Roediger Agencies cc

REG No: 93/29837/23
VAT No: 4200155465
Polymer Science Building
De Beer Street, STELLENBOSCH 7600
www.roedigeragencies.co.za

ANALYTICAL LABORATORY

PO Box 3202
MATIELAND 7602
Tel: +27 21 887 0010
Fax: +27 21 886 4731
Cell: 083 250 9281

4 December 2017

Cecilia Holm
WanabiWood Flooring cc
Unit 10, Avon Business Park
Malcolm Moodie Crescent
Jet Park, Johannesburg

Dear Ms. Holm

REF no.: 2811WWF1/1

Vinyl flooring samples in a sealed box was sent to the analytical laboratory of Roediger Agencies cc to determine heavy metal and phthalate content. The sealed box was labelled:

1	Echowood Classic lime stone17/07/14 (100% virgin)	

Results were obtained via the following test methods.

Ash content

The ash content was determined by ashing each sample in a muffler oven up to 550 °C and holding it at that temperature for an hour, then weighing each sample and the percentage residue is calculated by mass difference from the original mass.

Sample		Ash content (%)
1	Echowood Classic lime stone17/07/14 (100% virgin)	54.24

The ash was sent for elemental analysis.

EDAX

EDAX is the employment of x-rays to analyse the elements present on a surface of a sample. Only the higher atomic numbers can be detected, the cut off limit is oxygen, thus the relative abundance of an element will result in a higher output signal from the excitation of the x-rays.

Sample			Elemental weight (%)				
			C	O	Si	Cl	Ca
1	Echowood Classic lime stone17/07/14 (100% virgin)	1	28.53	46.51	0.39	5.70	18.86
		2	24.51	47.48	0.57	2.97	24.47
		3	20.12	47.23	1.28	6.90	24.47
		4	21.20	43.07	0.35	9.36	26.02
		5	26.25	41.42	1.26	5.84	25.22
		Average	**24.12**	**45.14**	**0.77**	**6.16**	**23.81**
		ppm	**130827**	**244839**	**4176**	**33412**	**129145**

Soxhlet extraction

The samples were extracted with diethyl ether in a soxhlet for 4 hours. The solvent was evaporated after the extraction and the amount of extractant quantified prior to analysing by infrared as described below.

Sample		Extract (%)
1	Echowood Classic lime stone17/07/14 (100% virgin)	14.4

FTIR and GC-MS analysis were conducted on the extract.

FTIR photoacoustic infrared

Fourier Transform Infrared (FTIR) is a common tool to analyse the chemical composition of a product and is typically employed to monitor the presence of the chemical functional groups on a molecule. To obtain an infrared a sample has to be prepared in a translucent film or be physical mixed with a salt that when pressed will give a translucent window through which an infrared beam can be passed and the absorbance of this beam is measured. A recent development in infrared is to make use of a photoacoustic cell (PAS), which has the advantage that sample preparation is eliminated and that a sample can be scanned in whatever form it appears. The sample is placed in an MTEC 300 chamber and flushed with ultra high purity helium. The resultant infrared spectrum is recorded on a Perkin Elmer Paragon 1000 FTIR.

The FTIR picks up absorbencies for each functional group. A single functional group yields more than one absorbance band due to the stretching, rocking and vibrational bond movements. Some absorbencies may overlap and hence it is sometimes difficult to clearly define an absorbance peak to only one bond. Peak areas are relative to the amount of a functional group present if the analysis is carried out under the same conditions each time. In the case of PAS FTIR this is the quantity of gas above the sample, the temperature of the sample and the amount of scans. A further unique feature of PAS FTIR is that the depth of analysis can be varied by varying the mirror speed of the infrared. The slower the mirror speed the deeper the penetration of the analysis.

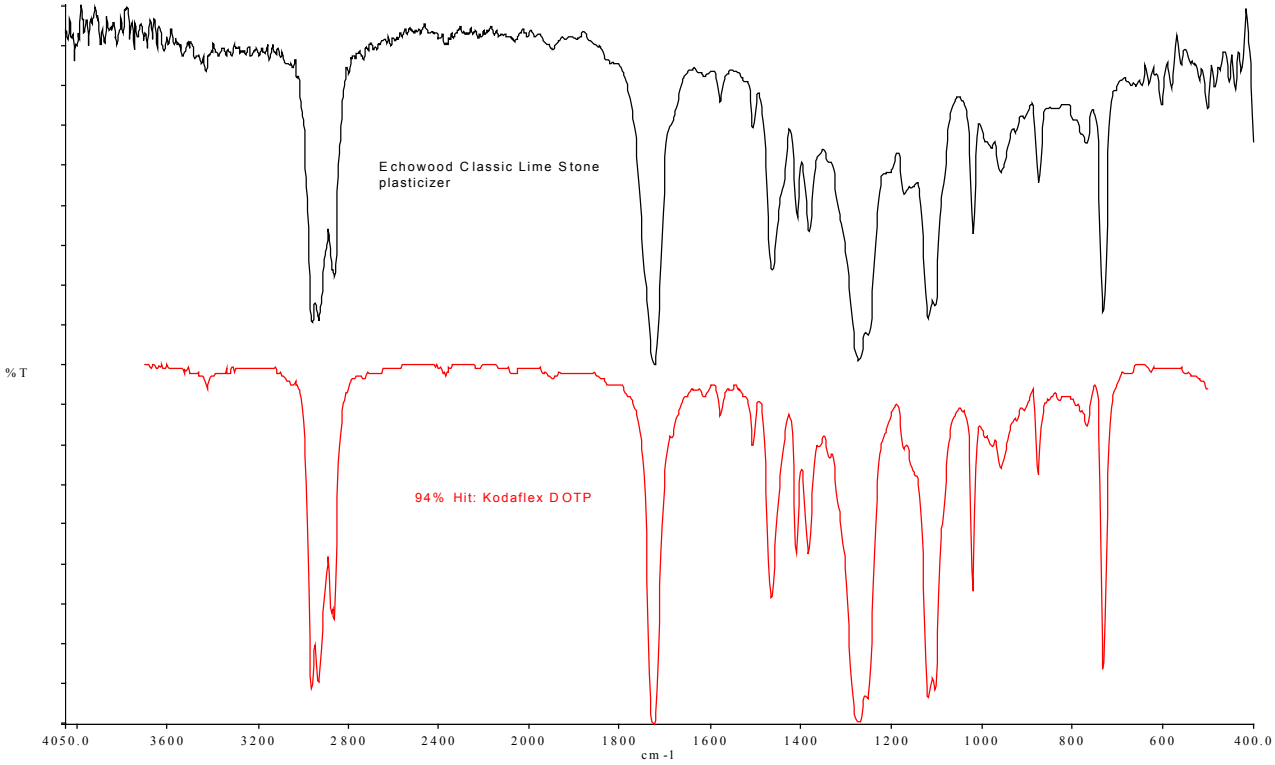
Procedure

The sample was analyzed by means of photo acoustic Fourier Transform Infrared spectroscopy (FTIR). The photoacoustic detector used was a MTEC model 300 unit that was coupled to a Perkin Elmer Paragon 1000. The parameters used for the determination of each spectrum were the following:

Mirror velocity (OPD)	=	0.1 cm/s
Resolution	=	8 cm^{-1}
Source aperture	=	maximum
Spectral Range	=	450 – 4 000 cm^{-1}
Number of scans	=	128
Sample reference	=	carbon black
Detector gas atmosphere	=	helium

A sample maximum 9 mm in diameter was placed in the sample holder cup, allowing a minimum amount of gas above the sample which is flushed with helium to illuminate any air from the sample compartment. A typical scan requires fifteen minutes scan time. This allowed enough time for the sample temperature to equilibrate and hence, to obtain a quantitative measurement controlling the room temperature was not necessary.

All the infrared spectra are scanned from wave number 4000 to 450 cm^{-1} and the spectra are subsequently mathematically adjusted to compensate for the photoacoustic effect.



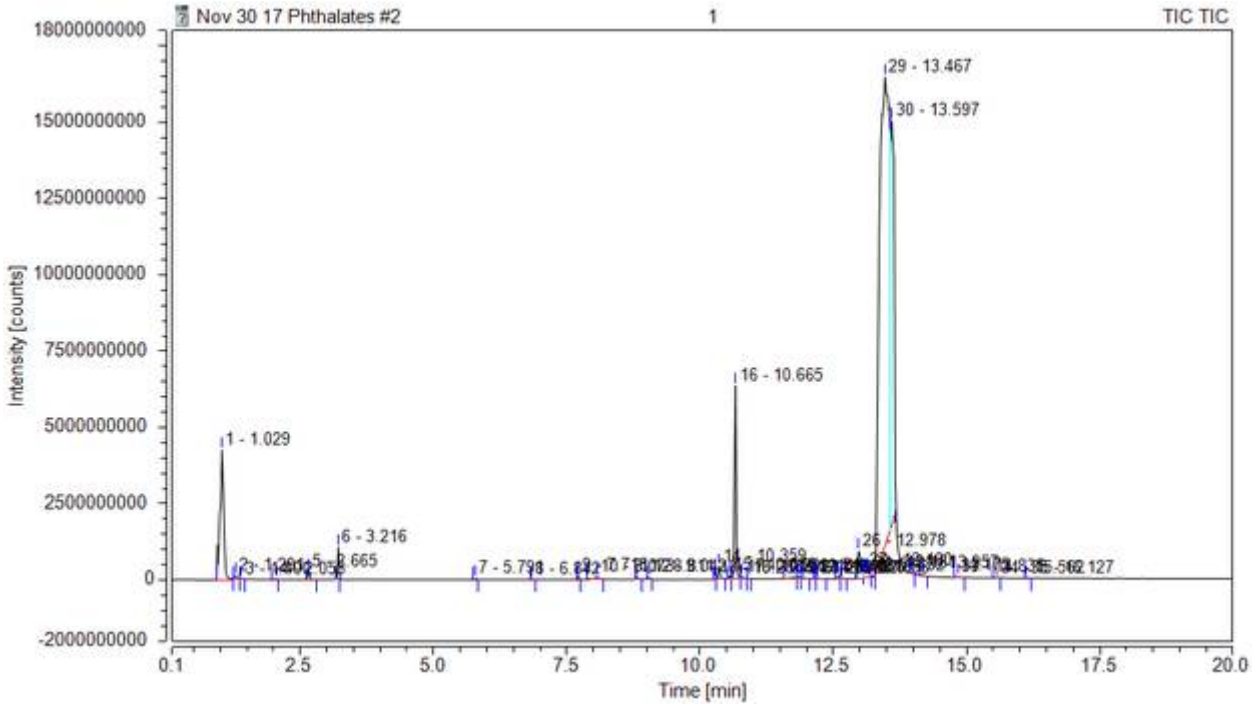
FTIR spectra of the Echowood Classic Lime Sone plasticizer and its electronic search library hit: Kodaflex DOTP – Bis(2-Ethylhexyl) Terephthalate

Phthalate analysis on GC-MS

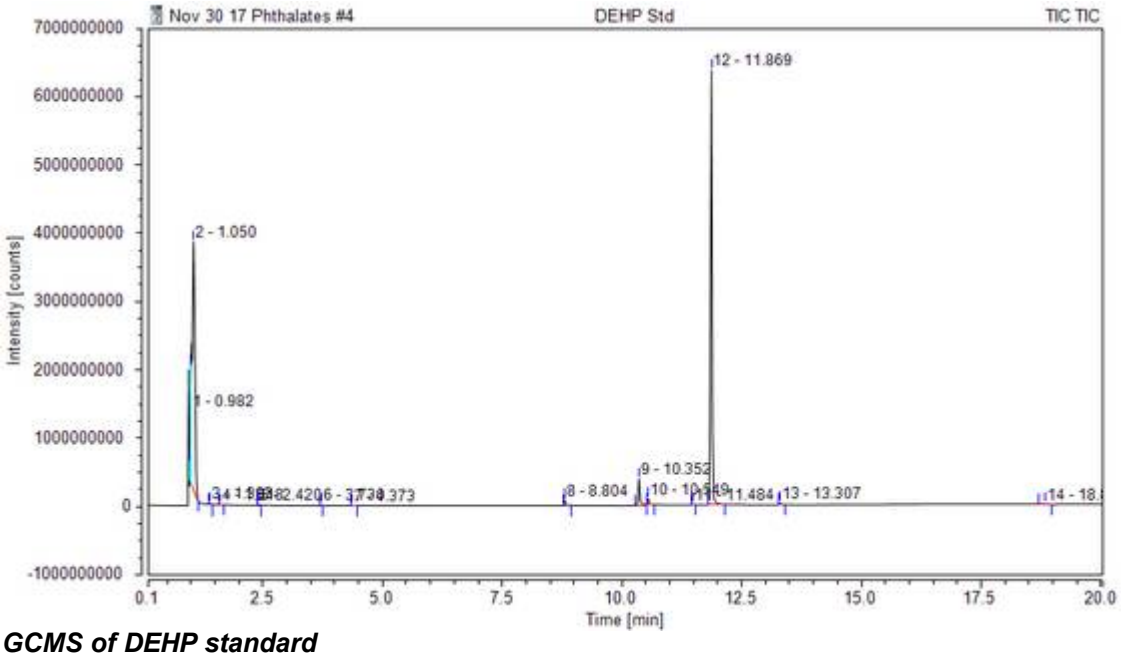
Column type:	Capillary
Column coating:	ZB-5MS
Column dimensions:	30 m, 0.25 ID, 0.25 micron
Injector temperature:	250 °C
Split Injection:	1:20
Front Inlet Flow:	2 mL/min.
Carrier gas:	Helium
Initial oven temperature:	150 °C
Initial time:	0 min
Ramp at:	10 °C/min.
Final oven temperature:	310 °C
Time @ final temperature:	14 min.

MS conditions

Transfer line:	280 °C
Ion source:	280 °C
Ionisation mode:	EI
Scan range:	35 – 1000 amu



GCMS of extractant



GCMS of DEHP standard

Plasticisers found were 5.3% Hexanedioic acid, bis(2ethylhexyl) ester and balance 1,4-Benzenedicarboxylic acid, bis(2ethylhexyl) ester.

Summary

Sample		Plasticiser (%)
1	Echowood Classic lime stone17/07/14 (100% virgin)	14.4

Sample		Phthalates (%)	
1	Echowood Classic lime stone17/07/14 (100% virgin)	Dibutyl phthalate (DBP)	0
		Bis(2-ethylhexyl) phthalate (DEHP)	0
		Benzyl butyl phthalate (BBP)	0
		Diisononyl phthalate (DINP)	0
		di-n-octyl phthalate (DNOP)	0
		Diisodecyl phthalate (DIDP)	0
		Heavy metals (%)	
		Cadmium (Cd)	
		Lead (Pb)	
		Mercury (Hg)	
		Chromium (Vi) (Cr)	
		Polybrominated Biphenyls (PBBs)	
		Polybrominated Diphenyl Ethers (PBDEs)	

The vinyl flooring contains no harmful chemicals as far as could be established using the methods cited above. The plasticisers found are iso or terephthalates which are not considered as a health risk. No heavy metals were found to be present.

Yours faithfully,

Dr. AHA Roediger.