Environment Agency

Evidence

Material comparators for end-of-waste decisions

Materials applied to land: peat

Report – SC130040/R3

Version 2

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Executive summary

This report details work carried out to characterise peat, a key non-waste comparator. This information will inform end-of-waste assessments for waste-derived materials intended to replace peat products that are applied to land.

The Waste Framework Directive (Article 6) provides criteria for identifying when a waste material has become a product and no longer needs to be regulated as a waste. Through Article 6 the case law requires us to consider the environmental and human health impacts from materials in comparison with their non-waste material alternatives.

> *... "It should be enough that the holder has converted the waste material into a distinct, marketable product, which can be used in exactly the same way as a [non-waste material], and with no worse environmental effects..."*

Market research was used to define peat as an ordinary comparator and a literature review was used to identify any existing published data.

No suitable pre-existing datasets were found during the literature review.

Ten samples of peat were collected from various peat suppliers. Analytical data from these samples are presented in this report.

We recommend comparing the concentrations of analytes in the comparators dataset to the concentrations in the waste-derived material, paying attention to the higher values. This comparison does not constitute a pass/fail test or an end of waste view. It will provide an indication of whether the waste material contains similar levels of analytes to non-waste materials and whether an end-of-waste application may be appropriate or that further analysis or improved treatment processes may be warranted.

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Contents

1 Introduction

To define end-of-waste criteria, the Environment Agency requires a set of ordinary material comparator data for use as a benchmark against which to assess other materials and wastes.

Article 6 of the Waste Framework Directive provides criteria for identifying when a waste material has become a product and no longer needs to be regulated as a waste. Through Article 6 the case law requires the environmental and human health impacts from materials to be considered in comparison with their non-waste material alternatives. In particular the Court of Appeal judgement in OSS Group Ltd v Environment Agency (2007) contained the statement:

> 'It should be enough that the holder has converted the waste material into a distinct, marketable product, which can be used in exactly the same way as a [non-waste material], and with no worse environmental effects.'

The purpose of this report is to provide an evidence base of the composition and characteristics (beneficial and potentially unbeneficial) of peat which is defined as an ordinary material comparator that is currently permitted for beneficial application to land. The report presents the results from the primary analysis of 10 peat samples.

Six other reports cover ordinary material comparators applied to land:

- manufactured fertilisers
- non-waste biochar
- non-waste wood
- PAS 100 compost
- soil improver
- straw

2 Definition

There are a range of peat products on the market. Some bagged products are purely peat; others are blended growing media which contain a percentage of peat. Pure natural peat samples were sought during this project. Peat can be sourced directly from peat bog owner or through companies that manufacture growing media.

2.1 Properties

Peat is a lightweight, inert growing medium. It has a low pH with good water-retentive properties and contains many nutrients required for plant growth. Traditionally peat was the main ingredient of most growing media products.

3 Comparator sub-types

Peat is a natural product and is extracted from a variety of bogs across England and Wales, as well as Scotland. No specific sub-types were identified, although three of the bogs where peat was sampled do grade the peat into two categories (professional and retail grade).

4 Material sources

Peat suppliers were identified from the *Directory of Mines and Quarries 2010* (BGS 2010). Peat samples were requested from a number of peat bog operators listed in the directory.

5 Sampling procedure

Samples were taken in accordance with BS EN 12579 (BSI 2000). Samples were taken from a variety of bogs across England and Scotland to provide a geographical spread.

6 Analytical parameters

The main parameters determined are summarised in Table 6.1 to 6.10. All laboratory work was carried out by the Environment Agency's National Laboratory Service (NLS).

Testing was carried out in accordance with relevant NLS documented in-house methods which meet the requirements of the performance standards of the Environment Agency's monitoring certification scheme (MCERTS). Specific tests used are outlined in the tables. Other test methods are available.

In the tables, 'LE' refers to the NLS Leeds laboratory and SAL refers to Scientific Analysis Laboratories Ltd.

Table 6.1 Analysis: beneficial properties

Parameter/ determinand	Test method used	Unit
pH	LE I pH and EC 01 pH and conductivity – water extracted, determined by specific electrode from ‘‘as received’ sample	–
Conductivity	LE I pH and EC 01 pH and conductivity – water extracted, determined by specific electrode from ‘‘as received’ sample	µS/cm
Dry solids @ 30°C	LE P soil preparation 01 – sample air dried at <30ºC in a controlled environment until constant weight is achieved	%
Dry solids @ 105°C	LE I dry solids and LoI 01 dry solids (105ºC) and loss on ignition (500ºC) – thermally treated, determined by gravimetry	%
Loss on ignition (LoI) @ 500°C (organic matter content)	LE I dry solids and LoI 01 dry solids (105ºC) and loss on ignition (500ºC) – thermally treated, determined by gravimetry	%
Carbon, organic as C	LE I TOC 01 – combusted with oxygen, thermal conductivity detection	%
Nitrogen as N	LE I nutrients (Kone) 01 NH_4, TON, NO_2 – 2M KCl extraction, determined colorimetrically by discrete analyser on ‘‘as received’ sample	mg/kg (DW)
Carbon	LE I TOC 01 TC % TN – combusted with oxygen, thermal conductivity detection	mg/kg (DW)
C:N	Calculated value, carbon divided by nitrogen as N	NA

EC = electrical conductivity; TOC = total organic carbon; TON = total organic nitrogen; TN = total nitrogen; DW = dry weight

Table 6.2 Analysis: primary nutrients

Parameter/ determinand	Test method used	Unit
Total nitrogen (N) Kjeldahl test	Parameter by calculation	mg/kg (DW)
Total P	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Total K	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ammoniacal nitrogen as N	LE I nutrients (Kone) 01 NH_4, TON, NO_2 – 2M KCl extraction, determined colorimetrically by discrete analyser on ‘as received’ sample	mg/kg (DW)
Nitrate as N	Parameter by calculation	mg/kg (DW)

ICP-OES = inductively coupled plasma optical emission spectrometry

Table 6.3 Analysis: secondary nutrients

Parameter/ determinand	Test method used	Unit
Ca	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Mg	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Total sulphur	SAL determination of total sulphur – dried and ground aliquot of the sample is weighed into a ceramic crucible. The sample is then oxidised in the analyser's combustion chamber and any organic sulphur present is converted to sulphur dioxide. The sulphur dioxide in the combustion gases is measured by an infra-red detector.	%

Table 6.4 Analysis: trace nutrients

Parameter/ determinand	Test method used	Unit
B	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Cu	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Fe	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Mn	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Mo	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Zn	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Chloride	LE I halides chloride, bromide and sulphate – water extracted determined directly by ion chromatography on ''as received' sample	mg/kg (DW)

Table 6.5 Analysis: other elements found in plants which may not be essential for growth

Parameter/ determinand	Test method used	Unit
Co	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Na	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ni	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Se	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Table 6.6 Analysis: Potentially Toxic Elements (PTEs)

Parameter/ determinand	Test method used	Unit
Cd	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Cr	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Cu	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Hg	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ni	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Pb	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Zn	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Table 6.7 Analysis: other potential contaminants

Parameter/ determinand	Test method used	Unit
V	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Table 6.8 Analysis: metals

Parameter/ determinand	Test method used	Unit
Al	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ag	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
As	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ba	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Be	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Li	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Parameter/ determinand	Test method used	Unit
Sb	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Sn	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES.	mg/kg (DW)
Sr	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Ti	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)
Tl	LE I metals (ICP-OES) 01 – digestion block aqua regia extracted under reflux, determined by ICP-OES	mg/kg (DW)

Table 6.9 Analysis: other analytes

Parameter/ determinand	Test method used	Unit
Bromide	LE I halides chloride, bromide and sulphate – water extracted determined directly by ion chromatography on 'as received' sample	mg/kg (DW)
Cr VI	LE I Cr (VI) 01 chromate – alkaline extracted determined by comparator disc colorimetry on 'as received' sample	mg/kg (DW)
Fluoride	LE I fluoride – 1M H_2SO_4 extraction, determined by ion selective electrode on 'as received' sample.	mg/kg (DW)
Nitrite as N	LE I nutrients (Kone) 01 NH_4, TON, NO_2 – 2M KCl extraction, determined colorimetrically by discrete analyser on 'as received' sample.	mg/kg (DW)
Sulphate	LE I halides chloride, bromide and sulphate - water extracted determined directly by Ion Chromatography on 'as received' sample.	mg/kg (DW)
Total oxidised nitrogen as N	LE I nutrients (Kone) 01 NH_4, TON, NO_2 – 2M KCl extraction, determined colorimetrically by discrete analyser on 'as received' sample.	mg/kg (DW)

Table 6.10 Analysis: GCMS semi-volatile screen

Parameter/ determinand	Test method used	Unit
Various	NLS O SV screens – solvent extracted, determined by GCMS (scan mode)	mg/kg (DW)

O SV = organic semi-volatile; GCMS = gas chromatography–mass spectrometry

7 Existing data

No suitable existing data were identified during the literature review.

Some data were found in the Phyllis2 database (http://www.ecn.nl/phyllis2/Browse/Standard/ECN-Phyllis) and other online sources. However, these data did not meet the quality assurance criteria required for this project and are not reproduced here.

8 Primary data

8.1 Statistical analysis of data

The mean, median, minimum and maximum values for each analyte were calculated. When the sample size was sufficient (that is, ≥10), the 90th percentile was also calculated. All analytical values determined as 'less than (<)' values were taken as the values themselves.

Box plots are used to graphically represent groups of quantitative data (Figure 8.1). The sample minimum, lower quartile (Q1), median (Q2), upper quartile (Q3) and sample maximum are used. The median is indicated by the horizontal line that runs across the box (Figure 8.1). The top of the box is the 75th percentile (upper quartile or Q3). The bottom of the box is the 25th percentile (lower quartile or Q1). The interquartile range is represented by the height of the box (Q3 – Q1). A smaller interquartile range indicates less variability in the dataset while a larger interquartile range indicates a variable dataset. Whiskers extend out of the box to represent the sample minimum and maximum. Outliers are plotted as asterisks and are defined as data points that are 1.5× the interquartile range. The box and whisker plot of calcium concentration in peat shown in Figure 8.1 demonstrates the issue of outliers in the dataset.

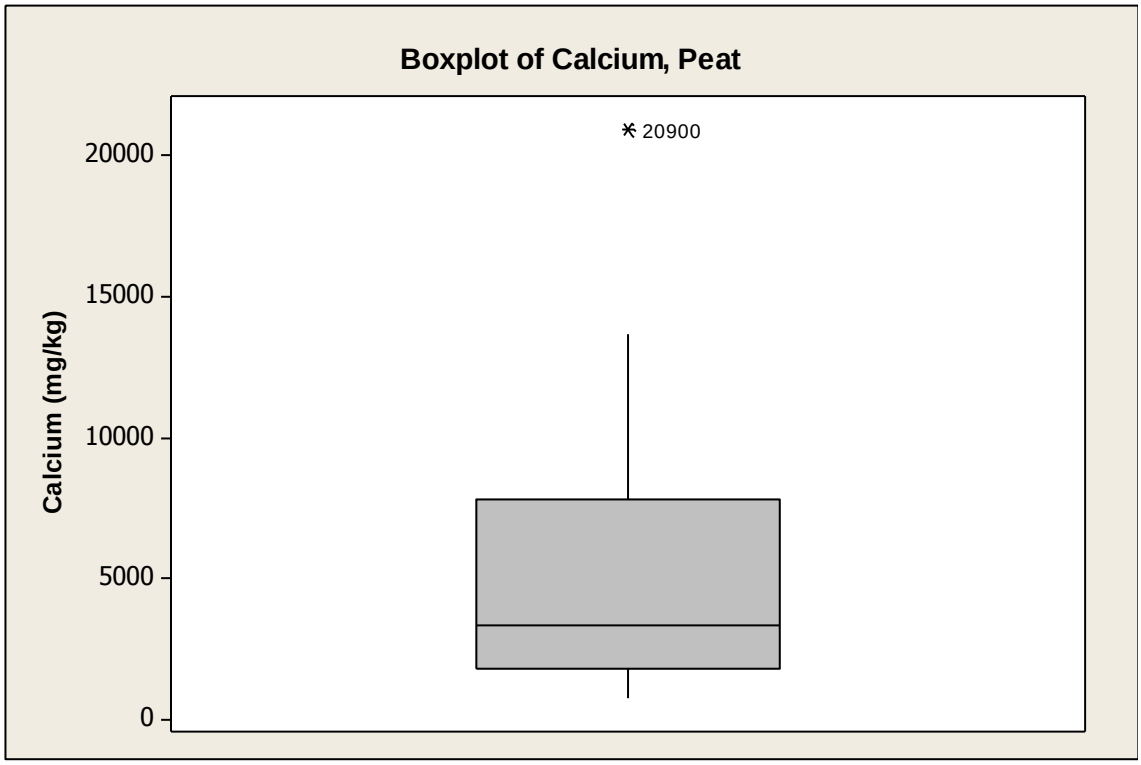

Figure 8.1 Box plot of calcium concentration in peat

Outliers can adversely affect the statistical analysis by:

- giving serious bias or influence to estimates that may be of less interest
- increasing the error variance and reducing the power of statistical tests
- decreasing normality (if non-random) and altering the odds of type I and II errors

8.2 Using the data tables

The analytical data are presented in the following tables:

- beneficial properties (Table 8.1)
- primary, secondary and trace nutrients (Table 8.2)
- other elements found in plants which may not be essential for growth, Potentially Toxic Elements (PTEs) and other potential contaminants (Table 8.3)
- other metals and analytes (Table 8.4)
- GCMS semi-volatile screen (Table 8.5)

We recommend comparing the concentrations of analytes in the comparators dataset to the concentrations in the waste-derived material, paying attention to the higher values. This comparison does not constitute a pass/fail test or an end of waste view. It will provide an indication of whether the waste material contains similar levels of analytes to non-waste materials and whether an end-of-waste application may be

appropriate or that further analysis or improved treatment processes may be warranted.

Due to difficulties encountered during sample preparation the limit of detection for some analytes was higher than the target limit of detection.

8.3 Primary data tables

Primary data are shown in Tables 8.1 to 8.5.

Table 8.1 Primary data for peat: beneficial properties

Sample ID	pH	Conductivity	Dry solids @ 30°C	Dry solids @ 105°C	LoI @ 500°C (organic matter content)	Carbon, organic as C	Nitrogen as N	Carbon	C:N [1]
		µS/cm	%	%	%	%	mg/kg (DW)	mg/kg (DW)	
Peat 01	5.23	0.26	34.6	36.5	85.2	41.1	20,400	417,000	20.4
Peat 02	4.36	0.14	56.8	75.1	88.7	46.0	8,540	392,000	45.9
Peat 03	4.27	0.16	61.6	75.9	90.6	39.0	8,910	408,000	45.8
Peat 04	6.47	0.10	34.8	79.4	92.4	44.2	8,470	392,000	46.3
Peat 05	6.86	0.12	46.3	72.3	97.8	46.2	9,920	468,000	47.2
Peat 06	–	–	65.2	82.5	98.8	41.9	9,050	431,000	47.6
Peat 07	–	–	61.5	77.8	98.7	42.8	8,970	437,000	48.7
Peat 08	7.27	0.37	59.0	69.5	98.6	46.3	8,230	493,000	59.9
Peat 09	5.70	0.21	44.5	53.2	95.2	41.7	7,880	438,000	55.6
Peat 10	5.29	0.57	57.1	82.5	86.6	17.5	6,540	196,000	30.0
Mean	5.68	0.24	52.1	70.5	93.3	40.7	9,691	407,200	44.7
Median	5.50	0.18	57.0	75.5	93.8	42.4	8,725	424,000	46.7
Minimum	4.27	0.10	34.6	36.5	85.2	17.5	6,540	196,000	20.4
Maximum	7.27	0.57	65.2	82.5	98.8	46.3	20,400	493,000	59.9
No. of samples	8	8	10	10	10	10	10	10	10
90th percentile	n/a	n/a	62	82.5	98.7	46.2	10,968	470,500	56
LOD	0.2	10	0.5	0.5	0.5	0	200	1,000	NA

Notes: [1] calculated value
n/a = not applicable

Table 8.2 Primary data for peat: primary, secondary and trace nutrients [1]

	Primary nutrients					Secondary nutrients									Trace nutrients
Sample ID	**Total nitrogen (N) Kjeldahl test**	**Total P**	**Total K**	**NH_3 as N**	**Nitrate as N**	**Ca**	**Mg**	**Total sulphur**	**B**	**Cu**	**Fe**	**Mn**	**Mo**	**Zn**	**Chloride**
Peat 01	20,300	648	1210	151	<61.4	20,900	2,440	0.23	24.6	10.2	17,400	210	2.43	39.9	58.1
Peat 02	8,530	186	196	93.4	<9.72	3,360	1,300	0.21	4.96	6.69	1,380	28.5	<2	8.34	46.7
Peat 03	8,900	216	208	104	<6.69	3,750	1,470	0.15	4.60	6.79	1,900	39.2	<2	10.2	58.2
Peat 04	8,460	213	702	52.0	<10.4	5,820	1,980	<0.05	4.51	3.59	8,150	75.3	<1	8.73	66.3
Peat 05	<9,920	186	194	120	<3.0	3,330	1,840	0.10	3.21	3.36	1,920	21.7	<1	10.1	75.9
Peat 06	<9,050	172	116	100	<5.0	794	1,480	0.07	3.59	2.13	1,510	14.4	<1	10.5	102
Peat 07	<8,970	177	86	84.5	<5.0	1,140	1,510	0.10	2.97	1.69	1,410	9.12	<1	9.24	96.2
Peat 08	<8,230	145	149	300	<5.0	2,020	1,730	0.07	2.37	1.88	1,140	24.0	<1	9.74	93.4
Peat 09	7,830	172	173	137	<45.5	2,310	1,640	0.05	2.59	5.23	1,730	24.8	<2	20.6	68.9
Peat 10	6,500	190	323	<4	<42.6	13,700	696	0.43	15.7	3.10	3,310	25.8	1.93	8.83	27.5
Mean	9,669	231	336	115	19.4	5,712	1,609	0.15	6.91	4.47	3,985	47.3	1.54	13.6	69.3
Median	8,715	186	195	102	8.21	3,345	1,575	0.10	4.05	3.48	1,815	25.3	1.47	9.92	67.6
Minimum	6,500	145	86	4.00	3.00	794	696	0.05	2.37	1.69	1,140	9.12	1.00	8.34	27.5
Maximum	20,300	648	1210	300	61.4	20,900	2,440	0.43	24.6	10.2	17,400	210	2.43	39.9	102
No. of samples	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
90th percentile	10,958	259	753	166	47.1	14,420	2,026	0.25	16.6	7.13	9,075	88.8	2.04	22.5	96.8
LOD	n/a	10	50	2	n/a	60	20	0.05	1	0.1	1	2	1	2	3

Notes: [1] All units mg/kg (DW) apart from total sulphur for which the units are % (DW).

Table 8.3 Primary data for peat: other elements found in plants which may not be essential for growth, PTEs and other potential contaminants [1]

Sample ID	Other elements found in plants which may not be essential for growth									PTEs	Other potential contaminants
	Co	Se	Na	Cd	Cr	Cu	Pb	Hg	Ni	Zn	V
Peat 01	2.27	2.00	154	<0.25	12.1	10.2	40.5	<2	8.56	39.9	15.0
Peat 02	0.60	1.43	232	<0.25	2.21	6.69	5.81	<2	2.25	8.34	2.52
Peat 03	0.72	1.56	262	<0.25	2.29	6.79	6.55	<2	2.32	10.2	2.80
Peat 04	2.63	<1	179	<0.2	6.36	3.59	2.67	<0.2	6.78	8.73	6.42
Peat 05	0.44	1.27	320	<0.2	1.58	3.36	9.52	<0.2	1.56	10.1	1.70
Peat 06	0.50	1.66	304	<0.2	1.18	2.13	7.39	<0.2	1.40	10.5	1.58
Peat 07	0.40	1.63	299	<0.2	0.95	1.69	7.33	<0.2	1.16	9.24	1.35
Peat 08	0.24	1.25	272	<0.2	0.65	1.88	8.66	<0.2	0.89	9.74	0.80
Peat 09	0.56	<2	252	<0.4	1.23	5.23	25.5	<0.4	1.83	20.6	1.88
Peat 10	0.44	<1	60.4	<0.2	3.35	3.10	3.05	<0.2	3.17	8.83	4.69
Mean	0.88	1.48	233	0.235	3.19	4.47	11.7	0.76	2.99	13.6	3.87
Median	0.53	1.50	257	0.200	1.90	3.48	7.36	0.20	2.04	9.92	2.20
Minimum	0.24	1.00	60.4	0.200	0.65	1.69	2.67	0.20	0.89	8.34	0.80
Maximum	2.63	2.00	320	0.400	12.1	10.2	40.5	2.00	8.56	39.9	15.0
No. of samples	10	10	10	10	10	10	10	10	10	10	10
90th percentile	2.31	2	306	0.27	6.93	7.13	27.0	1[2]	6.96	22.5	7.28
LOD	0.1	1	10	0.2	0.5	1	1	0.2	0.6	2	0.1

Notes: [1] All units mg/kg (DW).
[2] The PAS 100 limit for Hg has been used due to sample clean-up problems

Table 8.4 Primary data for peat: other metals and analytes [1]

Sample ID	Metals												Other analytes				
	Al	Sb	As	Ba	Be	Li	Ag	Sr	Tl	Sn	Ti	Cr VI	Fluoride	Bromide	Sulphate	Nitrite as N	TON as N
Peat 01	4,610	<10	15.5	71.5	0.261	6.98	<10	129	<3	<20	44.6	1.94	<20	<1	437	<0.3	61.4
Peat 02	1,580	<10	1.55	37.2	0.049	<6	<10	22.7	<3	<20	28.6	<0.7	<40	<3	111	<0.2	9.72
Peat 03	1,580	<10	2.27	37.8	0.053	<6	<10	25.1	<3	<20	26.5	<0.6	<30	<5	117	<0.2	6.69
Peat 04	3,650	<1	2.92	89.0	0.169	5.19	<1	23.9	<1	<1	57.4	<0.6	57.5	<0.3	100	<0.1	10.4
Peat 05	785	<1	1.35	21.0	<0.1	<1	<1	22.6	<1	<1	16.3	<0.4	<40	3.59	114	<0.1	<3
Peat 06	566	<1	0.87	10.1	0.105	<1	<1	15.9	<1	<1	15.3	<1	<30	<5	59.4	<0.2	<5
Peat 07	526	<1	0.81	9.28	<0.1	<1	<1	16.1	<1	<1	16.3	<1	<30	<5	63.9	<0.2	<5
Peat 08	375	<1	0.63	15.6	<0.1	<1	<1	14.1	<1	<1	<3	<0.3	<30	<3	79.1	<0.2	<5
Peat 09	567	<2	1.20	17.5	<0.2	<2	<2	14.6	<2	<2	15.5	<0.5	<40	<7	82.6	<0.2	45.5
Peat 10	1,880	<1	1.63	14.2	<0.1	2.13	<1	76.2	<1	<1	12.2	<0.4	<40	<5	1,030	<0.2	42.6
Mean	1,612	3.80	2.87	32.3	0.124	3.23	3.8	36.0	1.7	6.80	23.6	0.74	35.8	3.79	219	0.19	19.4
Median	1,183	1.00	1.45	19.3	0.100	2.07	1.0	22.7	1.0	1.00	16.3	0.60	35.0	4.30	106	0.20	8.21
Minimum	375	1.00	0.63	9.28	0.049	1.00	1.0	14.1	1.0	1.00	3.00	0.30	20.0	0.30	59.4	0.10	3.00
Maximum	4,610	10.0	15.5	89.0	0.261	6.98	10.0	129	3.0	20.0	57.4	1.94	57.5	7.00	1,030	0.30	61.4
No. of samples	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
90th percentile	3,746	10	4.18	73.3	0.206	6.1	10	81.5	3	20	45.9	1.09	41.8	5.20	496	0.21	47.1
LOD	50	1	0.5	0.5	0.1	1	1	1	1	1	3	0.3	20	0.3	5	0.1	3

Notes: [1] All units mg/kg (DW).

Table 8.5 Primary data for peat: GCMS semi-volatile screen [1,2]

Sample ID	1-eicosene	1-nonadecene	2-heptacosanone	2-nonacosanone	2-pentacosanone	9,12,12a,12b,13,14,14a,14b-eicosahydropicene	1,2,3,4,4a,5,6,6a,6b,7,8,8a,-octamethyl-	2,2,4a,6a,8a,9,12b,14a-type	refined, specialised oil	series of hydrocarbons detected,indicating a	D-friedoolean -14-en-3-one	ol,(3.alpha.)	D:A-Friedoolean-3-	(3.alpha)	D:A-friedooleanan-3-ol,	friedelan-3-one	fucosterol	γ-sitosterol	lup-20(29)-en-3-one	nonacosane	octacosane	olean-12-ene	stigmast-4-en-3-one	dione,(5.alpha)	stigmastane-3,6-	stigmastanol
Peat 01																	25	40							25
Peat 02					22			13								95									47
Peat 03	17		19	17												75		45		12			23		50
Peat 04			13							Yes	25					87		78	46				21		35
Peat 05			30	43	19					Yes	124					148		73	101				24		63
Peat 06														44		44		110	34				37		
Peat 07																29	26	66	23				50		
Peat 08			31	30	30		213.1							11		92		203	80		32	35	59		56
Peat 09		21	34									76							81					29	
Peat 10*																									

Notes: [1] Analytes >10 mg/kg (DW) or >20 mg/kg (DW) (latter indicated by *) only; analytes not detected or those with <10mg/kg (DW) or <20 mg/kg (DW) (latter indicated by *) have not been reported.

[2] The full GCMS screen data with <10 mg/kg values will be included in the comparator spreadsheet tool. The compounds identified at concentrations greater than the detection level during the GCMS screen are believed to be, in the vast majority of cases, naturally occurring substances within the sample matrix, rather than pollutants.

9 Conclusions

Data are presented for 10 samples of peat. Physical properties and chemical analyses are provided. These data can be used by companies and individuals to assist in the process of applying for end-of-waste status for their products, either by confirming their product's comparable composition or identifying problems to be rectified before such status can be achieved.

References

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BSI, 2000. *BS EN 12579:2000. Soil improvers and growing media. Sampling.* London: British Standards Institution.

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List of abbreviations

AAS	atomic absorption spectrometry
1M	1 molar
2M	2 molar
Ag	Silver
Al	Aluminium
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
C	Carbon
Ca	Calcium
CaO	Calcium oxide
Cd	Cadmium
Chromium VI	Chromium Hexavalent
Co	Cobalt
Cr	Chromium
Cu	Copper
DW	dry weight
EC	electrical conductivity
Fe	Iron
GCMS	Gas Chromatography Mass Spectrometry
H_2SO_4	Sulphuric acid
Hg	Mercury
ICP-AES	inductively coupled plasma atomic emission spectroscopy
ICP-OES	inductively coupled plasma optical emission spectrometry
K	Potassium
KCL	Potassium chloride
LE	Leeds laboratory of NLS
Li	Lithium
LOD	limit of detection
LoI	loss on ignition

Mg	Magnesium
Mn	Manganese
Mo	Molybdenum
N	Nitrogen
Na	Sodium
NH_3 as N	Ammoniacal nitrogen
NH_4	Ammonium
Ni	Nickel
NLS	National Laboratory Service [Environment Agency]
NO_2	Nitrogen dioxide
O SV	Organic semi volatile
P	Phosphorus
PAS	Publically Available Standard
Pb	Lead
PTEs	Potentially Toxic Elements
SAL	Scientific Analysis Laboratories Limited
Sb	Antimony
Se	Selenium
Sn	Tin
Sr	Strontium
TC	total carbon
Ti	Titanium
Tl	Thallium
TN	total nitrogen
TOC	total organic carbon
TON	total organic nitrogen
V	Vanadium
Zn	Zinc

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