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SEASONAL COLOR SPECTROPHOTOMETRIC VARIATION OF DUST SAMPLE WITHIN KUWAIT

1st International Conference on
Natural Hazards and Disaster Management
June 1-3, 2017 Osaka, Japan

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Out line

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- Sample collection (outdoor)
- Spectroscopy background
- Sample for FT-MIR
- UV-VIS
- FT-NIR
- Indoor dust result (Electron microscope (EDS))

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Out line

- Indoor result FT-MIR
- UV-VIS Result out door
- FT-IR Result out door
- Fast model on FT-NIR out door
- Distance between spectra out door
- Indoor dust result (Electron microscope (EDS))
- Indoor result FT-MIR
- UV-VIS Result out door

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Out line

- FT-IR Result out door
- Fast model on FT-NIR out door
- Distance between spectra out door
- FT-NIR Result
- Data discussion for indoor
- Out door discussions
- Conclusion
- reference

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Introduction

1- collecting sample from the outside climate and indoor one is one way to understand the surrounding.

2- Testing the sample in different technique to get information on the nature of environment.

3- suggest solution for the problems and take action for protection if possible.

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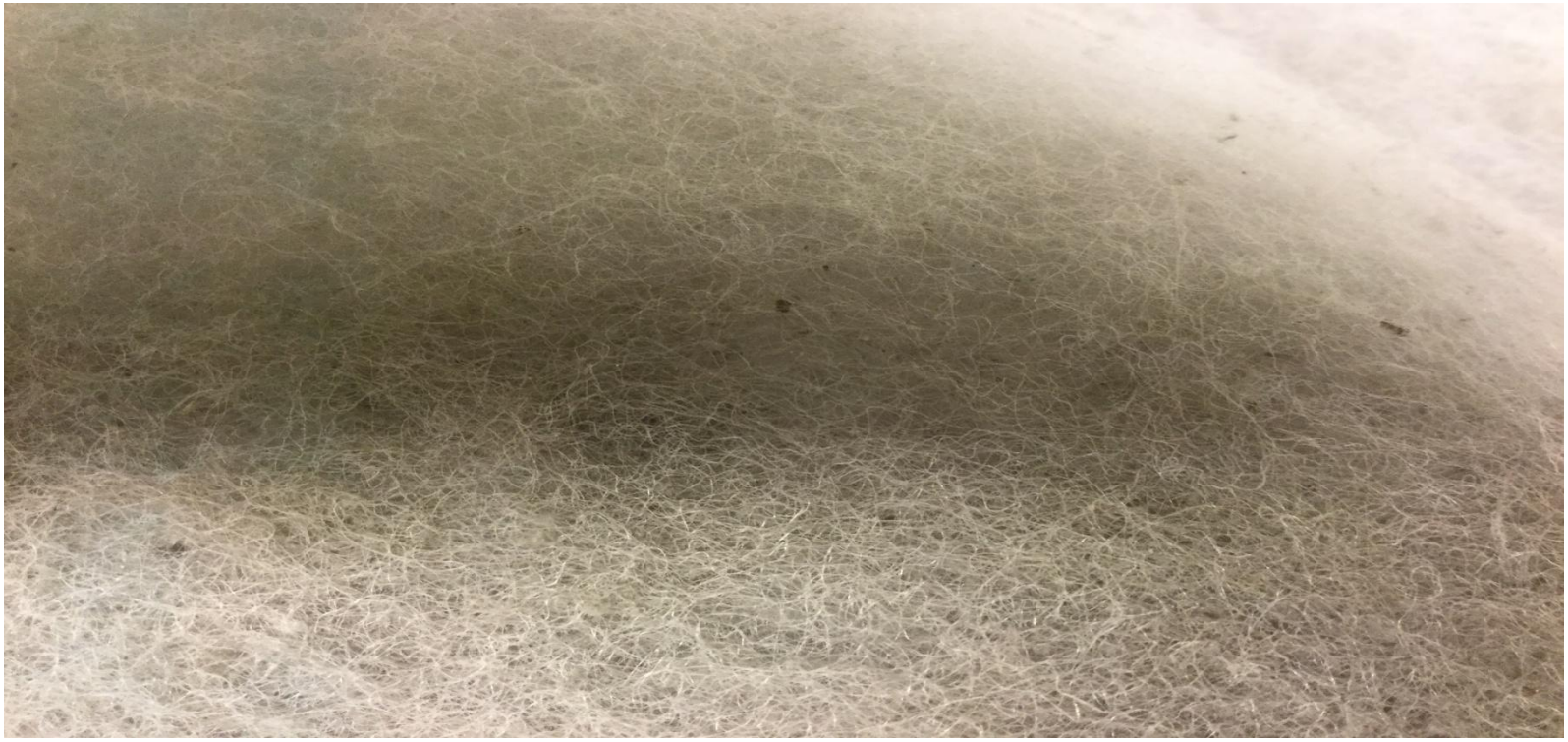
Sample collection (inside)



Air condition duct diber

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Sample collection (inside)

Dust removed from the dibber

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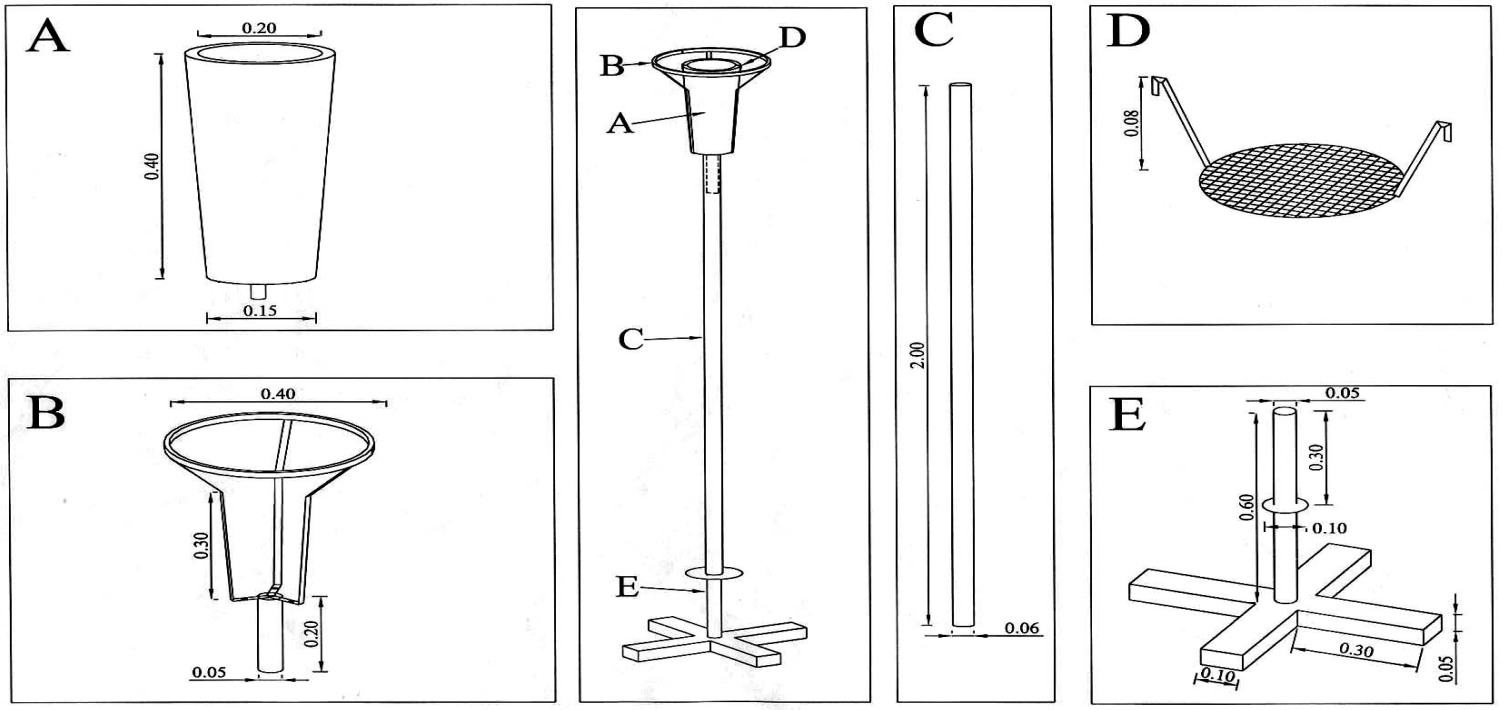
Sample collection (inside)

Dust removed from the dibber

Sample collection (out door)

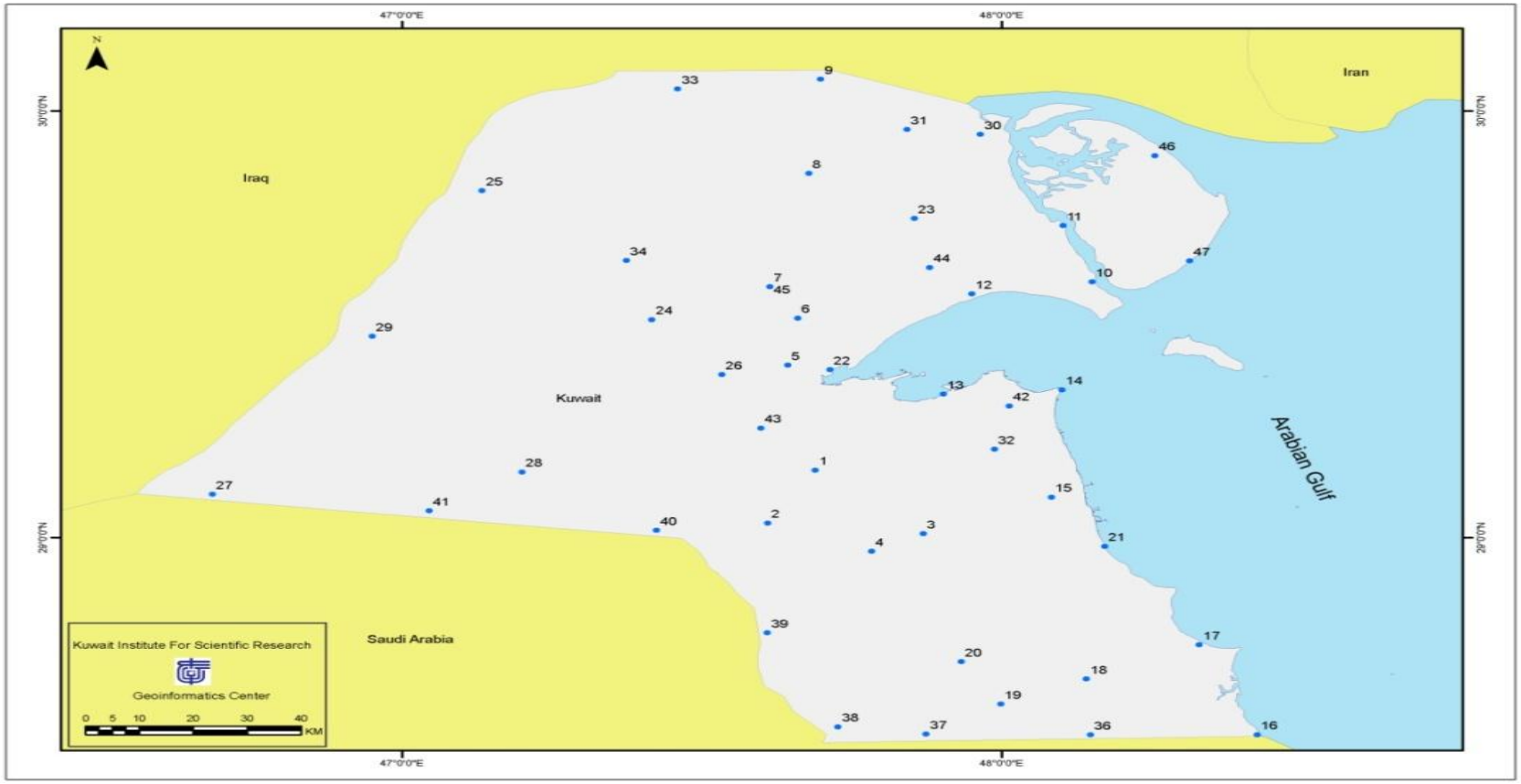


Dust collector (source: Reheis, 1 995 with some modifications).

Sample collection (outdoor)

Dust collector (source: Reheis, 1 995 with some modifications).

Sample collection (outdoor)



Dust collectors in Kuwait

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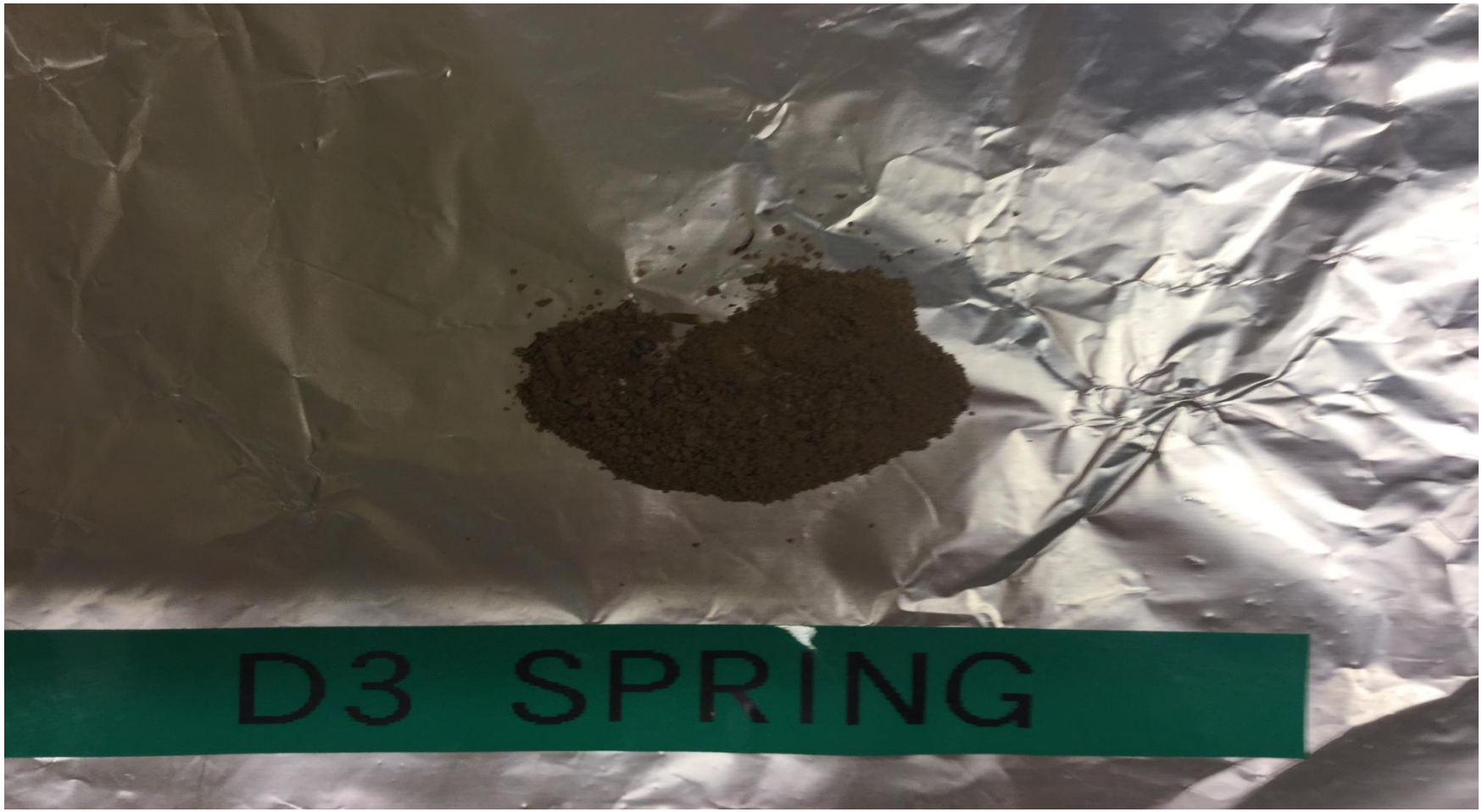
Sample collection (outdoor)



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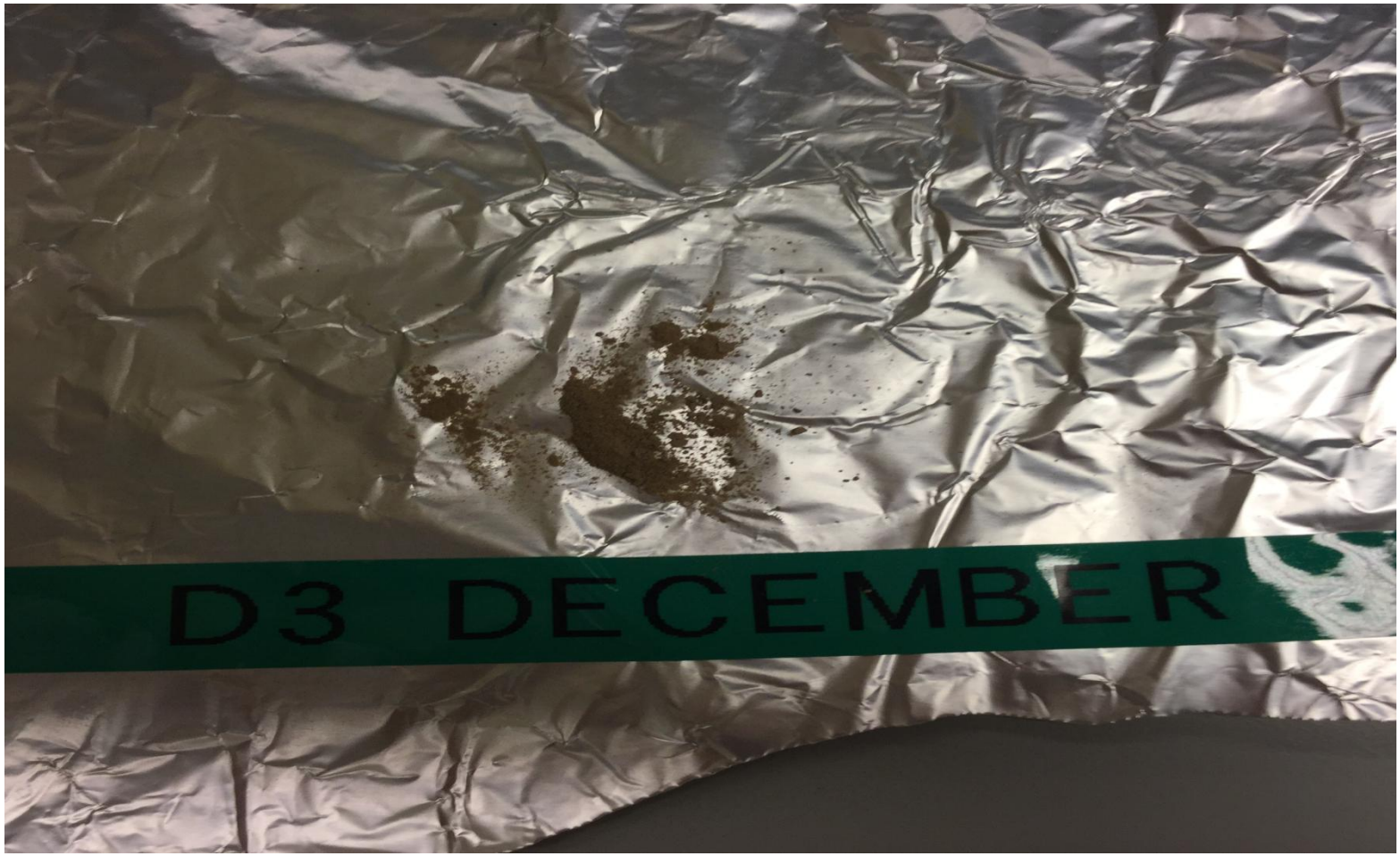
Sample collection (outdoor)



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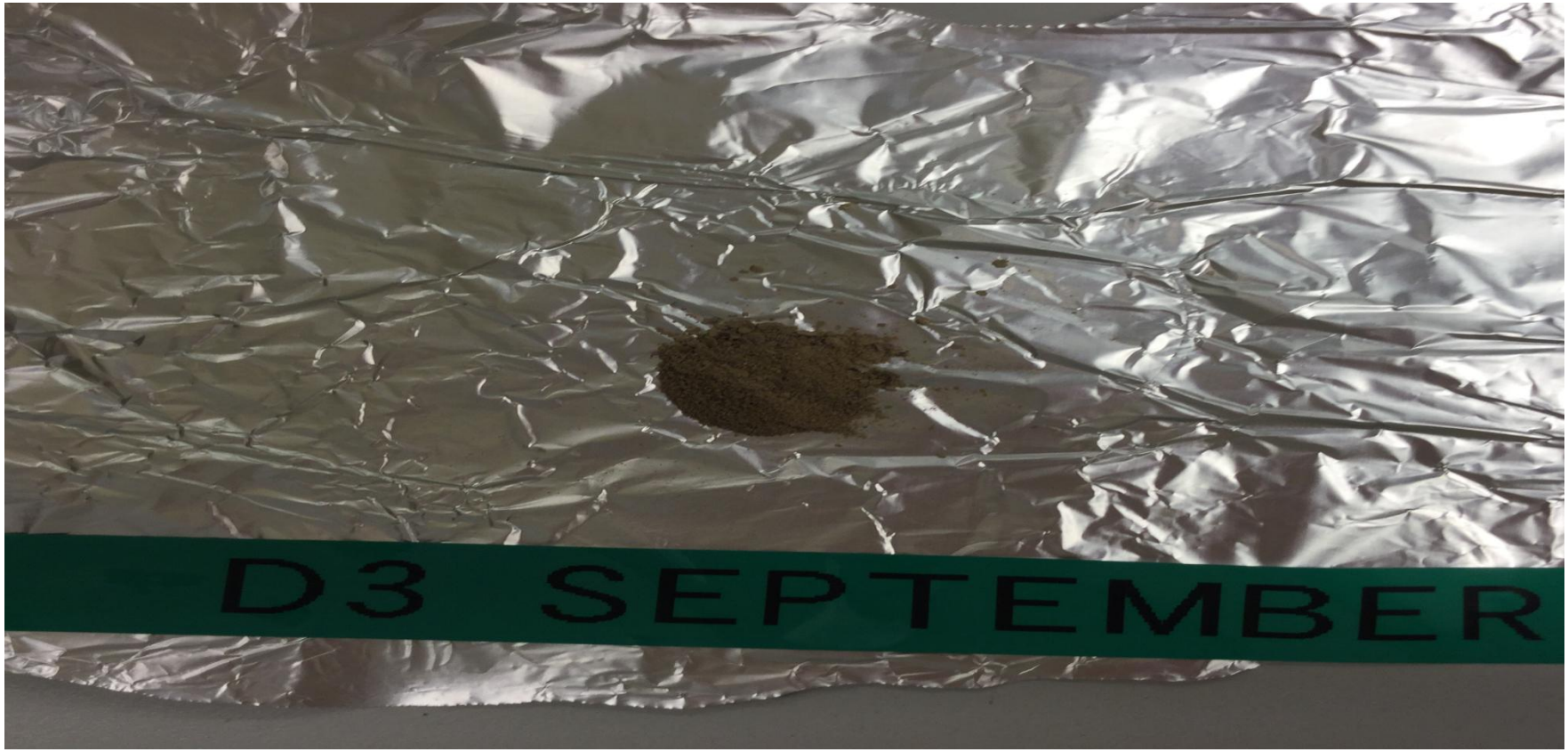
Sample collection (outdoor)



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Spectroscopy background

- Indoor sample analysis by microscope and FT-MIR
- Outdoor sample analysis by FT-MID,UV-VIS, and FT-NIR

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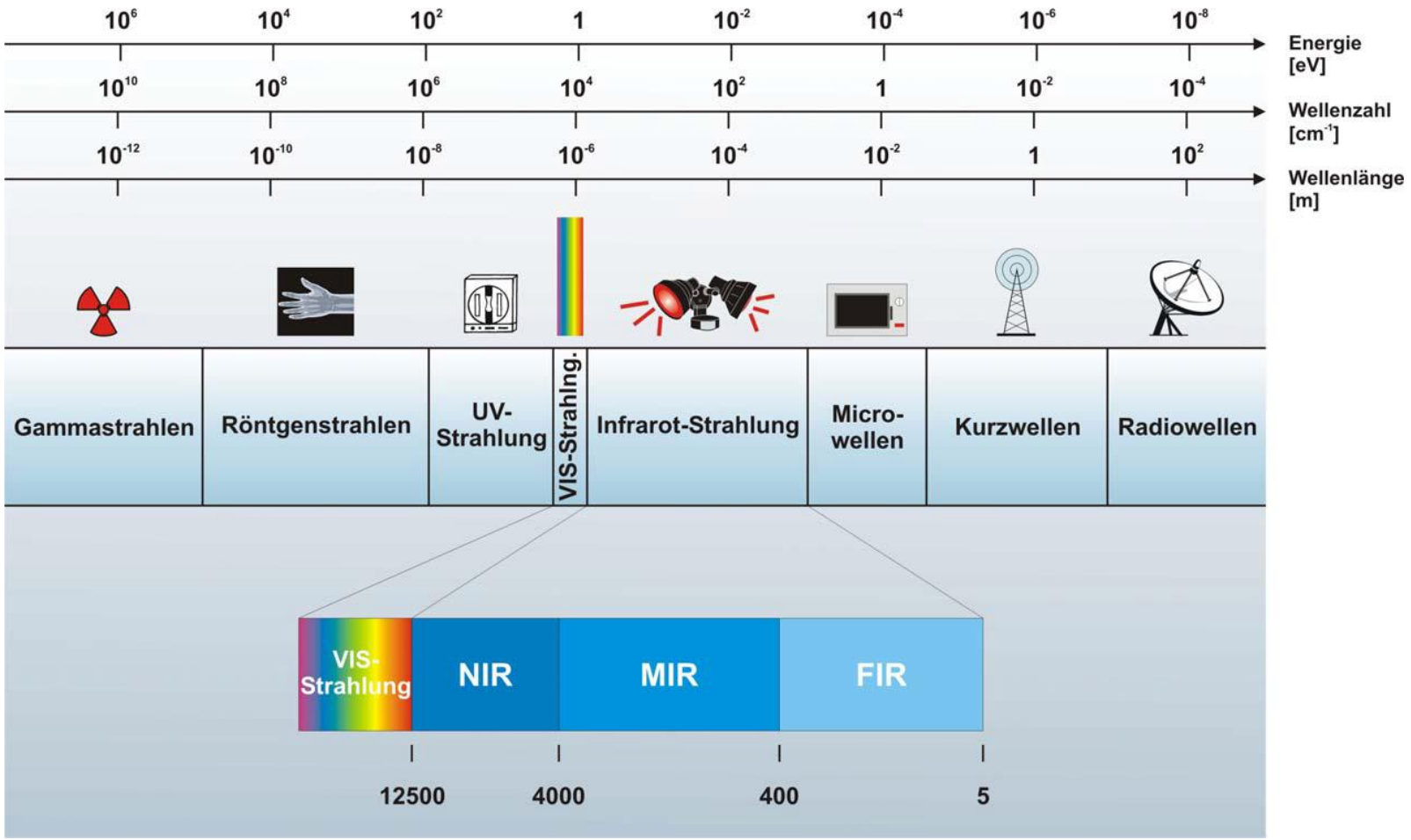
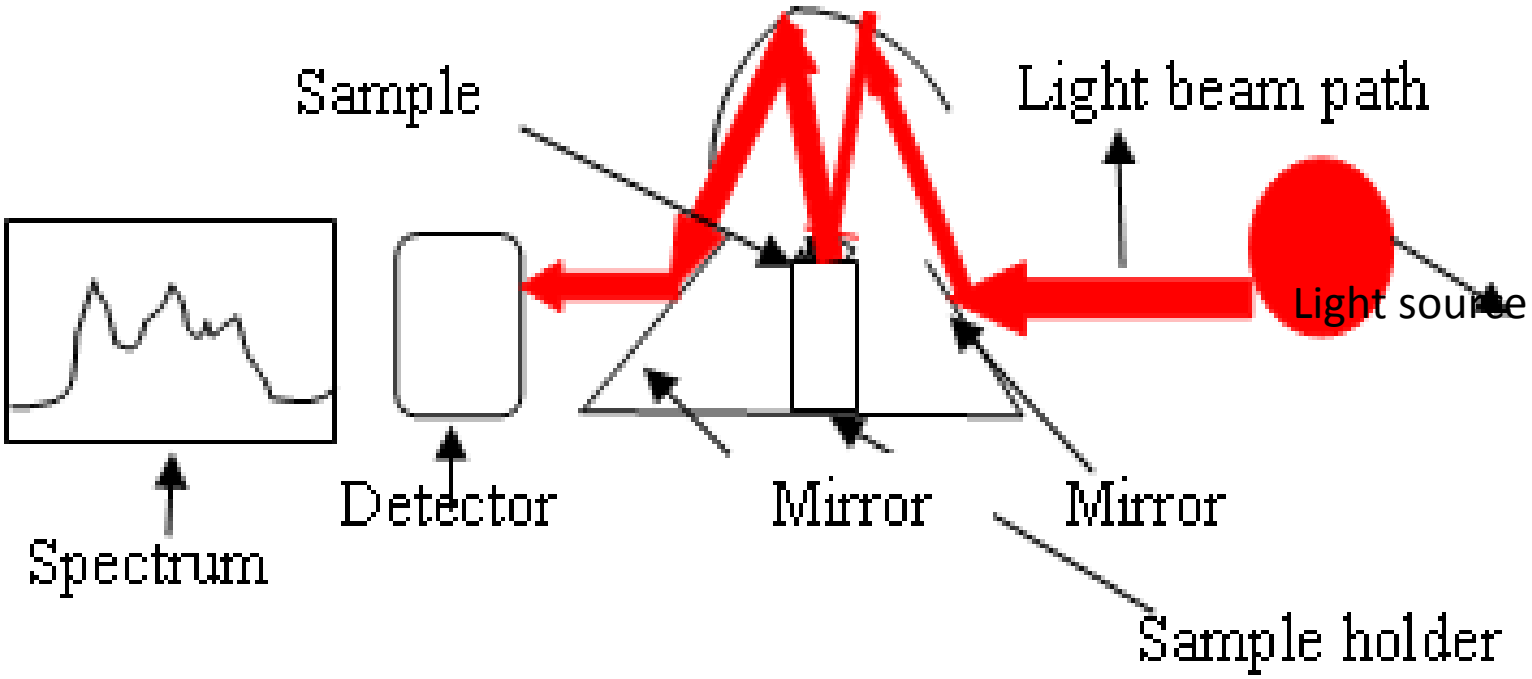
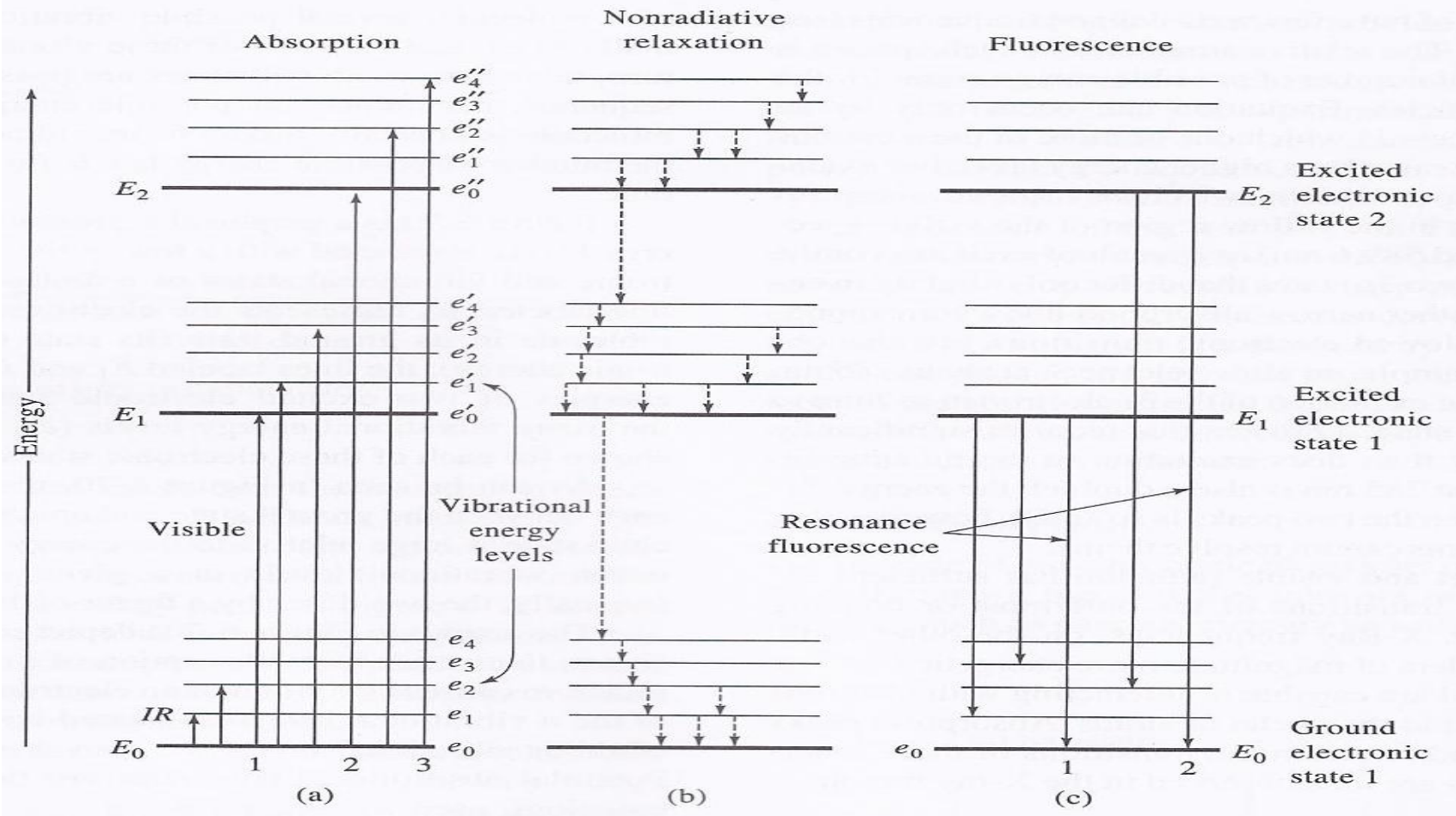
Spectroscopy background



Spectroscopy background
Defuse reflectance



Spectroscopy Background
Defuse Reflectance



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Sample for FT-MIR

KBr Potassium bromide is reference material

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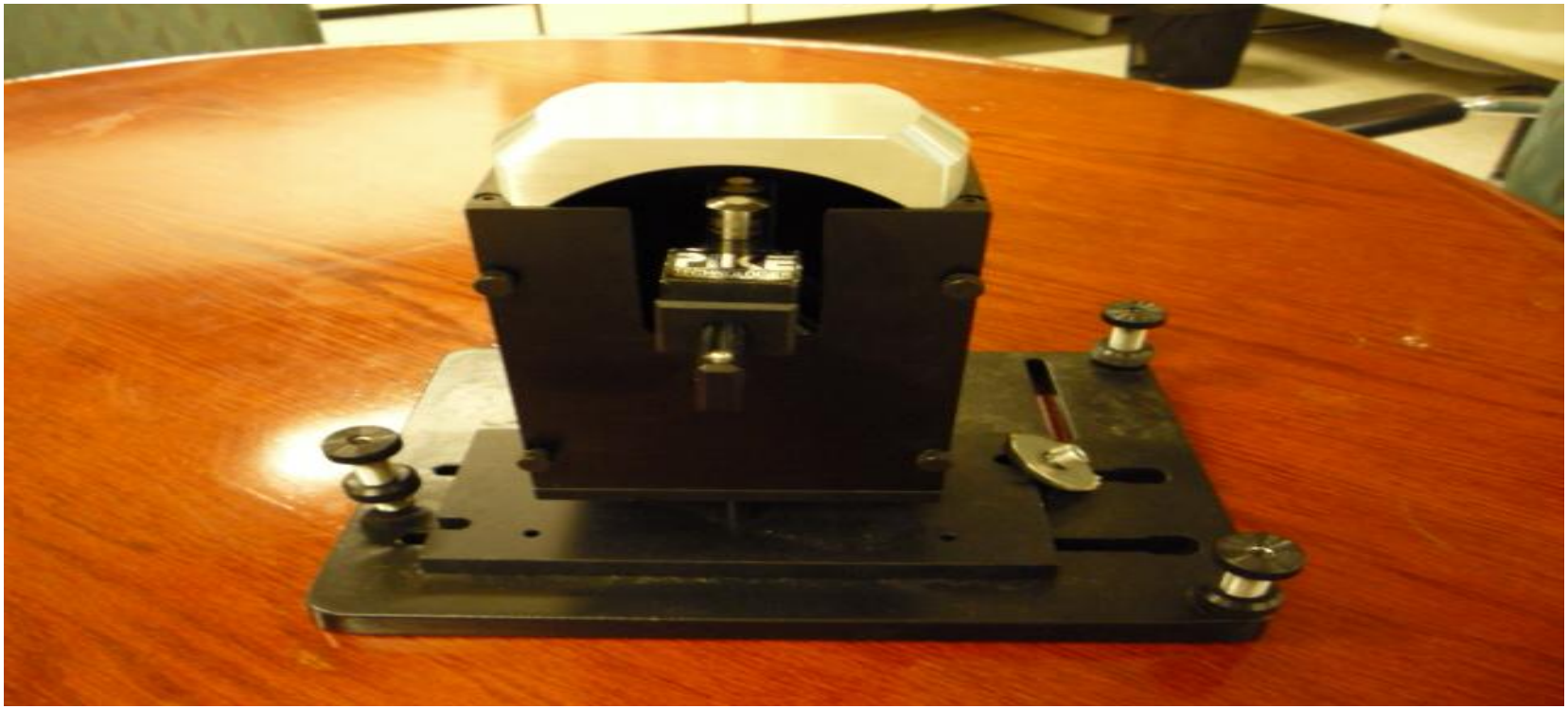
Sample for FT-MIR



Diffuse reflectance accessory for FT-MIR

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Sample for FT-MIR

Sample Holder for the FT-MIR diffuse reflectance

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UV-VIS

Diffuse reflectance reference for UV-VIS

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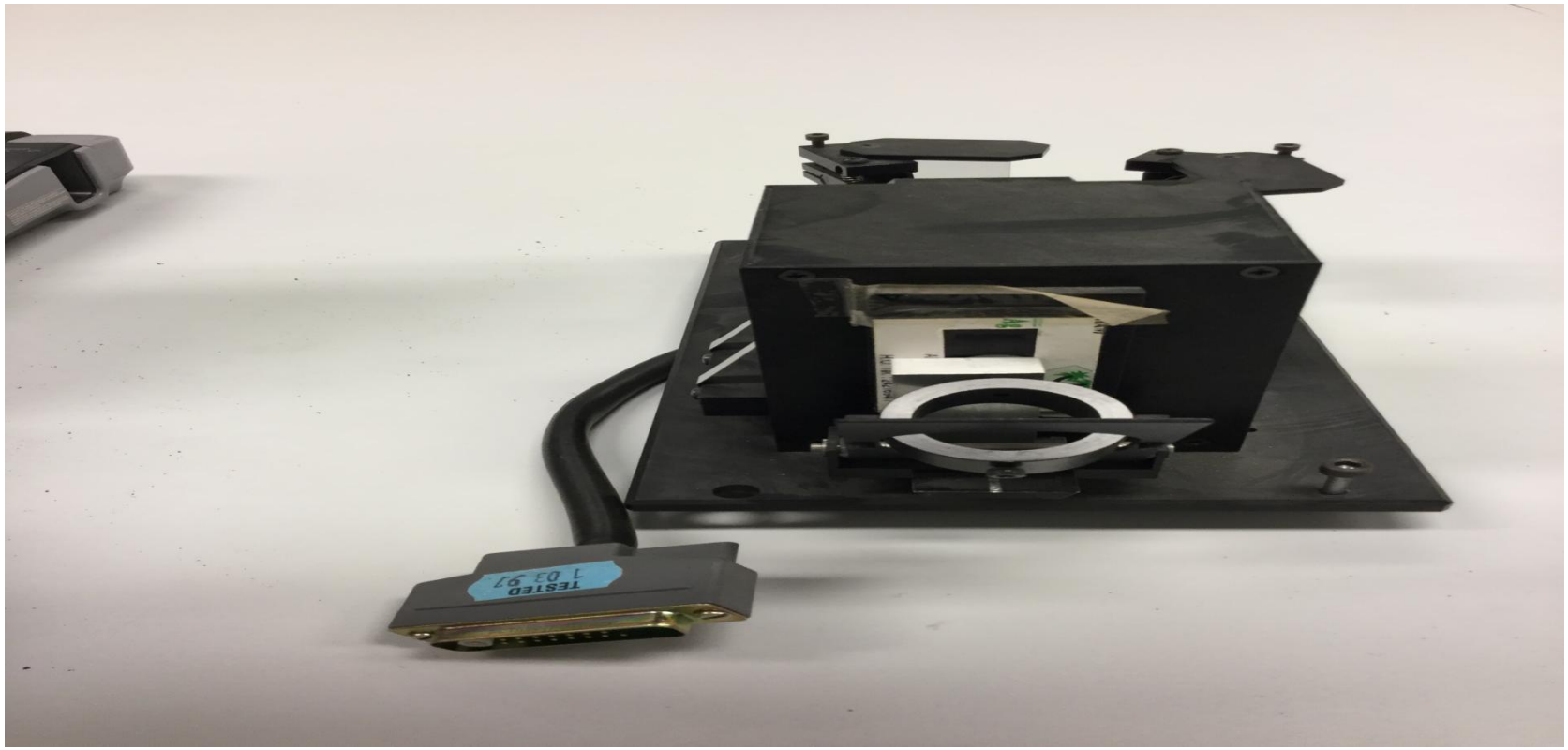
UV-VIS



Diffuse reflectance for UV-VIS

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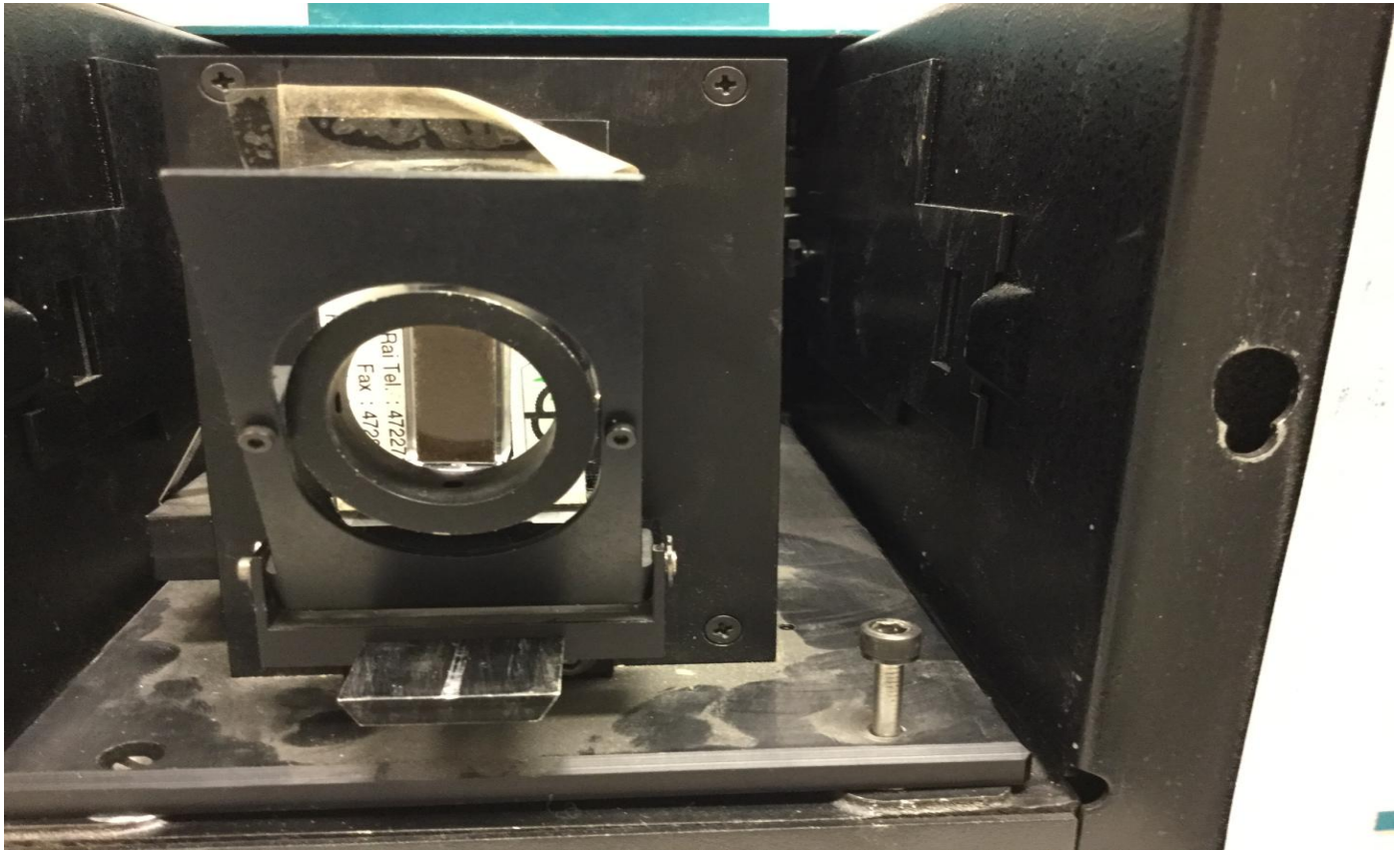
UV-VIS



Diffuse reflectance for UV-VIS

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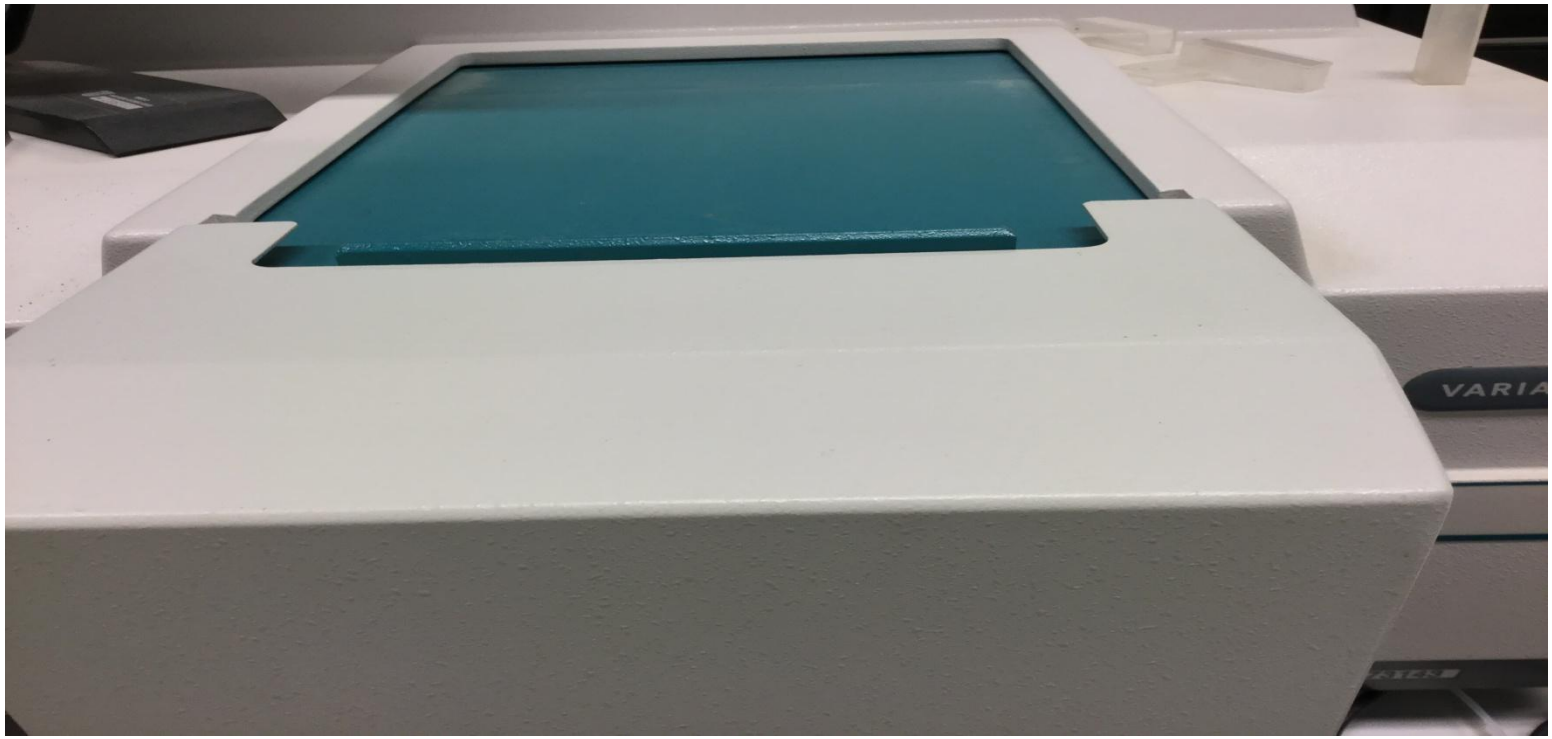
UV-VIS



Covering the sample compartment. Instrument UV-VIS effect only

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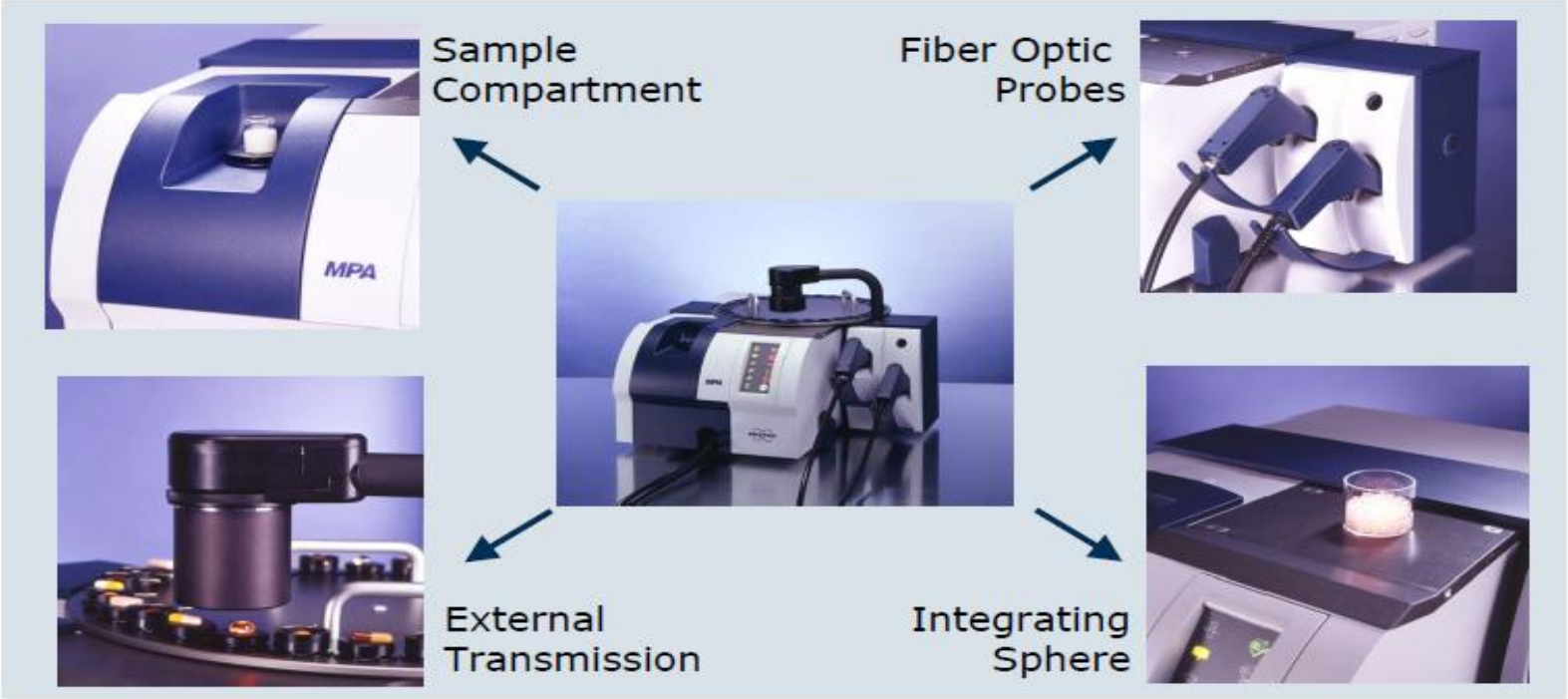
FT-NIR



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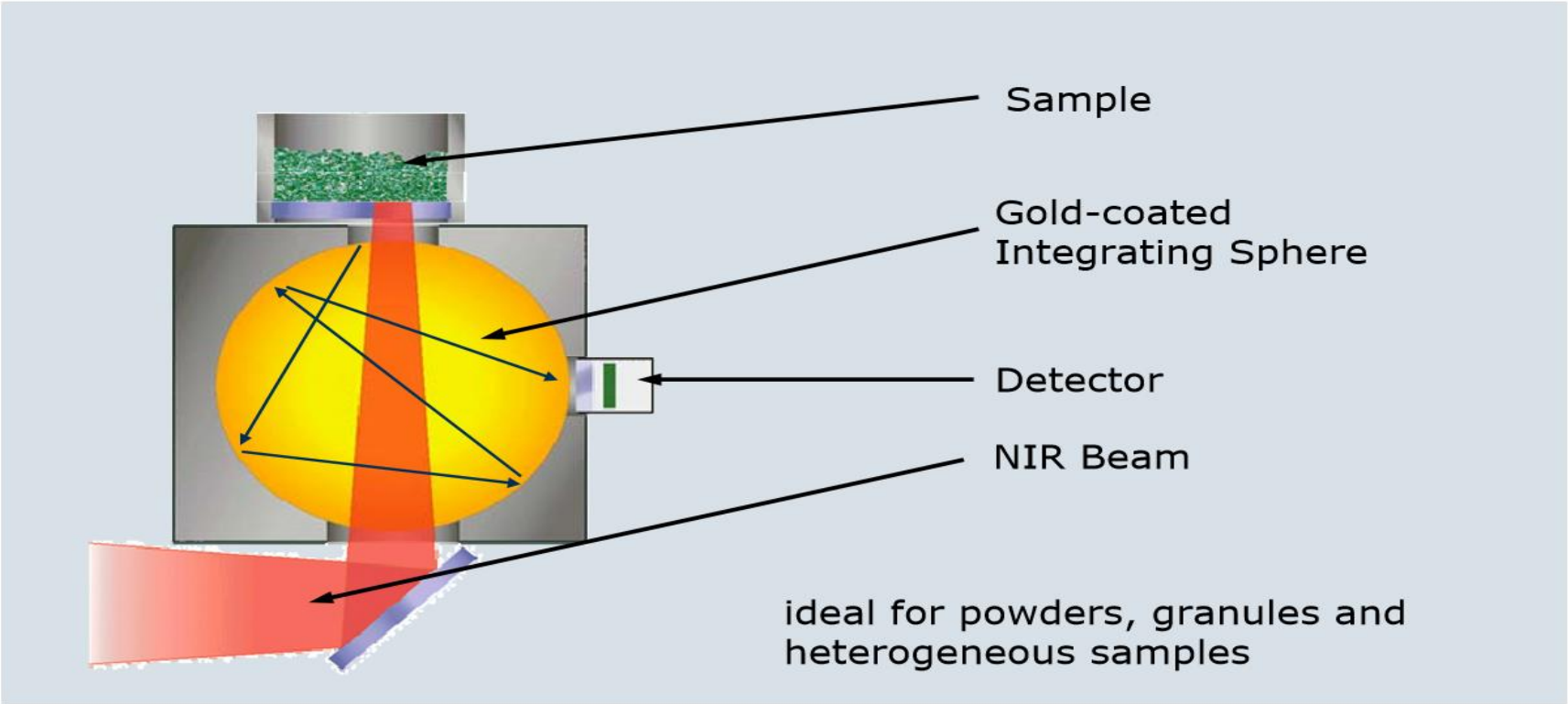
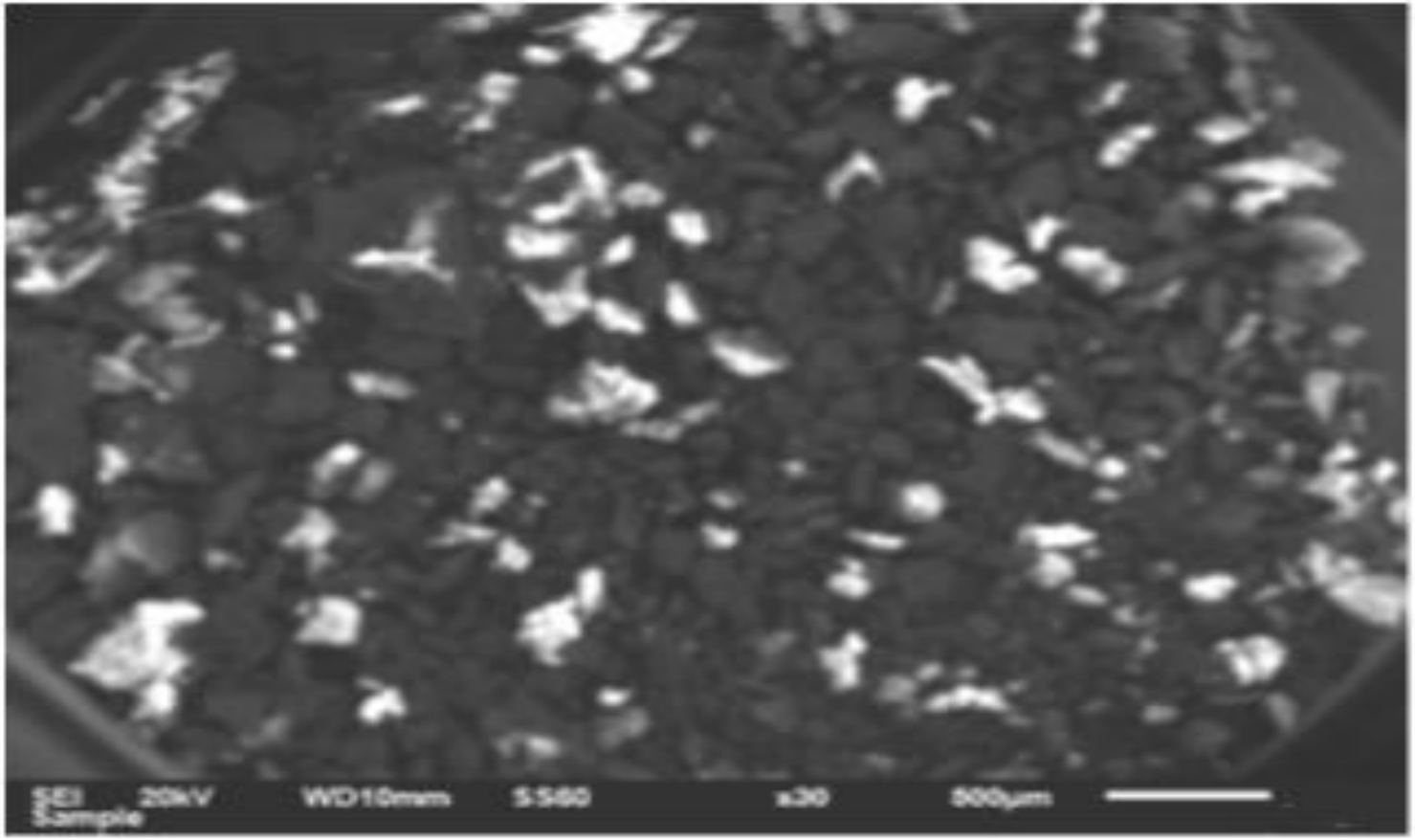
FT-NIR

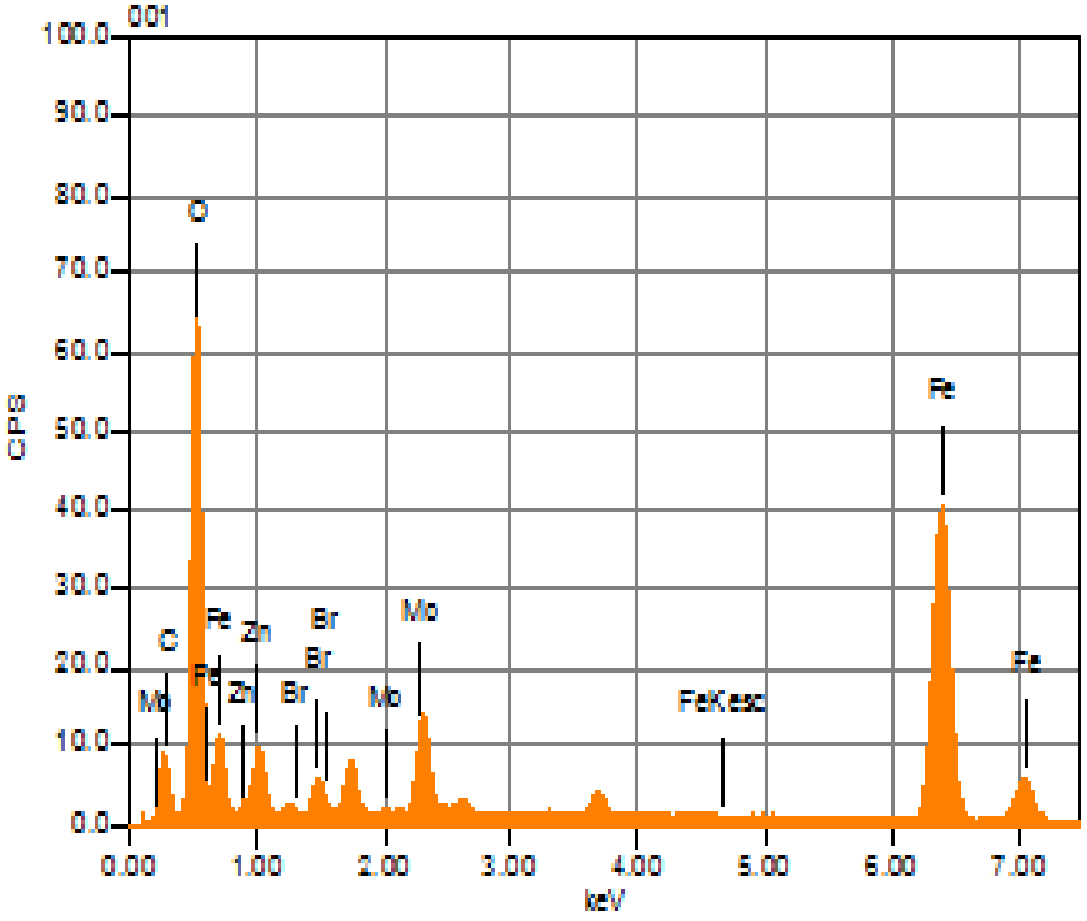


FT-NIR Diffuse reflectance

Indoor dust result (Electron microscope (EDS))



Indoor dust result Indoor dust result (Electron microscope (EDS))



Acquisition Condition

Instrument : 6010LA

Volt : 20.00 kV

Current : ---

Process Time : T1

Live time : 197.47 sec.

Real Time : 200.00 sec.

DeadTime : 1.00 %

Count Rate : 2719.00 CPS

Indoor dust result Indoor dust result (Electron microscope (EDS))

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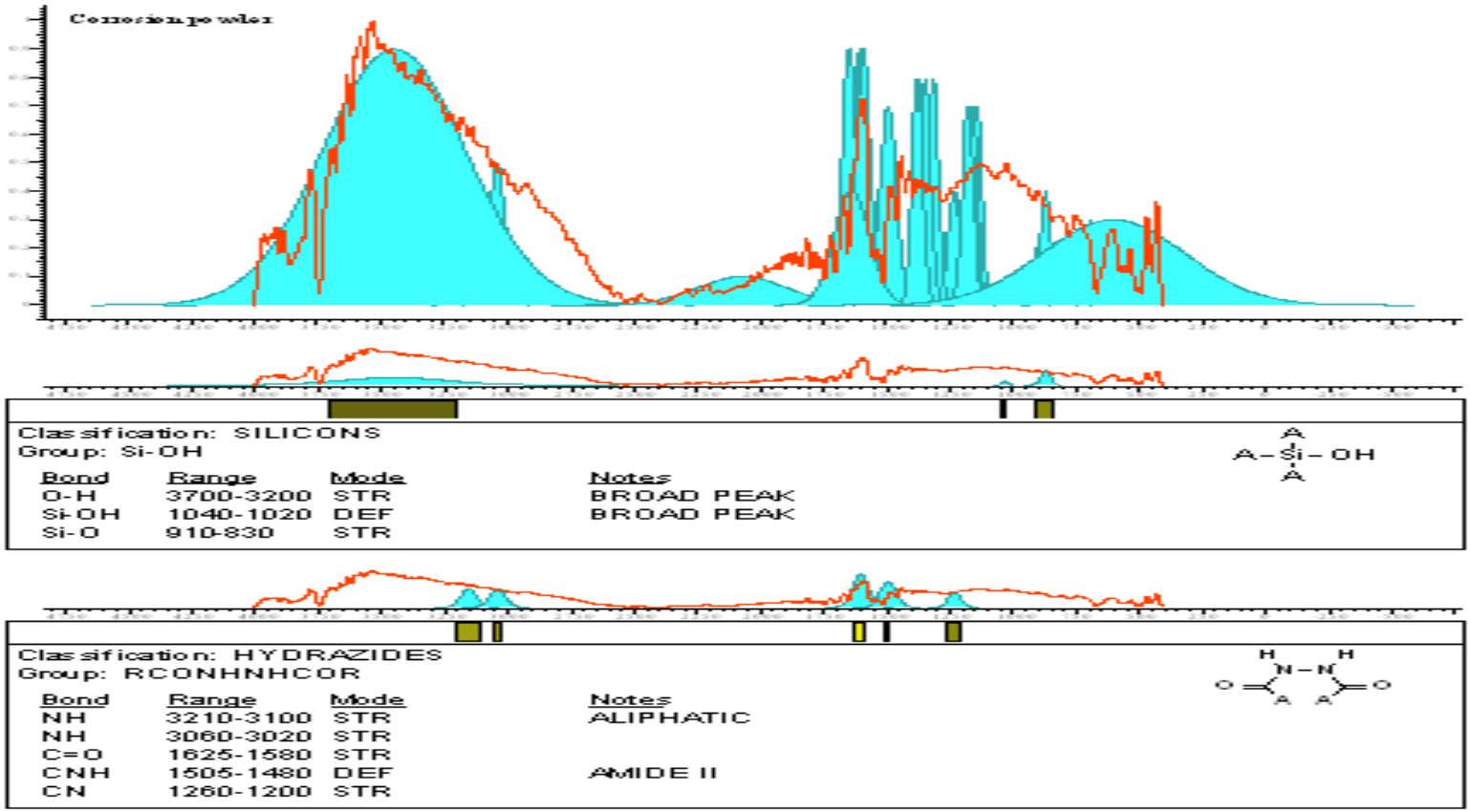
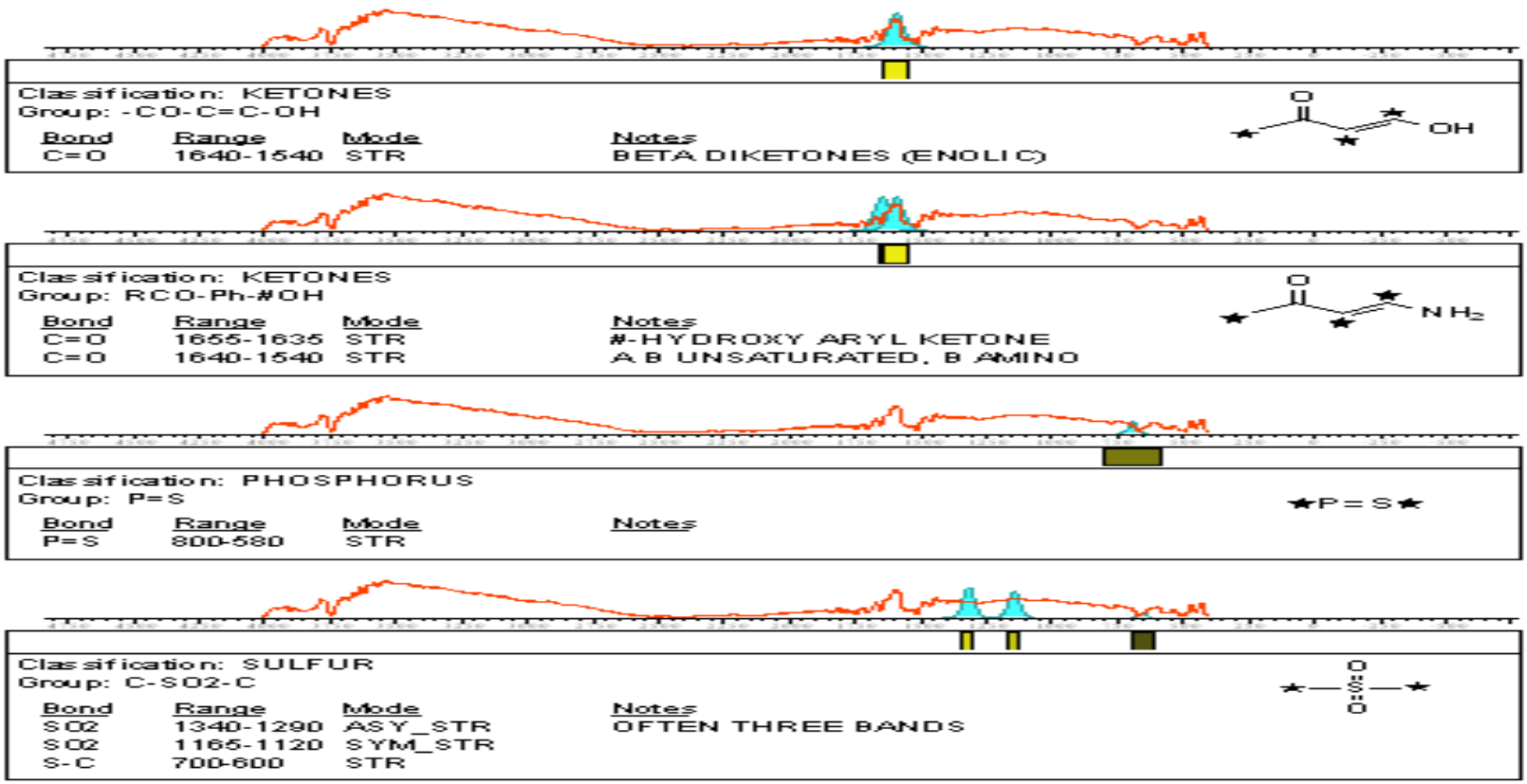
Chemical formula	mass%	mol%	Cation	Sigma	Net	K ratio	Line
C	19.71	61.90	0.00	0.03	40508	0.0050458	K
O							
FeO	56.01	29.41	16.28	0.09	547946	0.2968664	K
ZnO*	8.31	3.85	2.13	0.07	40712	0.0423788	K
Br*	3.15	1.49	0.00	0.05	43532	0.0117440	L
MoO3*	12.82	3.36	1.86	0.08	139343	0.0399735	L
Total	100.00	100.00	20.28				

Indoor result FT-MIR



Indoor result FT-MIR



UV-VIS Result out door

Table C1 light absorption of the dust collector in different seasons.

Waves NO	900-740nm		740-625nm		625-590nm		590-565nm		565-520nm		520-500nm		500-430nm		430-380nm		380-190nm	
Light order	IR		Red		Orange		Yellow		Green		Cyan		Blue		Violet		Ultraviolet	
Units / Dust collector	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)	ABS	Wave number (nm)
D1, 29-12-10	0.019	892	0.0083	732	0.01	609	0.0071	584	0.009	523	0.0095	508	0.01	477	0.0096	423	0.0088	339
D-1, 28-10-2010	7.00E-04	892	-0.016	732	-0.02	592	-0.017	581	-0.017	560	-0.019	513	-0.019	484	-0.019	385	0.0017	191
D-1, 28_6_2010	0.038	900	0.0088	647	0.01	590	0.009	564	0.012	520	0.0126	514	0.015	445	0.0156	393	0.0248	348
D-2 28-03-2010	0.018	897	0.0037	669	0	617	0.0024	574	0.004	523	0.0046	512	0.005	491	0.0044	383	0.0115	341
D-2 28-10-2010	-0.042	895	-0.058	740	-0.06	619	-0.06	568	-0.059	528	-0.059	507	-0.057	386	-0.057	346	-0.057	198
D-5 1_7_2010	0.046	895	0.0207	630	0.02	591	0.0233	568	0.027	528	0.0287	500	0.033	450	0.0434	341	0.0448	324
D-6 1-3-2010	0.031	900	0.0159	679	0.02	590	0.016	568	0.019	529	0.0189	509	0.022	447	0.0218	386	0.0237	347
D-8 3-3-2010	0.048	900	0.0164	716	0.01	596	0.0139	587	0.015	526	0.0141	515	0.015	477	0.0139	422	0.0252	190
D-10 29-6-2010	0.019	896	-0.002	667	0	624	-0.002	566	-1.00E-03	520	-4.00E-04	501	4.00E-04	469	-4.00E-04	429	0.0004	348

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UV-VIS Result out door

Continue. Table C1 light absorption of the dust collector in different seasons.

D-10 29-10-2010	0.026	888	0.0195	717	0.02	598	0.0182	570	0.02	522	0.021	506	0.021	485	0.0214	391	0.0208	374
D-12 29-10-2010	0.024	884	0.0181	690	0.02	620	0.0155	582	0.015	521	0.0153	505	0.015	485	0.013	419	0.0111	377
D-13 31_10_2010	-0.009	900	-0.026	735	-0.03	603	-0.03	587	-0.032	560	-0.036	516	-0.037	493	-0.04	416	-0.017	193
D-13 31-03-2010	0.015	897	-0.002	735	0	617	-0.003	586	#####	523	######	502	2.00E-04	482	-2.00E-04	388	0.0067	341
D-13 31-12-10-2010	0.03	895	0.015	668	0.01	592	0.0152	574	0.018	528	0.0195	505	0.021	431	0.0215	391	0.0221	377
D-15 28-12-10-2010	0.018	899	0.0099	688	0.01	624	0.008	582	0.009	529	0.0099	503	0.01	482	0.0091	419	0.0075	377
D-16 30-6-2010	0.019	892	0.0098	657	0.01	619	0.0092	567	0.012	530	0.0124	507	0.014	431	0.0133	388	0.0186	343
D-16 30-10-2010	0.053	900	0.0254	717	0.02	624	0.0233	588	0.024	523	0.0243	518	0.025	480	0.0236	419	0.0221	378
D-18 02-03-2010	0.038	900	0.0179	634	0.02	593	0.0184	566	0.021	529	0.0217	503	0.024	448	0.026	385	0.0275	347
D-19 24 02-03-2010	0.026	900	0.007	708	0.01	594	0.0063	579	0.009	526	0.0092	502	0.011	472	0.0111	397	0.0206	347
D-19 30-10-2010	-6.00E-04	900	-0.016	733	-0.02	603	-0.016	587	-0.016	553	-0.017	504	-0.017	484	-0.017	416	0.0063	190
D-20 2-3-2010	0.029	891	0.0176	669	0.02	608	0.0396	566	0.018	529	0.0177	502	0.018	411	0.0192	458	0.0192	347
D-28 30-12-2010	0.037	897	0.0167	630	0.02	590	0.0175	565	0.02	522	0.0214	501	0.023	435	0.0243	389	0.0263	349
D29 4-3-2010	0.026	895	0.0077	646	0.01	590	0.0087	565	0.012	522	0.0134	501	0.015	431	0.0166	396	0.0239	336

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UV-VIS Result out door

Continue. Table C1 light absorption of the dust collector in different seasons.

D-33-31-10-2010	0.03	899	0.0039	736	0	621	0.0021	524	0.003	516	0.0026	516	0.003	457	0.0018	398	0.0043	347
D33 31-3-2010	0.024	893	0.0244	625	0.03	590	0.0279	566	0.034	521	0.0352	501	0.04	431	0.0432	380	0.0483	343
D-33 31-12-2010	0.032	893	0.0075	730	0.01	624	0.0065	565	0.008	522	0.009	503	0.009	464	0.0089	426	0.0095	343
D35 4-3-2010	0.04	899	0.0266	625	0.03	590	0.029	567	0.034	521	0.0352	502	0.039	431	0.0402	396	0.0472	343
D-36 24 2-3-2010	0.021	891	0.0079	736	0.01	622	0.0057	589	0.006	546	0.0061	514	0.007	477	0.0059	385	0.0169	347
D-38 30-3-2010	0.041	895	0.0159	717	0.02	605	0.0148	578	0.017	532	0.0177	503	0.02	462	0.0187	400	0.0187	341
D-38 30-12-2010	0.027	898	0.0134	643	0.01	599	0.0142	565	0.017	525	0.0179	509	0.021	463	0.0213	395	0.0226	345
D-40 2-3-2010	0.024	887	0.0107	652	0.01	595	0.0106	573	0.014	531	0.0148	501	0.017	457	0.0179	397	0.0191	341
D-41 30-6-2010	0.039	893	0.012	651	0.01	592	0.0123	569	0.015	528	0.0167	501	0.02	445	0.0202	381	0.0215	341
D-41 30-9-2010	0.031	887	0.015	651	0.01	595	0.0146	569	0.017	531	0.0179	503	0.02	445	0.0207	398	0.021	365
D-42 29-10-2010	-0.034	896	-0.059	733	-0.06	621	-0.063	576	-0.061	528	-0.061	506	-0.061	471	-0.061	411	-0.059	193
D-42 29-12-2010	0.031	895	0.0146	649	0.01	615	0.0142	565	0.017	522	0.0175	501	0.019	453	0.0203	402	0.0208	345
D43 1-3-2010	0.034	899	0.0034	698	0	602	0.003	570	0.006	521	0.006	514	0.007	484	0.0066	396	0.0149	342
D-43 29-9-2010	0.031	887	0.0133	651	0.01	606	0.0134	569	0.016	527	0.0172	501	0.019	441	0.0211	381	0.0216	346
D-43 29-10-2010	0.026	887	0.0123	652	0.01	621	0.0116	566	0.012	528	0.0129	504	0.014	461	0.0136	381	0.0131	351
D-43 29-12-2010	0.024	894	0.0132	670	0.01	592	0.0138	565	0.017	525	0.0174	501	0.019	447	0.0204	398	0.023	346
D-43_B 29-9-2010	0.042	899	0.0175	710	0.02	620	0.0173	569	0.02	523	0.0202	507	0.022	439	0.0223	387	0.0233	365
D44 1-3-2010	0.036	899	0.0125	652	0.01	602	0.0132	565	0.016	521	0.0168	514	0.02	457	0.0202	396	0.0269	342
D-44 29-6-2010	0.703	815	0.6759	740	0.65	619	0.6502	569	0.654	539	0.6521	519	0.657	476	0.6575	380	1.3426	200
D-44 29-9-2010	0.039	899	0.0163	710	0.02	591	0.0167	574	0.02	523	0.0206	518	0.023	441	0.0235	385	0.0234	372
D-44 29-10-2010	0.023	898	0.0031	658	0	611	0.0021	579	0.002	528	0.0028	504	0.004	453	0.0037	381	0.0027	377
D-45 1-3-2010	0.034	888	0.021	628	0.02	590	0.0221	566	0.025	524	0.0255	509	0.028	447	0.0297	381	0.0319	347

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FT-IR Result out door

Table 1. Collector D-3, December 2010

No.	Function Group	Compound	Bounds	Peak Regions (cm^{-1})		
				From		To
1	Alkanes	R'-CH_2-R"	CH	2936	To	2916
			CH	2863	To	2843
			CH	1485	To	1445
		R(CH_2)$_4$-C	CH	2936	To	2916
			CH	2863	To	2843
			CH	1485	To	1445
			CC	750	To	720
		RCH_3	CH	2972	To	2952
			CH	2882	To	2862
			CH	1475	To	1435
			CH	1380	To	1385
2	Ketones	RCO-Ph#NH_2	C=O	1655	To	1635
		4C ring K	C=O	1785	To	1765
		Fused ring	C=O	1655	To	1635
3	Nitrite	R-O-N=O	N=O	1681	To	1648
			N=O	1625	To	1605
			N-O	814	To	751
4	Phosphorus	P=S	P=S	800	To	580
5	Silicon	Si-OH	O-H	3700	To	3200
			Si-OH	1040	To	1020
			Si-O	910	To	830
		Si-O-Si	Si-O-Si	1020	To	1010
		Si-O-C	Si-O-C	1100	To	1000
		Si-O-C	Si-O-C	990	To	945
		Si-Cl	Si-Cl	550	To	470
6	Sulphur	S=S	S=S	500	To	400
		R-SO_3 H_3O	H_3O	2800	To	1650
			SO_3	1230	To	1120

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FT-IR Result out door

Table 2 Sample D-3 28-3-2010

No	Function group	Compound	Bounds	Peak regions (cm^{-1})		
				From		To
1	Ethers	4-Ring ETH	C-O-C	1035	To	1020
			C-O-C	990	To	975
		6-Ring ETH	C-O-C	1110	To	1090
			C-O-C	820	To	805
2	Halogens	C-Br	C-Br	600	To	500
		C-I	C-I	610	To	485
3	Ketones	Ph-CO-Ph	C=O	1670	To	1660
		RCO-Ph#NH_2	C=O	1655	To	1635
		C=C-CO-C=C	C=O	1670	To	1663
		Quinones	C=O	1655	To	1635
4	Phosphorus	P=S	P=S	800	To	580
5	SILICONS	Si-O-Si	Si-O-Si	1020	To	1010
6	Sulphur	C=S	C=S	1200	To	1050
		S-S	S-S	500	To	400
		R-SOOH	O-H	2790	To	2340
			S=O	1090	To	990
			S-O	870	To	810

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FT-IR Result out door

Table 3. Sample D-3 28-September-2010

No	Function Group	Compound	Bounds	Peak Regions (cm^{-1})		
				From		To
1	Alkanes	Ph-CH_3	CH	2930	To	2920
			CH	2870	To	2860
		R'-CH_2-R''	CH	2936	To	2916
			CH	2863	To	2843
			CH	1485	To	1445
2	Ethers	4-Ring ETH	C-O-C	1035	To	1020
			C-O-C	990	To	975
		6-Ring ETH	C-O-C	1110	To	1090
			C-O-C	820	To	805
3	Halogens	C-Br	C-Br	600	To	500
		C-I	C-I	610	To	485
4	Ketones	Ph-CO-Ph	C=O	1670	To	1660
		RCO-Ph#NH_2	C=O	1655	To	1635
		C=C-CO-C=C	C=O	1670	To	1663
		Quinones	C=O	1655	To	1635
5	Silicon	Si-O-Si	Si-O-Si	1100	To	1000
		Si-F	Si-F	920	To	820
		Si-OH	O-H	3700	To	3200
			Si-OH	1040	To	1020
			Si-O	910	To	830
6	Sulphur	C=S	C=S	1200	To	1050
		S-S	S-S	500	To	400
		R-SOOH	O-H	2790	To	2340
			S=O	1090	To	990
			S-O	870	To	810

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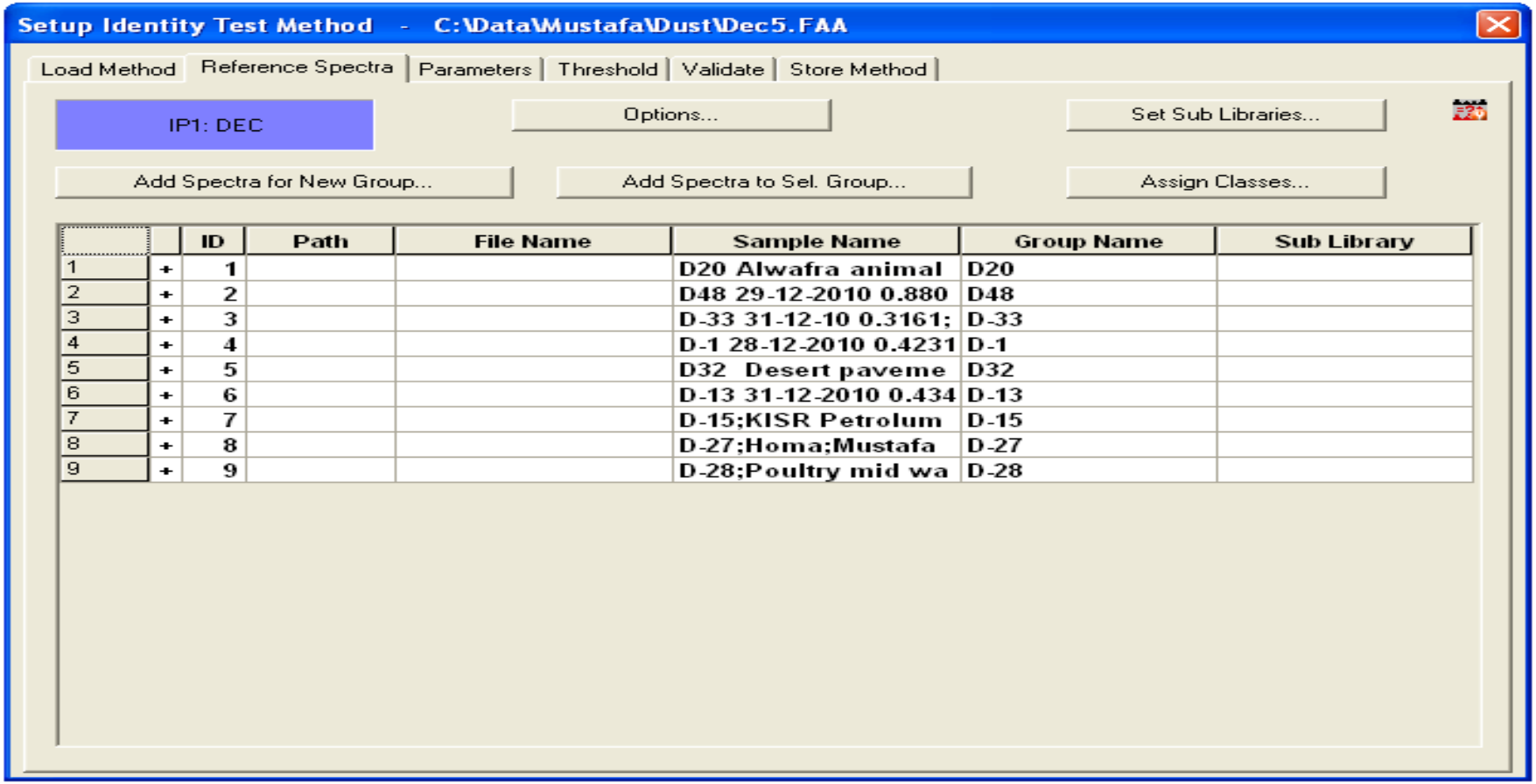
Fast model on FT-NIR out door

1. FT-NIR Indent model a data base for the dust collector is produced.
2. The Data base contain all the information of the dust in certain time in the year.
3. The Data base will reduce the time and save money for sample testing.
4. The data base is updated and increase each time new sample is tested

Fast model on FT-NIR out door



		ID	Path	File Name	Sample Name	Group Name	Sub Library
1	+	1			D20 Alwafra animal	D20	
2	+	2			D48 29-12-2010 0.880	D48	
3	+	3			D-33 31-12-10 0.3161;	D-33	
4	+	4			D-1 28-12-2010 0.4231	D-1	
5	+	5			D32 Desert paveme	D32	
6	+	6			D-13 31-12-2010 0.434	D-13	
7	+	7			D-15;KISR Petrolum	D-15	
8	+	8			D-27;Homa;Mustafa	D-27	
9	+	9			D-28;Poultry mid wa	D-28	

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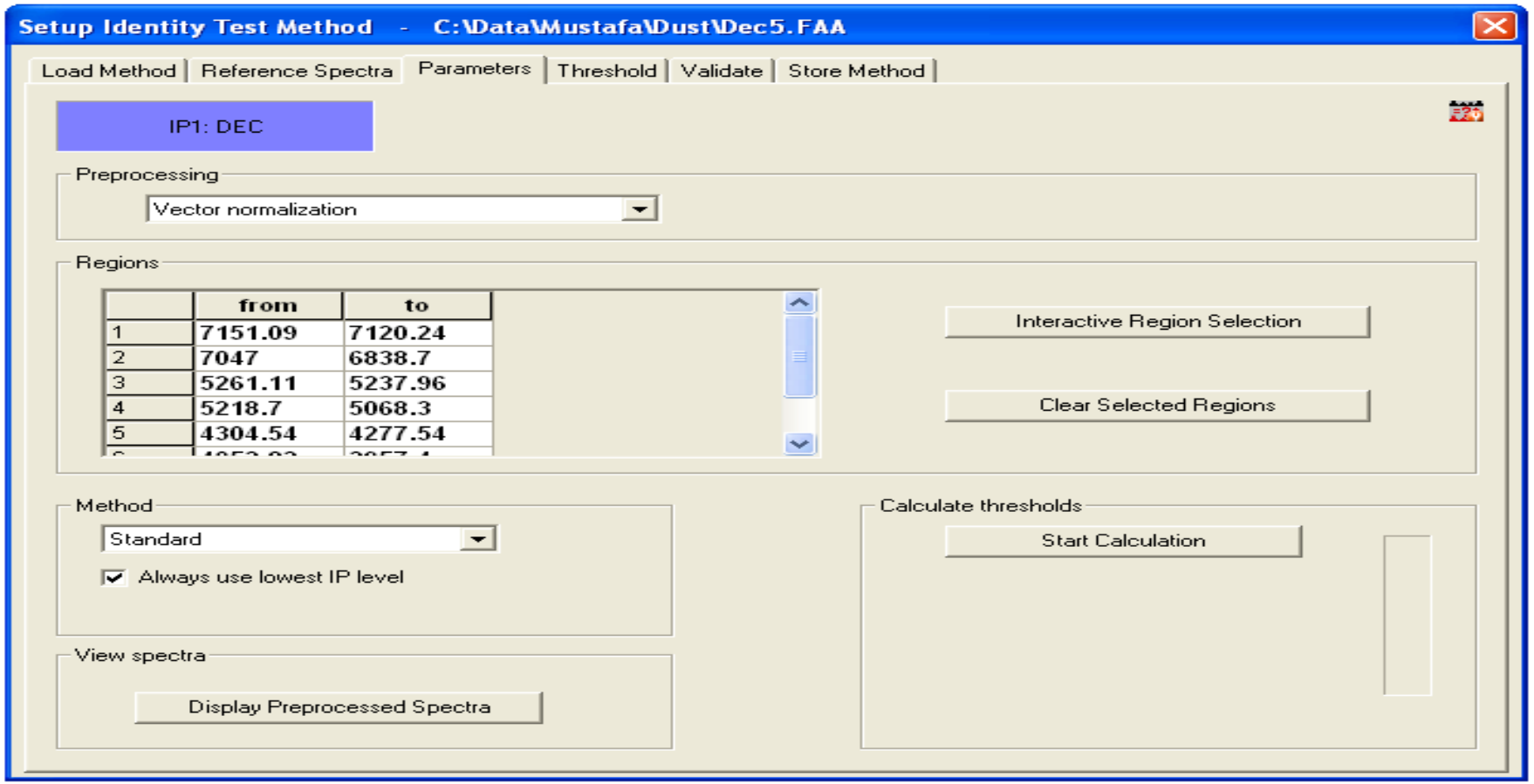
Fast model on FT-NIR out door



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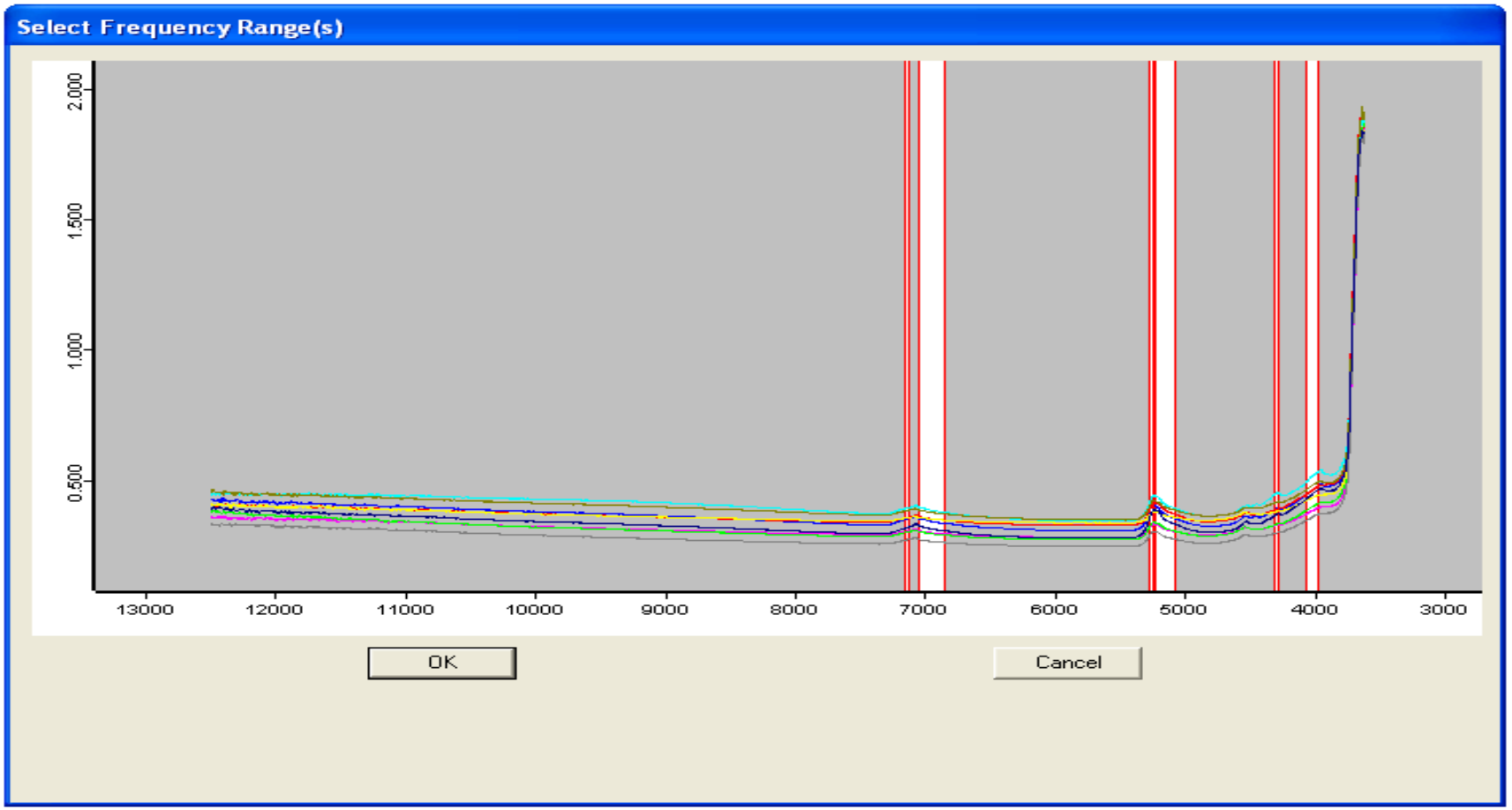
Fast model on FT-NIR out door



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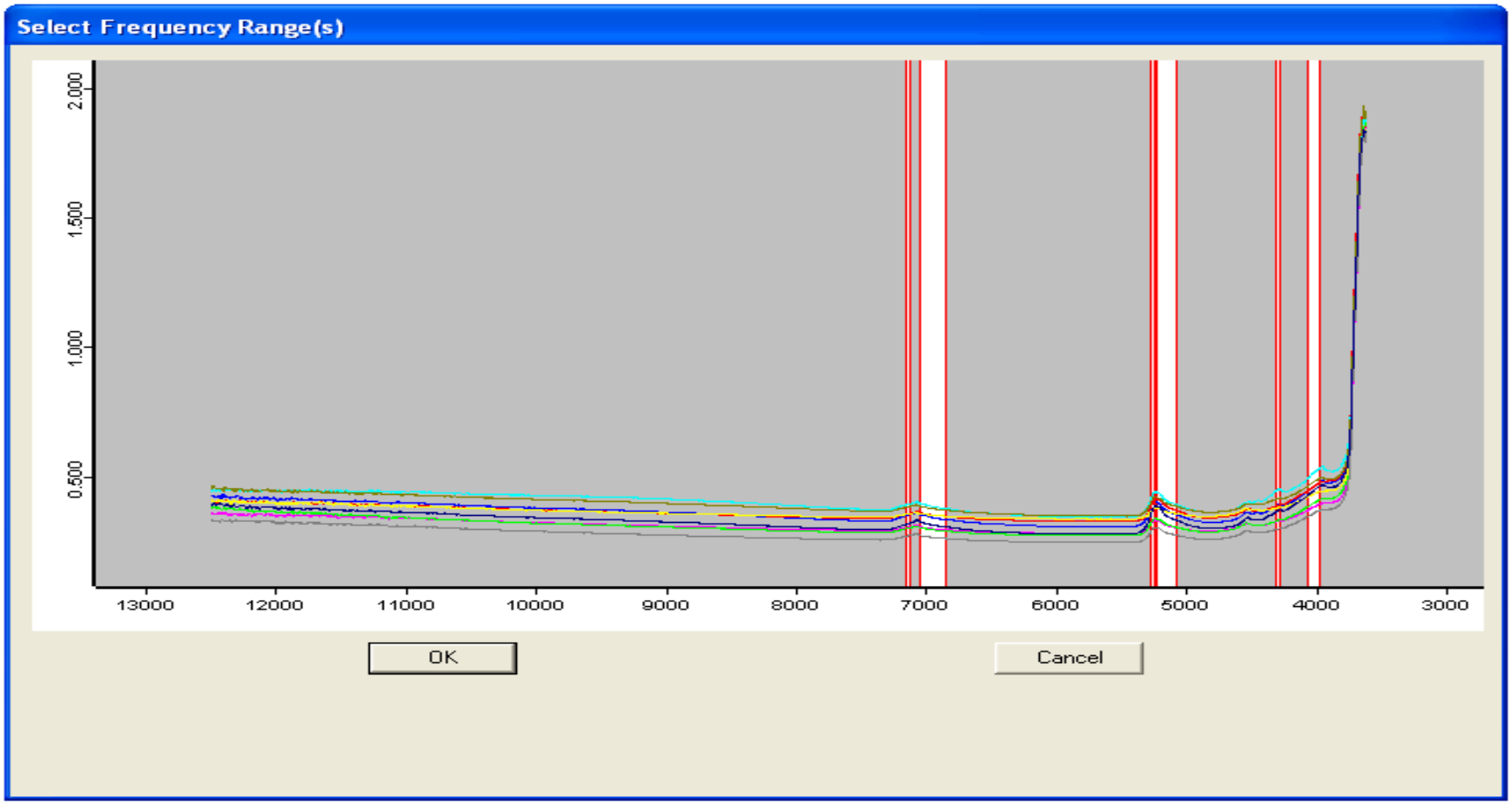
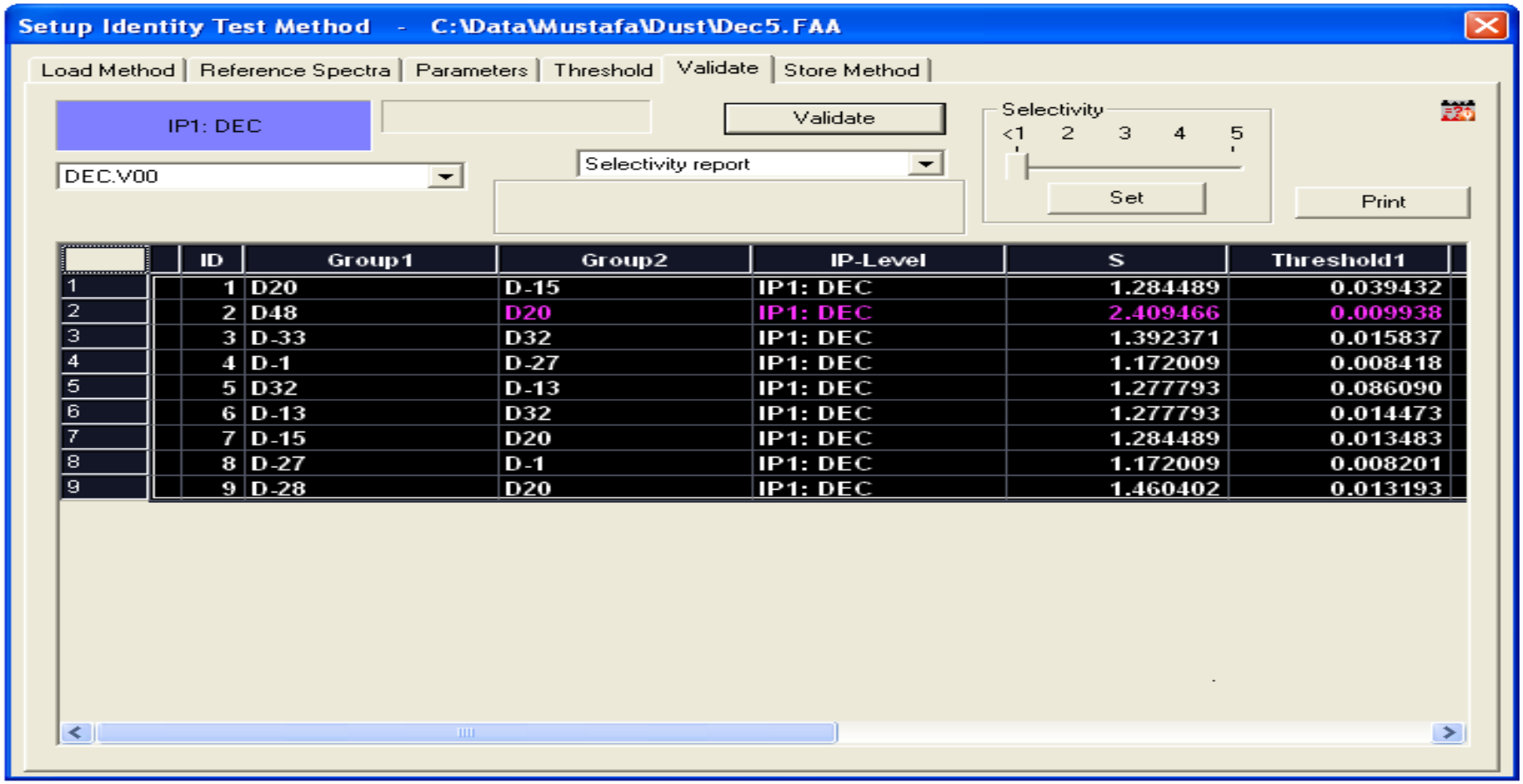
Fast model on FT-NIR out door

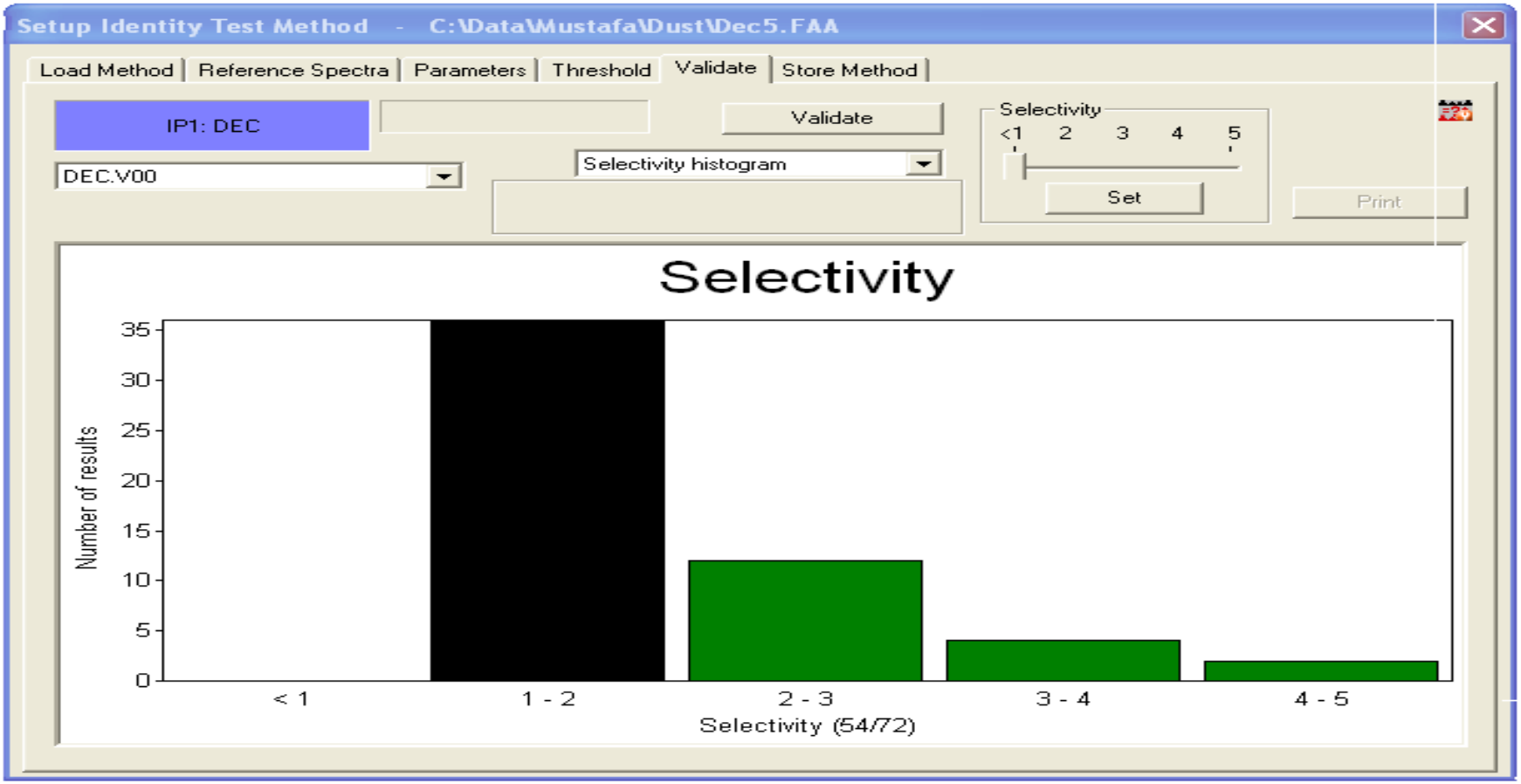


Fast model on FT-NIR out door

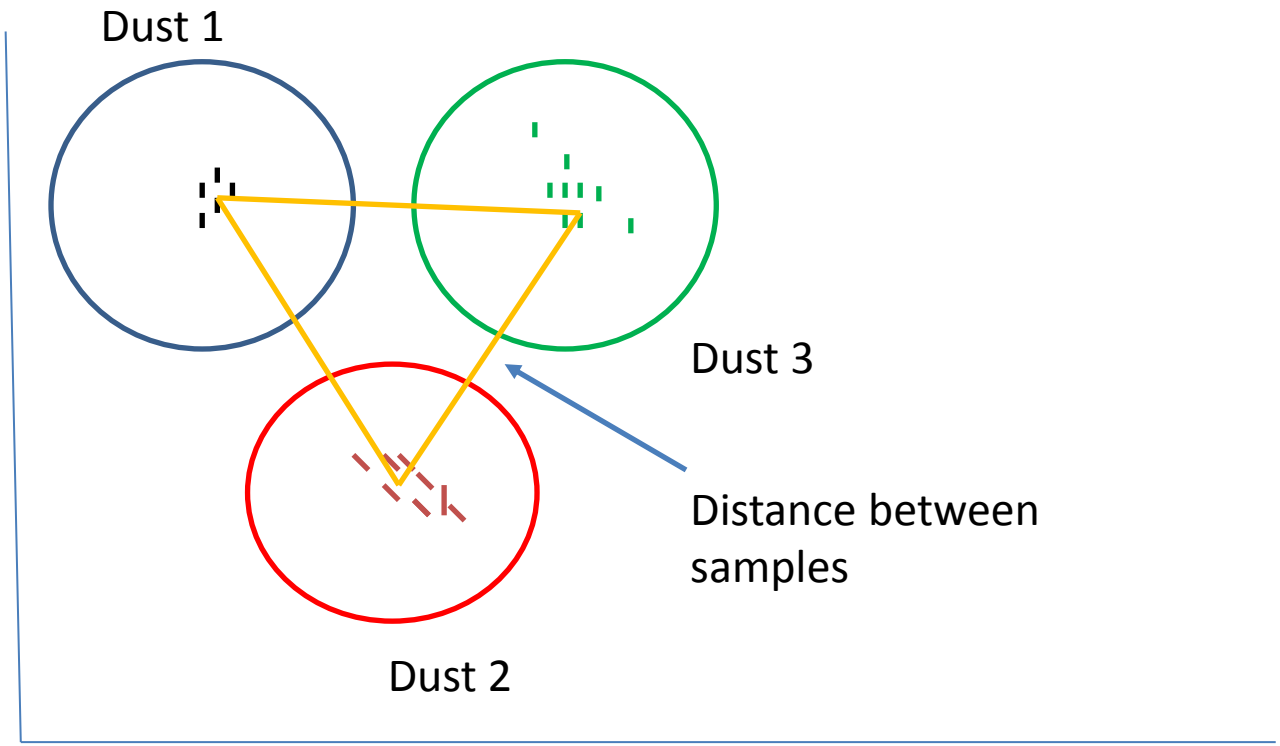


	ID	Group1	Group2	IP-Level	S	Threshold1
1	1	D20	D-15	IP1: DEC	1.284489	0.039432
2	2	D48	D20	IP1: DEC	2.409466	0.009938
3	3	D-33	D32	IP1: DEC	1.392371	0.015837
4	4	D-1	D-27	IP1: DEC	1.172009	0.008418
5	5	D32	D-13	IP1: DEC	1.277793	0.086090
6	6	D-13	D32	IP1: DEC	1.277793	0.014473
7	7	D-15	D20	IP1: DEC	1.284489	0.013483
8	8	D-27	D-1	IP1: DEC	1.172009	0.008201
9	9	D-28	D20	IP1: DEC	1.460402	0.013193

Fast model on FT-NIR out door



Distance between spectra out door



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FT-NIR Result

Result of IDENT evaluation:

Sample name: D33 Desert pavement with patches of drift sands and granule ripples;Ritqa;Mustafa A Al-Shamali;29-4-2014;july 2010 bag 1-7-2010 table;colour;Du
Sample: C:\Data\Mustafa\Dust 2014_4_29\D33 Desert pavement with patches of drift sands and granule ripples_Ritqa_Mustafa A Al-Shamali_29-4-.0
Date and time (measurement): 29/04/2014 09:37:21.069 (GMT+2)
Method file: C:\Data\Mustafa\Dust\SUMMER2.FAA

Hit no.	Sample name	Hit qual.	Threshold	Group
1	D33 Desert pavement with patches of drift	0.00003	0.00006	D33
2	D-1 protected area;Kabd (KISR Expirement	0.00018	0.00005	D-1
3	D-10 sbkha and drift sands;Sabiya (close to	0.00057	0.00005	D-10
4	D-25 active sand sheets;South Buffer zone	0.00065	0.00010	D-25
5	D-5 restricted area;Mutla (abduli road);Mustafa	0.00088	0.00012	D-5

IDENTIFIED AS D33

OK

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FT-NIR Result

Result of IDENT evaluation:

Sample name: D-10 Sabkha and Drift sand;Sabiya(close to the Bubiyan bridge);Mr. Mustafa A Al-Shamali;21-4-2014;Autumn October collection;colour;Dust
Sample: C:\Data\Mustafa\Dust\2014_4_21\D-10 Sabkha and Drift sand_Sabiya(close to the Bubiyan bridge)_Mr. Mustafa A Al-Shamali_21-4-2014.0
Date and time (measurement): 21/04/2014 09:52:11.065 (GMT+2)
Method file: C:\Data\Mustafa\Dust\OCTOBER6.FAA

Hit no.	Sample name	Hit qual.	Threshold	Group
1	D-10 Sabkha and Drift sand;Sabiya(close to the	0.00006	0.00006	D-10
2	D1 Protected Area;Kabd Station @KISR	0.00047	0.00005	D1
3	D-27 Desert Pavement. few Halaxylon	0.00145	0.00068	D-27
4	D-20 Active sand sheets;Wafra Animal	0.00296	0.00088	D-20

IDENTIFIED AS D-10

OK

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FT-NIR Result

Result of IDENT evaluation:

Sample name: D20 Active sand sheet;Wafra Animal Production;Mustafa A Al-Shamali;27-4-2014;2-3-2010 march collection ;colour;Dust
Sample: C:\Data\Mustafa\Dust\2014_4_27\D20 Active sand sheet_Wafra Animal Production_Mustafa A Al-Shamali_27-4-2014.0
Date and time (measurement): 27/04/2014 12:24:21.214 (GMT+2)
Method file: C:\Data\Mustafa\Dust\March2.FAA

Hit no.	Sample name	Hit qual.	Threshold	Group
1	D20 Wafra animal production (jawakheir)	0.06137	0.09116	D20
2	D-27 30-3-2010 0.5045;Salmi Boarder Zone;Ms.	0.16761	0.05165	D-27
3	D-13 31-3-2010 0.4822;KISR Main Building	0.26637	0.01200	D-13
4	D-6 1-3-2010 0.4328;North Mutla (Abduli Road)	0.34028	0.02974	D-6
5	D-31 Sand dunes and nabkhs;Um	0.37724	0.01132	D-31

IDENTIFIED AS D20

OK

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FT-NIR Result

Result of IDENT evaluation:

Sample name: D32 Desert pavement with patches of drift sands and granule ripples;Homa;Mustafa A Al-Shamali;8-5-2014;December 2010 31-12-2010;colou
Sample: C:\Data\Mustafa\Dust 2014_5_8\D32 Desert pavement with patches of drift sands and granule ripples_Homa_Mustafa A Al-Shamali_8-5-2.0
Date and time (measurement): 08/05/2014 12:35:53.721 (GMT+2)
Method file: C:\Data\Mustafa\Dust Dec5.FAA

Hit no.	Sample name	Hit qual.	Threshold	Group
1	D32 Desert pavement with patches of drift	0.07959	0.08609	D32
2	D-15;KISR Petrolum Center (Al-Ahmadi) Urban	0.07992	0.01348	D-15
3	D-27;Homa;Mustafa A	0.10636	0.00820	D-27
4	D20 Alwafra animal medical 30-12-2010 2.5889	0.11170	0.03943	D20
5	D-33 31-12-10 0.3161;Ritqa;Ms. Safaa	0.11450	0.01584	D-33

IDENTIFIED AS D32

OK

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Data discussion for indoor

1. The sample has high amount of curded Iron. And other materials like sulphur, hydrocarbons, silicon compounds and extra.
2. The duct should be isolated to prevent it from any reaction
3. The condition filter material should be reselected and the replacing time should be monitored.

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Out door discussions

1- The ability of dust to absorb light is vary from season to season for the same dust collector.

2- The chemical content of the dust is vary from season to season for the same collector.

3- The dust help in absorption the Ultraviolet light that has relation with cancer.

4- the dust has the ability to absorb infrared light that has relation with heat.

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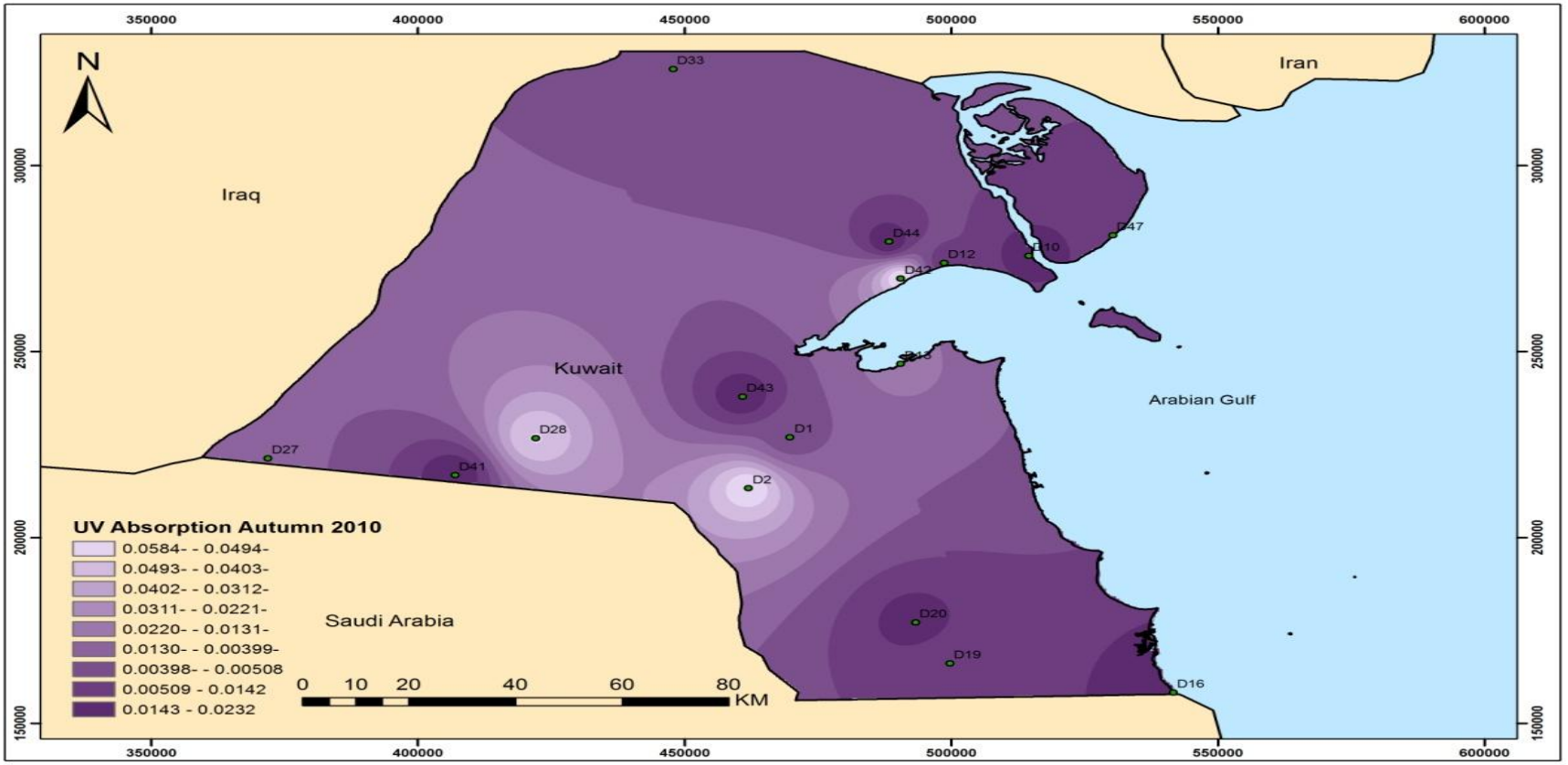
Out door discussions

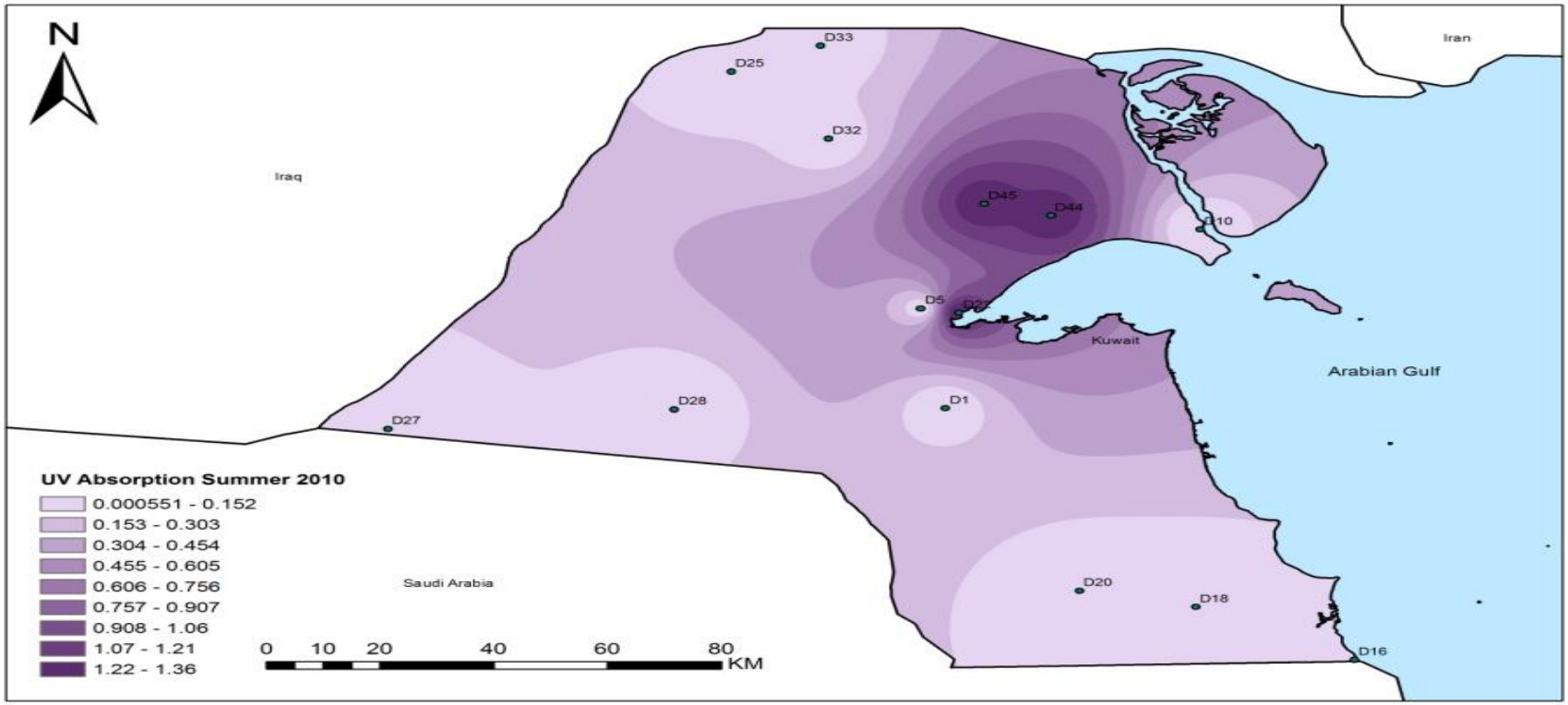
1. The chemical content effect the colour of the dust.
2. The chemical content of the dust will information about any activity that cause any component to be present in the collector.

Out door discussions



UV-Absorption in Autumn 2010

Out door discussions



UV-Absorption in summer 2010

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conclusion

1- The monitoring the outdoor and indoor dust and air is very important to understand what happened in the surrounding.

2- taking action is very is very important before problems become big.

3- The content of the dust vary depend on the culture area and the seasons.

4- The changes in dust content can be observe by eye however it need to be tested.

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M. AL-SHAMALI, S. AL-AWADHI AND N. AL-DOUSARI, SEASONAL COLOR SPECTROPHOTOMETRIC VARIATION OF DUST SAMPLE WITHIN KUWAIT KISR **EC058G 2016**

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Acknowledgment

My Acknowledgment to

- team who work with me on **EC058G research activity.**
- Conference Series Ltd
- **Natural Hazards and Disaster Management**