

APPENDICES

- Appendix 1** Rebecca OPS, Zuliana R, Boyce AN and Chandran S (2008). Determining pigment extraction efficiency and pigment stability of dragon fruit (*Hylocereus polyrhizus*). Journal of Biological Sciences 8 (7): 1174 – 1180
- Appendix 2** Silver Medal Award in the University of Malaya Research Expo 2009
- Appendix 3** Rebecca OPS, Boyce AN and Chandran S (2010). Pigment identification and antioxidant properties of red dragon fruit (*Hylocereus polyrhizus*) African Journal of Biotechnology: 9 (10): 1450 – 1454
- Appendix 4** Rebecca OPS, Boyce AN and Chandran S (2012).). Isolation and identification of myo-inositol crystals from dragon fruit (*Hylocereus polyrhizus*). Molecules 17: 4583 - 4594
- Appendix 5** The official result for all the analysis carried out on the *Hylocereus polyrhizus* extract from Consolidated Laboratory (M) Sdn Bhd
- Appendix 6** The official result for all the analysis carried out on the *Hylocereus polyrhizus* extract from Consolidated Laboratory (M) Sdn Bhd
- Appendix 7** List of the tested organochlorine insecticides
- Appendix 8** List of the tested organophosphorus insecticides
- Appendix 9** Wizard^R SV gel and PCR purification Clean-up system (Promega) quick protocol

Appendix 10: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW

Volume		Replicate 1	Replicate 2	Replicate 3	Average
5ml	pH	5.34	5.43	5.48	5.43 ± 0.07
	Absorbance at 538nm	2.781	2.781	2.810	2.782±0.017
	Betalain concentration (mg/L)	25.50	25.50	25.76	25.59 ± 0.15

Appendix 11: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 10ml of SDW

Volume		Replicate 1	Replicate 2	Replicate 3	Average
10ml	pH	5.39	5.48	5.47	5.54 ± 0.05
	Absorbance at 538nm	2.769	2.727	2.808	2.760±0.041
	Betalain concentration (mg/L)	25.38	24.50	25.74	25.21 ± 0.64

Appendix 12: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 15ml of SDW

Volume		Replicate 1	Replicate 2	Replicate 3	Average
15ml	pH	5.50	5.42	5.37	5.43 ± 0.07
	Absorbance at 538nm	2.725	2.721	2.733	2.721±0.006
	Betalain concentration (mg/L)	24.98	24.94	25.05	24.99 ± 0.06

Appendix 13: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 25ml of SDW

Volume		Replicate 1	Replicate 2	Replicate 3	Average
25ml	pH	5.53	5.43	5.48	5.47 ± 0.05
	Absorbance at 538nm	2.744	2.721	2.598	2.642±0.079
	Betalain concentration (mg/L)	25.15	24.94	23.82	24.64 ± 0.72

Appendix 14: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes

Temperature		Replicate 1	Replicate 2	Replicate 3	Average
RT	pH	5.34	5.43	5.29	5.35 ± 0.07
	Absorbance at 538nm	2.831	2.865	2.884	2.860±0.027
	Betalain concentration (mg/L)	25.95	26.26	26.44	26.22 ± 0.25

Appendix 15: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 40°C for 10 minutes

Temperature		Replicate 1	Replicate 2	Replicate 3	Average
40°C	pH	5.32	5.23	5.26	5.27 ± 0.05
	Absorbance at 538nm	2.789	2.813	2.784	2.795±0.016
	Betalain concentration (mg/L)	25.57	25.79	25.52	25.62 ± 0.14

Appendix 16: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 60°C for 10 minutes

Temperature		Replicate 1	Replicate 2	Replicate 3	Average
60°C	pH	5.29	5.20	5.25	5.25 ± 0.05
	Absorbance at 538nm	2.806	2.874	2.845	2.842±0.034
	Betalain concentration (mg/L)	25.72	26.35	26.08	26.05 ± 0.32

Appendix 17: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 80°C for 10 minutes

Temperature		Replicate 1	Replicate 2	Replicate 3	Average
80°C	pH	5.23	5.20	5.18	5.20 ± 0.03
	Absorbance at 538nm	2.869	2.781	2.778	2.809±0.052
	Betalain concentration (mg/L)	26.30	25.49	25.47	25.75 ± 0.47

Appendix 18: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes

Temperature		Replicate 1	Replicate 2	Replicate 3	Average
100°C	pH	5.30	5.27	5.26	5.28 ± 0.02
	Absorbance at 538nm	2.835	2.901	2.849	2.862±0.035
	Betalain concentration (mg/L)	25.99	26.59	26.11	26.23 ± 0.32

Appendix 19: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes before keeping for one week at RT, exposed to light.

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.73	5.87	6.23	5.94 ± 0.26
Absorbance at 538nm	2.872	2.813	2.974	2.886±0.081
Betalain concentration (mg/L)	26.33	25.70	27.26	26.43 ± 0.78

Appendix 20: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes after keeping for one week at RT, exposed to light.

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.94	6.09	5.59	5.87 ± 0.26
Absorbance at 538nm (11 times dilution)	0.454	0.667	0.894	0.672±0.220
Betalain concentration (mg/L)	45.78	66.65	90.15	67.53±22.20

Appendix 21: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes before keeping for one week at RT in the dark.

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.58	6.20	6.13	5.97 ± 0.34
Absorbance at 538nm	2.804	2.858	2.843	2.835±0.028
Betalain concentration (mg/L)	25.70	26.20	26.06	25.99 ± 0.25

Appendix 22: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes after keeping for one week at RT in the dark.

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.90	6.05	5.58	5.84 ± 0.24
Absorbance at 538nm (11 times dilution)	0.809	0.448	0.793	0.683±0.204
Betalain concentration (mg/L)	81.57	45.17	79.96	68.90 ± 20.57

Appendix 23: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes before keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.86	5.69	5.52	5.69 ± 0.17
Absorbance at 538nm	2.905	2.870	2.800	2.858 ± 0.053
Betalain concentration (mg/L)	26.63	26.31	25.67	26.20 ± 0.49

Appendix 24: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes after keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.95	5.72	5.59	5.75 ± 0.18
Absorbance at 538nm (11 times dilution)	1.052	0.832	0.936	0.940 ± 0.110
Betalain concentration (mg/L)	106.08	83.89	94.38	94.78 ± 11.10

Appendix 25: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes before keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.46	5.45	5.55	5.49 ± 0.06
Absorbance at 538nm	2.933	2.830	2.851	2.871±0.054
Betalain concentration (mg/L)	26.89	25.94	26.13	26.32 ± 0.50

Appendix 26: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at RT for 10 minutes after keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.56	5.55	5.59	5.57 ± 0.02
Absorbance at 538nm (11 times dilution)	0.662	0.700	0.517	0.626±0.097
Betalain concentration (mg/L)	66.75	70.58	52.13	63.15 ± 9.74

Appendix 27: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes before keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.25	5.22	5.28	5.25 ± 0.03
Absorbance at 538nm	2.763	2.836	2.780	2.793±0.038
Betalain concentration (mg/L)	25.33	26.00	25.48	25.60 ± 0.35

Appendix 28: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes after keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	6.64	5.64	5.77	6.02 ± 0.54
Absorbance at 538nm (11 times dilution)	1.298	1.134	1.408	1.280±0.138
Betalain concentration (mg/L)	130.88	114.35	141.97	129.07±13.90

Appendix 29: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes before keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.33	5.30	5.28	5.30 ± 0.03
Absorbance at 538nm	2.827	2.790	2.828	2.815±0.022
Betalain concentration (mg/L)	25.91	25.58	25.92	25.80 ± 0.19

Appendix 30: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes after keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.96	5.17	5.99	5.71 ± 0.47
Absorbance at 538nm (11 times dilution)	0.454	0.667	0.894	0.672±0.220
Betalain concentration (mg/L)	45.78	67.26	90.15	67.73±22.19

Appendix 31: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes before keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.38	5.39	5.38	5.38 ± 0.01
Absorbance at 538nm	2.774	2.800	2.821	2.798±0.024
Betalain concentration (mg/L)	25.43	25.67	25.86	25.65 ± 0.22

Appendix 32: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes after keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.53	5.57	5.56	5.55 ± 0.02
Absorbance at 538nm (11 times dilution)	0.932	1.033	0.851	0.939±0.091
Betalain concentration (mg/L)	93.98	104.16	85.81	94.65 ± 9.19

Appendix 33: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes before keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.35	5.33	5.33	5.34 ± 0.01
Absorbance at 538nm	2.759	2.814	2.794	2.789±0.028
Betalain concentration (mg/L)	25.29	25.80	25.61	25.57 ± 0.26

Appendix 34: pH measurement, absorbance reading and total betalain concentration of 5g of dragon fruit pulp in 5ml of SDW at 100°C for 10 minutes after keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.43	5.42	5.45	5.43 ± 0.02
Absorbance at 538nm (11 times dilution)	1.122	0.981	0.954	1.019±0.090
Betalain concentration (mg/L)	113.14	98.92	96.20	102.75±9.10

Appendix 35: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes before keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.81	4.86	4.86	4.84 ± 0.03
Absorbance at 538nm (11 times dilution)	2.552	2.532	2.241	2.440±0.174
Betalain concentration (mg/L)	257.33	255.31	225.97	246.2±17.55

Appendix 36: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes after keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.95	5.02	4.85	4.94 ± 0.09
Absorbance at 538nm (11 times dilution)	0.592	0.658	0.765	0.672±0.087
Betalain concentration (mg/L)	59.69	66.35	77.14	67.7 3± 8.81

Appendix 37: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes before keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.87	4.88	4.88	4.88 ± 0.01
Absorbance at 538nm (11 times dilution)	2.368	2.530	2.430	2.443±0.082
Betalain concentration (mg/L)	238.77	255.11	245.03	246.3±8.24

Appendix 38: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes after keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.48	4.76	4.70	4.65 ± 0.15
Absorbance at 538nm (11 times dilution)	2.084	2.158	2.299	2.180±0.109
Betalain concentration (mg/L)	210.14	217.60	23.18	219.85±11.01

Appendix 39: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes before keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.88	4.89	4.89	4.89 ± 0.01
Absorbance at 538nm (11 times dilution)	2.567	2.571	2.656	2.598±0.050
Betalain concentration (mg/L)	258.84	259.24	267.81	261.96±5.07

Appendix 40: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes after keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.05	5.06	5.07	5.06 ± 0.01
Absorbance at 538nm (11 times dilution)	2.355	2.286	2.132	2.258±0.114
Betalain concentration (mg/L)	237.46	230.51	214.98	227.65±11.51

Appendix 41: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes before keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.89	4.90	4.89	4.89 ± 0.01
Absorbance at 538nm (11 times dilution)	2.474	2.250	2.318	2.347±0.115
Betalain concentration (mg/L)	249.46	226.88	233.73	236.69±11.58

Appendix 42: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at RT for 10 minutes after keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.97	5.00	5.00	4.99 ± 0.02
Absorbance at 538nm (11 times dilution)	2.688	2.351	2.472	2.503±0.171
Betalain concentration (mg/L)	271.04	237.06	249.26	252.45±17.21

Appendix 43: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes before keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.64	4.66	4.68	4.66 ± 0.02
Absorbance at 538nm (11 times dilution)	2.598	2.479	2.644	2.573±0.085
Betalain concentration (mg/L)	261.97	249.97	266.60	259.51±8.58

Appendix 44: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes after keeping for one week at RT, exposed to light

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.97	4.70	4.66	4.78 ± 0.17
Absorbance at 538nm (11 times dilution)	1.993	2.051	2.245	2.096±0.132
Betalain concentration (mg/L)	200.96	206.81	226.37	211.38±13.31

Appendix 45: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes before keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.64	4.63	4.63	4.63 ± 0.01
Absorbance at 538nm (11 times dilution)	2.725	2.219	2.48	2.475±0.253
Betalain concentration (mg/L)	274.77	223.75	250.07	249.53±25.51

Appendix 46: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes after keeping for one week at RT in the dark

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.86	4.66	4.76	4.76 ± 0.1
Absorbance at 538nm (11 times dilution)	2.176	1.756	2.127	2.020±0.230
Betalain concentration (mg/L)	219.41	177.06	214.47	203.65±23.16

Appendix 47: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes before keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.65	4.64	4.67	4.65 ± 0.02
Absorbance at 538nm (11 times dilution)	2.339	2.480	2.741	2.520±0.204
Betalain concentration (mg/L)	235.85	250.07	276.38	254.1±20.56

Appendix 48: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes after keeping for one week at 4°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.04	5.03	5.04	5.04 ± 0.01
Absorbance at 538nm (11 times dilution)	2.155	1.992	2.161	2.103±0.096
Betalain concentration (mg/L)	217.30	200.86	217.90	212.02±9.67

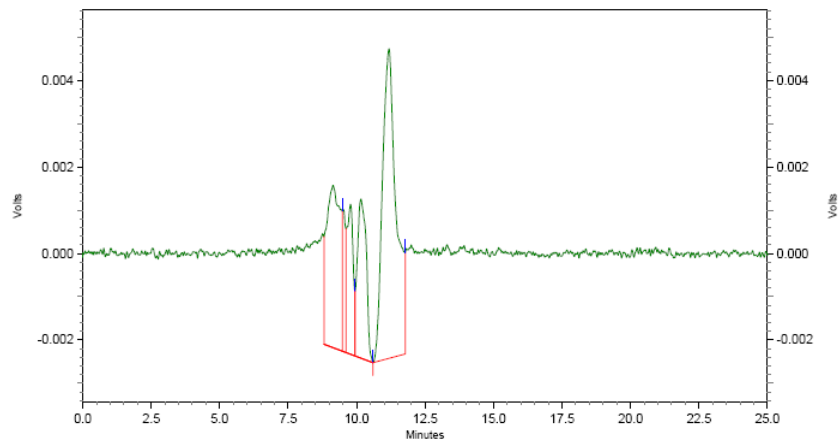
Appendix 49: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes before keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	4.69	4.69	4.70	4.69 ± 0.01
Absorbance at 538nm (11 times dilution)	2.617	2.340	2.313	2.423±0.168
Betalain concentration (mg/L)	263.88	235.95	233.23	244.35±16.97

Appendix 50: pH measurement, absorbance reading and total betalain concentration of 5ml of dragon fruit juice concentrate extracted at 100°C for 10 minutes after keeping for one week at -20°C

	Replicate 1	Replicate 2	Replicate 3	Average
pH	5.10	5.10	5.04	5.08 ± 0.03
Absorbance at 538nm (11 times dilution)	2.039	1.883	2.154	2.025±0.136
Betalain concentration (mg/L)	205.60	189.87	217.20	204.22±13.72

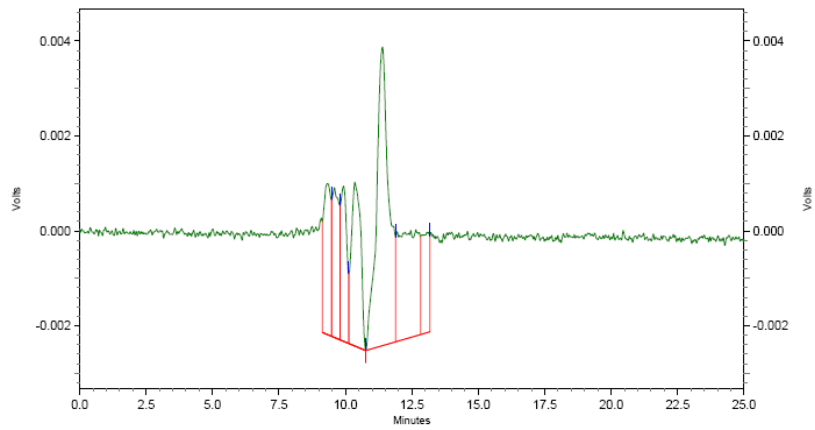
Appendix 51 Dragon fruit sample HPLC analysis 1



Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
1		9.133	132755	3753
2		9.775	54531	3468
3		10.158	84144	3680
4		11.183	248589	7157

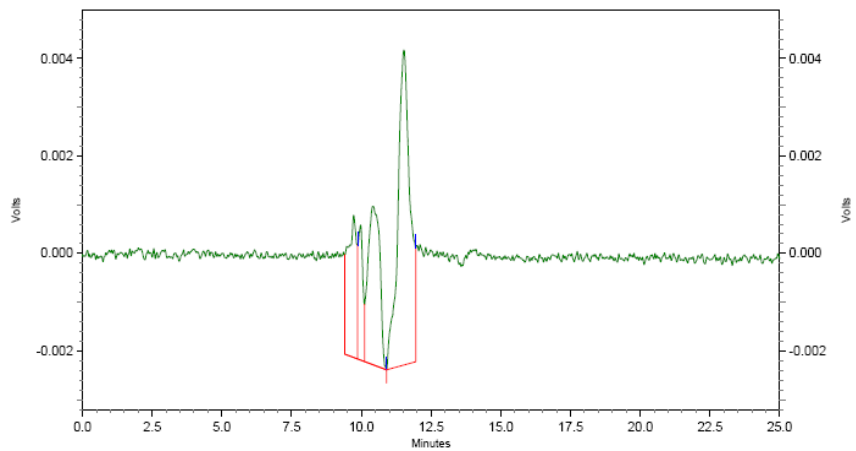
Appendix 52 Dragon fruit sample HPLC analysis 2



Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
1		9.317	61567	3180
2		9.583	56592	3154
3		9.925	52358	3269
4		10.350	85918	3451
5		11.392	203083	6296
6		13.067	43722	2114

Appendix 53 Dragon fruit sample HPLC analysis 3



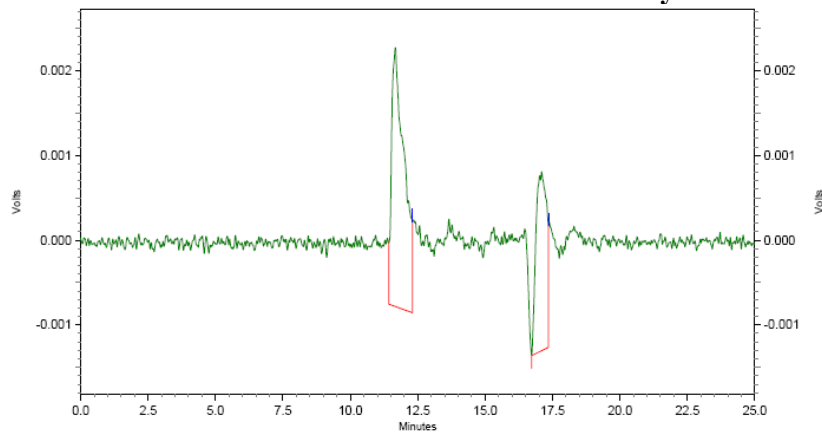
Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
1		9.725	67026	2917
2		10.425	97171	3253
3		11.525	195438	6465

Appendix 54 Retention time and area of dragon fruit sample obtained from HPLC

	Replicate 1	Replicate 2	Replicate 3	Average
Retention Time	11.18	11.39	11.53	11.37 ± 0.17
Area	248589	203083	195438	215703.3 ± 28735.2

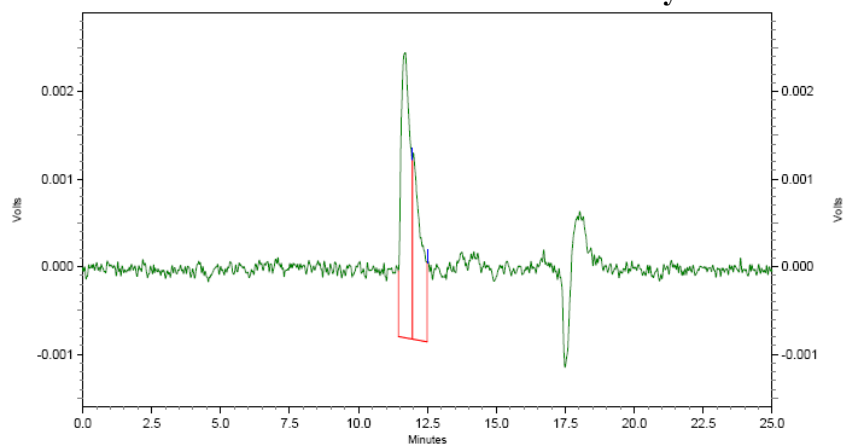
Appendix 55 Betanin standard from beet root in HPLC analysis 1



Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
1		11.667	100276	3054
2		17.092	58173	2113

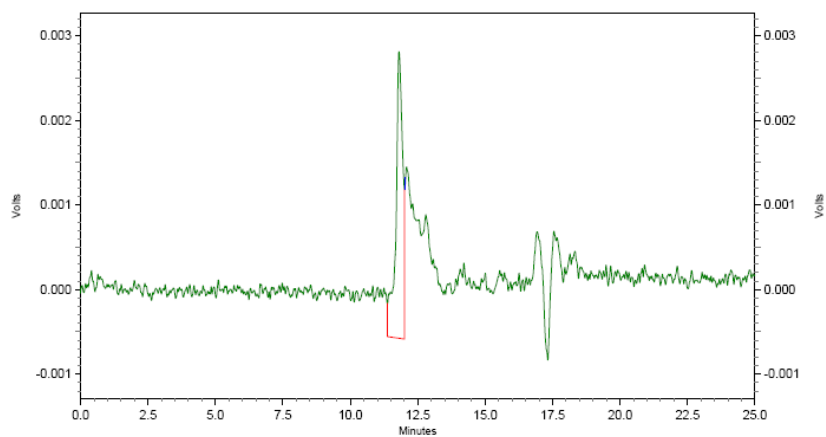
Appendix 56 Betanin standard from beet root in HPLC analysis 2



Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
1		11.692	74450	3263
2		11.992	45661	2129

Appendix 57 Betanin standard from beet root in HPLC analysis 3



Detector A - 1
(538nm)

Pk #	Name	Retention Time	Area	Height
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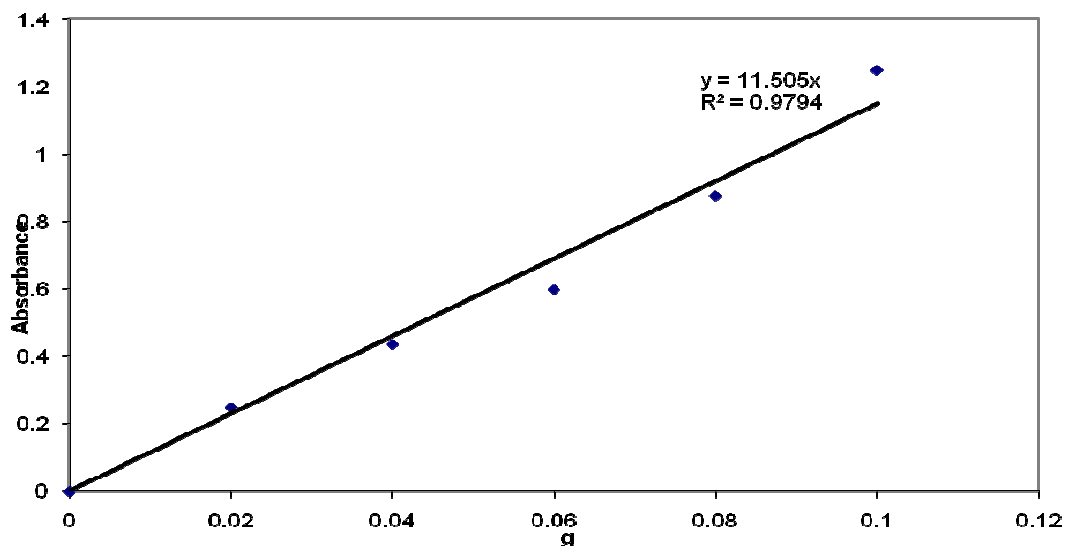
11.800		59775	3390
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Appendix 58 Retention time and area of dragon fruit sample obtained from HPLC

	Replicate 1	Replicate 2	Replicate 3	Average
Retention Time	11.7	11.7	11.8	11.73 ± 0.06
Area	100276	74450	59775	78167 ± 20504.75

Appendix 59 Gallic acid standard curve for total polyphenolic content determination

Total polyphenol standard curve (Gallic acid)



Appendix 60 Total polyphenolic content determination in dragon fruit sample

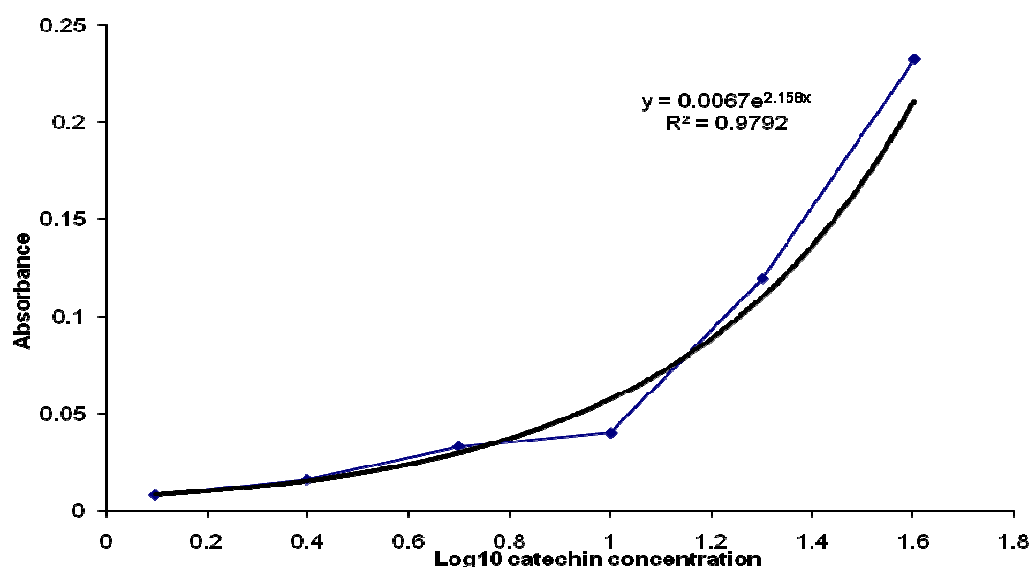
Sample (g)		Replicate 1	Replicate 2	Replicate 3	Average
0.5	Absorbance	0.929	1.045	1.031	1.00 ± 0.06
	Total polyphenol (mg)	94.8	106.7	104.2	101.9 ± 6.27

Appendix 61 Reducing power assay in dragon fruit sample

Sample (g)	Absorbance			Average
	Replicate 1	Replicate 2	Replicate 3	
0.03125	0.16	0.18	0.193	0.178 ± 0.017
0.0625	0.399	0.427	0.45	0.425 ± 0.026
0.125	0.77	0.809	0.85	0.810 ± 0.04
0.25	1.375	1.427	1.464	1.422 ± 0.045
0.5	2.154	2.456	2.484	2.365 ± 0.183

Appendix 62 Catechin standard for Vanillin-HCl assay in dragon fruit sample

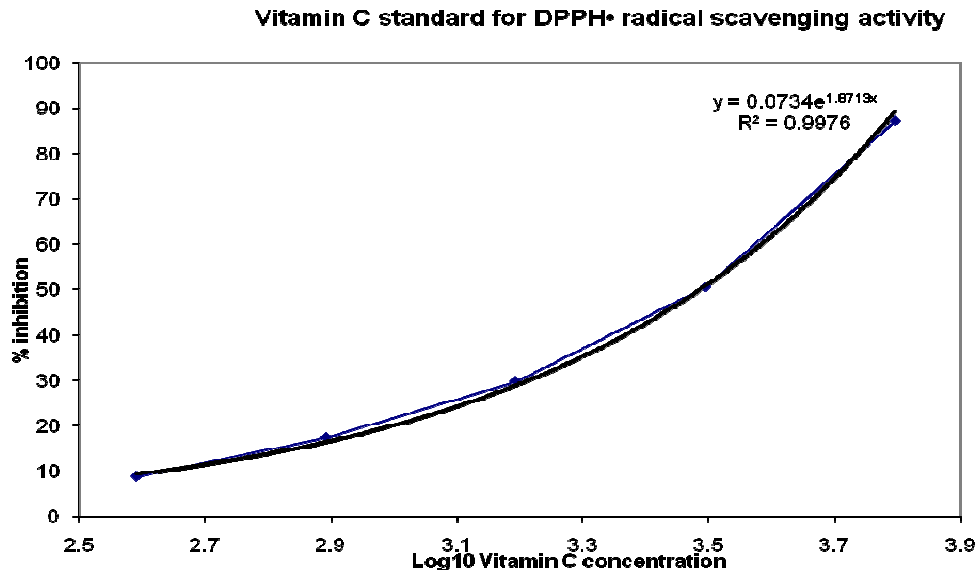
Catechin standard for Vanillin-HCl assay



Appendix 63 Vanillin-HCl assay in dragon fruit sample

Sample (g)		Replicate 1	Replicate 2	Replicate 3	Average
0.5	Absorbance	0.013	0.015	0.015	0.014 ± 0.001
	Catechin equivalent (mg/g)				2.30 ± 0.2

Appendix 64 Vitamin C standard curve for DPPH[•] radical scavenging activity in dragon fruit sample



Appendix 65 % of inhibition in DPPH[•] radical scavenging activity in dragon fruit sample

