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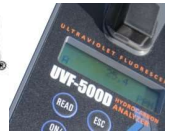


UVF-500D TEST PROCEDURES FOR BaP IN ASPHALT

Ultraviolet Fluorescence Method for Benzo[a]Pyrene Analysis Using Methanol Extraction

Supplies & Equipment Required for Analysis:

Sample Test Kit:
Part No. EXTR010-20-PAHS

- Supplies for 20 samples.
- Use with methanol (solvent not included). Use with HPLC grade methanol, CAS #67-56-2.

Sitelab UVF-500D Analyzer:
Part No. 50200

- Use the 8mm Cuvette Adapter
- Use on Channel A optics only

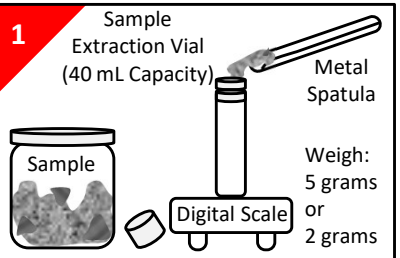
Lab Equipment and Other Parts Needed, Sold Separately:

- UVF-500D Starter Kit, Part No. 90300
- Soil Accessory Kit, Part No. 90300-SAK
- 8mm Round Glass Cuvettes, 400/Pack, Part No. 50957
- Benzo[a]Pyrene Standard, Part No. CAL-BAP-COALTAR

Sample Extraction Procedure for Reclaimed Asphalts & Coal Tar Contaminates

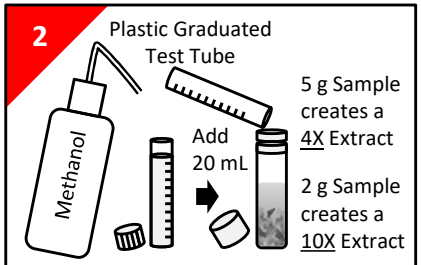
Samples prepared using materials supplied in EXTR010-20-PAHS test kit. Solvent dispenser bottle, digital scale, pipette and other tools needed are included in UVF-500D accessories.

1



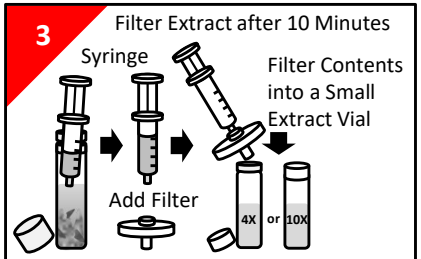
Asphalt samples should be crushed and sieved to 4 mm particle size prior to use following ADEPT (UK) guidelines. Using a glass sample extraction vial, remove the cap and place the vial onto the scale and tare the weight to zero. Scoop out and weigh 5.0 g of sample into the vial. Or use 2.0 g for highly contaminated samples. Be precise (within +/- 0.1 g).

2



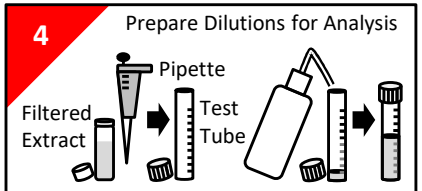
Add methanol to the solvent dispenser bottle. Squirt 10 mL of methanol into a plastic graduated test tube. Pour contents into the sample extraction vial. Add another 10 mL to vial for a total of 20 mL of solvent. Keep track of the dilution created in the extract (4X or 10X). Tighten cap and shake vial periodically for 10 minutes, no more than 20 minutes.

3



Once the sample has been extracted for 10 minutes, remove the cap, dip a syringe into the vial and suck up the Extract into the syringe. Screw on a filter, push down on the plunger and filter the Extract into a small glass extract vial. Label the vial with "4X" or "10X." Samples extracted for 24 hours will produce higher concentrations and is recommended more for coal tars.

4



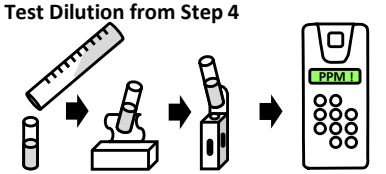
Pipette Extract	Add Solvent To	4X Extract Dilution	10X Extract Dilution
200 µL	5 mL line	= 100X	= 250X
100 µL	5 mL line	= 200X	= 500X
50 µL	5 mL line	= 400X	**= 1,000X**
40 µL	10 mL line	**= 1,000X**	= 2,500X

Attach a tip to the adjustable pipette, transfer aliquots of the Filtered Extract into a plastic graduated test tube and dilute with methanol using examples shown above. Prepare a 1,000X Dilution first, recommended for most samples.

Test Sample using UVF-500D Hydrocarbon Analyzer

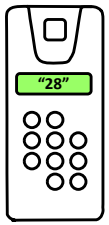
Use with analyzer calibrated to 50 ppb Benzo[a]Pyrene using standard supplied in Sitelab CAL-BAP-COALTAR. Record results manually using a log book.

Test Dilution from Step 4



Glass Cuvette | Tissue Wipes | Cuvette Adapter | Insert into Analyzer

Fill glass cuvette about ½ full with the Dilution made in Step 4. Clean cuvette using a tissue to remove any liquids or fingerprints, place into the cuvette adapter, insert into analyzer and press the READ button. The UVF-500D displays PPM units only, but BaP is calibrated and analyzed at PPB concentrations. Divide readings by 1,000 to covert to PPB.



Calculate BaP Concentration:
Example: Test a 1,000X Dilution
28 ppb x 1,000X = 28,000 ppb
÷ 1,000 = 28 ppm (mg/Kg)

Detection Range & Limits:
Lower limit = 5 ppb (µg/Kg)
Upper limit = 100 ppb (µg/Kg)

Multiply the reading by dilution made to report final concentration. Divide result by 1,000 to convert back to PPM units. Press READ again to check repeatability. If the 1,000X dilution reads below 5 ppb, report sample as "Non-Detect <5 mg/Kg". Empty and rinse test tube with methanol to prepare and test higher or lower dilutions, as needed, using the Extract.

Quality Control Tests

The UVF-500D does not need to be calibrated each time its used. The QC tests described below are recommended to help validate results and confirm analyzer performs properly.

QC Check for Sample Quenching

1,000X Dilution Result = 28 ppm
vs. 500X Dilution Result = 26 ppm
Good, Similar Results! RPD = 7%

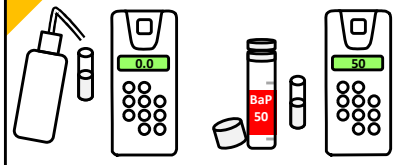
Monitor Extraction Efficiency Over Time

*10 Minutes:	24 Hours:
Result = 28 ppm	Result = 66 ppm

**Performs best vs. Lab GC Methods*

"Quenching" can occur when the detector is swamped by too many hydrocarbons which can produce low or poor results. Test a sample at multiple dilutions to confirm readings are linear and results are <20% RPD. Reclaimed asphalts extracted for 24 hours can over quantify BaP, but the data generated may provide helpful information about the sample's contents.

QC Test Your Solvent & Perform Calibration Checks



Methanol Blank | 50 ppb Standard

Fill the cuvette ½ full with methanol and test a blank to make sure the solvent is clean. Readings in the blank should be close to zero ppm. If available, test the 50 ppb and 5 ppb BaP Standards to check the analyzer for accuracy or drift. Readings should be close to each standard's concentration, <20% RPD. See calibration instructions for more details.

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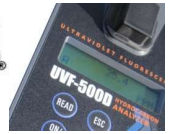


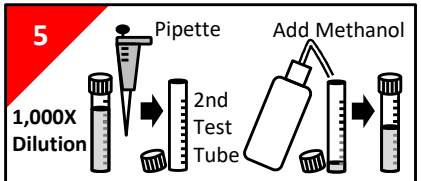
UVF-500D TEST PROCEDURES FOR BaP IN ASPHALT

Ultraviolet Fluorescence Method for Benzo[a]Pyrene Analysis Using Methanol Extraction

Highly Contaminated Coal Tars Requiring 24 Hour Extraction

Prepare and analyze high dilutions. May not be practical for quick screening purposes.

5

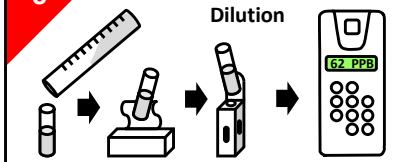


Pipette Volume	Add Solvent To	New Dilution Created
250 µL x2	5 mL line	= 10,000X
250 µL	5 mL line	= 20,000X
100 µL	5 mL line	= 50,000X
50 µL	5 mL line	= 100,000X
50 µL	10 mL line	= 200,000X

Use the adjustable pipette and a second test tube to prepare very high dilutions, if necessary, using the dilution in Step 4 diluted further in methanol. Examples shown here uses the 1,000X Dilution with new dilutions created.

6

Example Testing a 50,000X Dilution



Glass Cuvette | Tissue Wipes | Cuvette Adapter | 0.062 x DIL = 3,100 ppm

Pour the dilution in Step 5 into a glass cuvette, place into the analyzer and press the READ button. Multiply the reading by the dilution factor to report the final concentration.

Use this protocol for coal tar driveway sealcoats, oily soil samples or DNAPL. The 24 hour extraction time performs best compared to BaP using lab GC methods.

Additional Tests to Perform

Use this option for qualitative analysis

Photograph Extract Colors

Coal Tar Asphalt

Interference in Coal Tar Free Asphalts

Asphalt Bitumen:

10 Minute Extraction
UVF BaP = 5 ppm

24 Hour Extraction
UVF BaP = 20 ppm

Unfiltered extracts yellow in color indicate high concentrations of PAHs. This can be useful deciding which dilution to make or for observing the color change over time.

Clean asphalts, like binders with no BaP, will fluoresce due to other PAHs in the sample which are not detected by the lab GC/MS methods. Monitoring background levels can help with false positive results.

Need to Test PAH Content?

Use STD VAL feature to estimate total PAHs

Coal Tars Contain 4 to 6% Benzo[a]Pyrene

1,000 ppb PAH Standard Response

Fluoresces Same as

50 ppb BaP Coal Tar Standard Response

PAH Calibration Kit CAL-061M-500D

The UVF-500D can measure PAHs, using Sitelab's PAH standards (EPA 16 PAHs) without the need to recalibrate.

Press the STD VAL button and use the arrow keys to increase the concentration from 50 to 1000. PAH sample readings will be about 20 times higher compared to BaP sample readings. Bap is 5% PAH.

The DIAG %FS values do not change!

Benzo[a]Pyrene Standard

Part No. CAL-BAP-COALTAR

Compatible with UVF-500D and UVF-Trilogy analyzers. Certified reference product with 6-month expiration date.

ADEPT, United Kingdom, Reclaimed Asphalt Regulations

This product and procedure was developed to meet ADEPT UK specifications as a Rapid Monitoring Technique (RMT) screening method. Use UVF on-site to determine if asphalts contain Benzo[a]Pyrene above or below ADEPT's 50 ppm and 25 ppm action limits.

OBSTITECH WATER ANALYZERS

The UVF-500D, Part No. 50200, and supplies available are sold online with Sitelab's partner Obstitech ApS in Denmark.

Visit web shop: **UVF-500D.COM**
Phone: +45 20315771

Key Features, Performance and Limitations Comparing UVF-500D and UVF-Trilogy Analyzers, both Suitable for BaP in Coal Tars

UVF-500D

Key Features

- Rugged, handheld, low-cost instrument
- Two optical channels
- Detects TPH and PAHs
- Detects <5 ppb Bap
- Solid Standard available, useful for extra QC test

Performance & Limitations

The analyzer uses a 375-nm light source and detects "Heavy PAHs". It has low detection limits and is very sensitive to Benzo[a]Pyrene, about the same as the UVF-Trilogy. PAH results in asphalts and coal tars are close, typically slightly lower compared to the UVF-Trilogy. It is not suitable for testing BaP or PAHs in diesel, gasoline, or other light-refined fuel oils. Lighter PAH compounds fluoresce poorly.

Calibration Data Recorded

Analyzer records the Fluorescence Scale (%FS) or voltage for the Blank and Calibration Standard.

1-Point BaP Calibration Curve

Standard (PPB)	Response (%FS)	Calibration Factor	QC Test 50 PPB Reading
0 (Blank)	0.3%		
50	32.4%	1.54	49.5

Lower & Higher Calibrations are Linear

5	3.2%	1.56	49.9
25	16.2%	1.54	48.5
100	64.5%	1.55	49.0
150	93.0%	1.61	50.3
200	OVER	RSD = 1.7%	RSD = 1.3%

OVER response indicates %FS exceeds 100% limit

UVF-Trilogy

Key Features

- Benchtop instrument
- Factory calibrated to both PAHs and BaP
- Performs multi-point calibration curves
- Detects <5 ppb BaP
- Computer connection

Performance & Limitations

The analyzer uses a 255-nm light source and detects "Target PAHs". It too has low detection limits. It is sensitive to PAHs in the C10 to C22 carbon range, including Benzo[a]Pyrene. It is suitable for testing a wider range of contaminants, including PAHs in gasoline, diesel and other refined fuel oils. When testing asphalts or coal tars, it's more susceptible to fluorescence quenching compared to the UVF-500D.

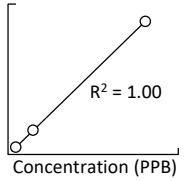
Analyzer Uses 'Snap In' UV Modules

Analyzer displays Raw Fluorescence Units (RFU) or voltage for the Blank and each Calibration Standard.

Modules for GRO, EDRO and TPH OIL are also available. All four modules are used for hydrocarbon fingerprinting analysis.

Example Showing BaP Calibration Curve

Standard (PPB)	Response (RFU)
0 (Blank)	3.1
5	595
50	4,998



Analyzer is calibrated in PPB units (µg/Kg)