µL	250 µL
Fluorene	85.9	81.4	61.4	73.6
Phenanthrene	85.0	80.2	58.9	71.5
Anthracene	51.5	4.8	57.3	52.6
Fluoranthene	82.8	79.6	64.4	74.1
Pyrene	76.4	77.9	64.4	61.0
Crysene	84.4	43.9	63.9	109.8
Benzo(b)fluoranthene	73.5	59.5	60.8	65.2
Benzo(a)pyrene	27.0	30.9	46.2	35.4
Benzoperylene	48.1	4.0	56.0	49.7

Table 4. PAH recoveries (%) using different volumes of 1,2-dichloroethane as extraction solvent. Sample: hydroalcoholic solution (pH 4 and 5 alc vol^{-1}) spiked with 50 µL of a PAH mix (20 µg mL^{-1} each) and 5 µL of I.S. (500 µg mL^{-1}).

PAH	Recovery			
	100 µL	200 µL	**250 µL**	300 µL
Fluorene	52.3	67.3	**102.2**	95.2
Phenanthrene	56.9	68.9	**99.8**	95.5
Anthracene	57.2	71.2	**89.9**	88.8
Fluoranthene	60.9	70.8	**96.4**	89.7
Pyrene	59.5	94.2	**104.0**	63.3
Crysene	56.9	71.7	**101.5**	106.3
Benzo(b)fluoranthene	53.0	61.6	**91.8**	79.9
Benzo(a)pyrene	51.0	60.4	**82.5**	68.4
Benzoperylene	45.3	50.2	**80.7**	64.0

Table 5. PAH recoveries (%) using different volumes of 1,1,2,2-tetrachloroethane as extraction solvent. Sample: hydroalcoholic solution (pH 4 and 5 alc vol^{-1}) spiked with 50 µL of a PAH mix (20 µg mL^{-1} each) and 5 µL of I.S. (500 µg mL^{-1}).

PAH	Recovery				
	50 µL	100 µL	150 µL	200 µL	250 µL
Fluorene	16.8	21.0	14.4	43.9	48.6
Phenanthrene	13.6	15.1	15.4	43.3	49.8
Anthracene	24.7	18.8	15.6	40.8	44.6
Fluoranthene	16.5	29.1	14.4	41.8	44.5
Pyrene	29.7	37.1	43.3	82.1	40.5
Crysene	14.4	16.9	13.2	38.0	46.8
Benzo(b)fluoranthene	9.3	9.5	12.1	34.3	42.4
Benzo(a)pyrene	4.4	8.1	8.9	28.4	39.3
Benzoperylene	5.2	7.7	9.0	27.5	36.5

Table 6. Effect of the quantity of salt, NaCl, on the PAH extraction. Sample: alcoholic solutions, pH 4 and 5 alc vol^{-1}, spiked with 20 μg mL^{-1} of each PAH and 5 μL of I.S. (500 μg mL^{-1}); extraction solvent: dichloromethane 250 μL.

PAH	0 g L^{-1}	10 g L^{-1}	25 g L^{-1}	50 g L^{-1}	100 g L^{-1}
Fluorene	87.4	106.2	100.3	89.2	75.6
Phenanthrene	78.3	98.7	99.6	86.7	72.4
Anthracene	84.2	94.0	95.1	85.0	70.9
Fluoranthene	91.5	94.7	101.7	86.7	71.2
Pyrene	89.9	101.0	99.4	98.9	80.7
Chrysene	91.9	93.9	97.6	89.7	73.3
Benzo(b)fluoranthene	89.3	88.1	96.0	85.8	70.3
Benzo(a)pyrene	83.9	89.4	94.6	85.6	70.8
Benzoperylene	79.4	86.3	97.2	86.8	71.6