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APPENDICES

Appendix A Data of mechanical properties of plastic cards

Table A1 Young's modulus of plastic cards before exposure

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
Non exposure	1	1498.00	1066.00	1131.00
	2	1445.00	1154.00	1150.00
	3	1232.00	1076.00	1096.00
	4	1203.00	1024.00	1246.00
	5	1273.00	1003.00	1299.00
Average		1330.20	1064.60	1184.40
SD		132.69	58.24	84.82

Table A2 Young's modulus of plastic cards after exposure in QUV accelerated weathering tester

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
QUV 1 cycle	1	1176.00	1458	1131.00
	2	1139.00	1531	1150.00
	3	1073.00	1285	1096.00
	4	1119.00	1353	1246.00
	5	1179.00	1382	1299.00
Average		1137.20	1401.8	1495.60
SD		43.90	95.22	63.12

Table A2 Young's modulus of plastic cards after exposure in QUV accelerated weathering tester (continue)

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
QUV 3 cycles	1	1030.00	1046	1542
	2	1099.00	1157.00	1461
	3	1259.00	1139.00	1521
	4	1279.00	1123.00	1552
	5	1056.00	1090.00	1402
Average		1330.20	1144.60	1111.00
SD		132.69	116.42	43.90
QUV 6 cycles	1	1379.00	1114.00	1150.00
	2	1219.00	1123.00	1109.00
	3	1263.00	1170.00	1147.00
	4	1332.00	1210.00	1051.00
	5	1358.00	1099.00	1008.00
Average		1330.20	1310.20	1143.20
SD		132.69	67.15	45.81
QUV 9 cycles	1	1492.00	1216.00	1269.00
	2	1329.00	1223.00	1284.00
	3	1279.00	1149.00	1395.00
	4	1275.00	1199.00	1165.00
	5	1305.00	1219.00	1275.00
Average		1330.20	1336.00	1201.20
SD		132.69	89.88	30.58

Table A2 Young's modulus of plastic cards after exposure in QUV accelerated weathering tester (continue)

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
QUV 12 cycles	1	1572.00	1259.00	1341.00
	2	1293.00	1077.00	1343.00
	3	1279.00	1233.00	1213.00
	4	1472.00	1336.00	1372.00
	5	1353.00	1173.00	1209.00
Average		1330.20	1393.80	1215.60
SD		132.69	125.37	97.09
QUV 15 cycles	1	1209	1180	1299.00
	2	1545	1103	1403.00
	3	1326	1107	1108.00
	4	1432	1129	1322.00
	5	1405	1279	1322.00
Average		1330.20	1383.4	1159.6
SD		132.69	125.15	73.45

Table A3 Young's modulus of plastic cards after outdoor exposure

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
Outdoor 1 month	1	1269.00	1038.00	1280.00
	2	1236.00	1077.00	1217.00
	3	1342.00	1097.00	1229.00
	4	1206.00	1017.00	1190.00
	5	1229.00	1086.00	1223.00

Table A3 Young's modulus of plastic cards after outdoor exposure (continue)

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
Outdoor 2 months	1	1455.00	1172.00	1518.00
	2	1581.00	1149.00	1501.00
	3	1388.00	1253.00	1287.00
	4	1316.00	1216.00	1219.00
	5	1594.00	1213.00	1382.00
Average		1466.80	1200.60	1381.40
SD		120.74	40.67	130.62
Outdoor 3 months	1	1253.00	1104.00	1273.00
	2	1330.00	1123.00	1007.00
	3	1438.00	924.00	1224.00
	4	1446.00	1050.00	1073.00
	5	1441.00	1123.00	1312.00
Average		1381.60	1064.80	1177.80
SD		86.69	84.19	131.68
Outdoor 4 months	1	1142.00	1083.00	1025.00
	2	1339.00	1031.00	1128.00
	3	1438.00	967.00	1327.00
	4	1411.00	1044.00	1139.00
	5	1425.00	914.00	1159.00
Average		1351.00	1007.80	1155.60
SD		122.95	67.02	108.95

Table A3 Young's modulus of plastic cards after outdoor exposure (continue)

Condition	Sample Number	The average Young's modulus (MPa)		
		PVC	PETG	PC
Outdoor 5 months	1	1346.00	1050.00	1319.00
	2	1329.00	954.00	1243.00
	3	1250.00	1003.00	1115.00
	4	1466.00	1030.00	1253.00
	5	1239.00	941.00	1329.00
Average		1326.00	995.60	1251.80
SD		91.32	47.19	85.54
Outdoor 6 months	1	1309.00	1070.00	1205.00
	2	1033.00	1012.00	1226.00
	3	1156.00	981.00	1068.00
	4	1216.00	857.00	1269.00
	5	1202.00	929.00	1227.00
Average		1183.20	969.80	1199.00
SD		100.69	81.14	76.83

Table A4 Tensile strength of plastic cards before exposure

Condition	Sample Number	The average tensile strength (GPa)		
		PVC	PETG	PC
Non exposure	1	57.16	54.06	68.46
	2	54.63	47.66	70.98
	3	50.53	49.08	74.23
	4	51.31	50.68	68.49
	5	52.76	52.69	69.33
Average		53.28	50.83	70.30
SD		2.67	2.60	2.42

Table A5 Tensile strength of plastic cards after exposure in QUV accelerated weathering tester

Condition	Sample Number	The average tensile strength (GPa)		
		PVC	PETG	PC
QUV 1 cycle	1	49.84	65.94	55.94
	2	49.28	71.54	58.88
	3	49.01	68.15	56.26
	4	45.29	62.25	57.75
	5	49.04	68.25	54.81
Average		48.49	67.23	56.73
SD		1.82	3.42	1.59
QUV 3 cycles	1	48.20	49.38	62.79
	2	48.48	49.28	62.45
	3	49.80	49.94	63.66
	4	48.54	51.41	62.85
	5	44.01	47.03	63.83
Average		47.81	49.41	63.12
SD		2.21	1.58	0.60
QUV 6 cycles	1	48.05	48.39	62.93
	2	43.40	43.53	64.86
	3	45.85	47.90	65.16
	4	48.18	49.10	66.90
	5	50.84	45.04	63.99
Average		47.26	46.79	64.77
SD		2.79	2.39	1.48

Table A5 Tensile strength of plastic cards after exposure in QUV accelerated weathering tester (continue)

Condition	Sample Number	The average tensile strength (GPa)		
		PVC	PETG	PC
QUV 9 cycles	1	50.75	48.64	63.86
	2	54.26	45.43	63.53
	3	50.58	45.35	64.66
	4	50.58	53.19	62.99
	5	51.01	52.16	58.91
Average		51.44	48.95	62.79
SD		1.59	3.67	2.25
QUV 12 cycles	1	58.76	46.44	72.35
	2	54.65	52.26	69.94
	3	54.79	50.94	61.14
	4	53.13	52.20	68.09
	5	55.06	47.61	61.98
Average		55.28	49.89	66.70
SD		2.09	2.70	4.94
QUV 15 cycles	1	42.18	31.21	64.94
	2	48.56	48.14	66.11
	3	48.09	47.41	66.41
	4	47.06	44.48	62.83
	5	50.49	53.19	69.23
Average		47.28	44.89	65.90
SD		3.11	8.26	2.33

Table A6 Tensile strength of plastic cards after outdoor exposure

Condition	Sample Number	The average tensile strength (GPa)		
		PVC	PETG	PC
Outdoor 1 month	1	51.80	50.45	65.14
	2	40.25	49.15	61.61
	3	42.89	50.83	68.69
	4	46.65	49.15	59.56
	5	52.99	53.00	65.50
Average		46.92	50.52	64.10
SD		5.51	1.58	3.57
Outdoor 2 months	1	45.06	55.89	69.26
	2	34.95	49.18	86.13
	3	37.65	35.09	67.49
	4	32.61	37.30	69.60
	5	48.03	39.41	68.79
Average		39.66	43.37	72.25
SD		6.62	8.82	7.80
Outdoor 3 months	1	29.89	37.46	65.30
	2	33.30	35.80	65.24
	3	38.76	32.45	63.39
	4	43.33	32.69	65.90
	5	38.76	33.68	64.16
Average		36.81	34.42	64.80
SD		5.25	2.16	1.01

Table A6 Tensile strength of plastic cards after outdoor exposure (continue)

Condition	Sample Number	The average tensile strength (GPa)		
		PVC	PETG	PC
Outdoor 4 months	1	27.99	34.71	57.25
	2	34.03	28.46	61.95
	3	33.54	29.81	68.39
	4	37.83	27.46	66.24
	5	40.48	23.79	63.63
Average		34.77	28.85	63.49
SD		4.74	3.97	4.27
Outdoor 5 months	1	30.65	32.00	63.33
	2	37.35	21.73	65.04
	3	30.69	27.89	66.68
	4	38.69	28.24	67.99
	5	25.58	27.65	64.03
Average		32.59	27.50	65.41
SD		5.40	3.69	1.91
Outdoor 6 months	1	29.68	31.90	68.05
	2	21.93	23.19	63.93
	3	26.19	35.25	67.18
	4	35.09	31.16	68.29
	5	25.89	35.58	65.38
Average		27.75	31.42	66.56
SD		4.93	5.00	1.87

Table A7 Toughness of plastic cards before exposure

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
Non exposure	1	9.30	87.29	43.05
	2	7.73	81.40	62.77
	3	7.13	*	50.09
	4	10.50	84.41	
	5			
Average		51.97	8.66	84.37
SD		9.99	1.53	2.95

Table A8 Toughness of plastic cards after exposure in QUV accelerated weathering tester

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
QUV 1 cycle	1	77.64		9.63
	2	74.19	6.64	25.78
	3	79.31	13.57	
	4	74.74		14.12
	5	78.45	11.57	9.03
Average		76.87	10.59	14.64
SD		2.28	3.57	7.77

Table A8 Toughness of plastic cards after exposure in QUV accelerated weathering tester (continue)

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
QUV 3 cycles	1	20.55	2.15	19.87
	2	19.51	2.35	11.86
	3	10.49	8.85	
	4	9.35	6.68	15.37
	5			17.60
Average		14.98	5.01	16.18
SD		5.87	3.31	3.41
QUV 6 cycles	1	3.77		12.53
	2	2.56	1.96	13.16
	3	3.76	1.74	11.59
	4	4.81		
	5	3.79	1.68	16.13
Average		3.74	1.79	13.35
SD		0.80	0.15	1.96
QUV 9 cycles	1	2.69	3.49	14.93
	2	3.00	1.82	9.51
	3	2.82	2.06	5.43
	4	2.84	2.41	17.90
	5	2.22	1.92	10.42
Average		2.71	2.34	11.64
SD		0.30	0.68	4.86

Table A8 Toughness of plastic cards after exposure in QUV accelerated weathering tester (continue)

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
QUV 12 cycles	1	3.77	1.77	8.06
	2	3.13	1.91	8.85
	3	3.45		3.29
	4	3.56		
	5	2.36	1.83	3.45
Average		3.25	1.83	5.91
SD		0.55	0.07	2.96
QUV 15 cycles	1	1.04	0.95	6.58
	2	1.77	1.69	5.65
	3	1.57	1.64	4.16
	4	1.11	1.68	3.15
	5	1.50	1.95	4.68
Average		1.40	1.58	4.84
SD		0.31	0.37	1.33

Table A9 Toughness of plastic cards after outdoor exposure

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
Outdoor 1 month	1	2.30		
	2	0.90	2.10	13.10
	3	0.90		
	4	1.70	2.10	16.80
	5	2.10	2.40	12.10
Average		1.58	2.20	14.00
SD		0.66	0.17	2.48
Outdoor 2 months	1	0.99		1518.00
	2	0.71	2.29	1501.00
	3	0.67	2.45	1287.00
	4	0.52	1.64	1219.00
	5	1.09	1.21	1382.00
Average		0.80	1.90	17.84
SD		0.24	0.58	3.53
Outdoor 3 months	1	0.39	1.02	1273.00
	2	0.51	0.93	1007.00
	3	0.71		1224.00
	4	0.92	0.92	1073.00
	5	0.71	1.05	1312.00
Average		0.65	0.98	19.73
SD		0.20	0.06	5.41

Table A9 Toughness of plastic cards after outdoor exposure (continue)

Condition	Sample Number	The average toughness (Mpa)		
		PVC	PETG	PC
Outdoor 4 months	1	0.38	1.31	8.12
	2	0.55	0.69	17.08
	3	0.50	0.73	9.64
	4	0.62	0.55	17.30
	5	0.74	0.35	
Average		0.56	0.72	13.04
SD		0.14	0.36	4.84
Outdoor 5 months	1	0.45	1.44	20.10
	2	0.70	0.33	6.14
	3	0.47	0.56	16.11
	4	0.75	0.55	
	5	0.33	0.79	6.83
Average		0.54	0.73	12.29
SD		0.18	0.43	6.91
Outdoor 6 months	1	0.41	0.54	12.19
	2	0.25	0.42	15.46
	3	0.36	1.07	10.64
	4	0.59	0.91	
	5	0.34	1.09	9.05
Average		0.39	0.80	11.84
SD		0.12	0.31	2.74

Appendix B M-file from MATLAB application

Curve fitting of PETG in QUV accelerated weathering tester condition

```
function PETGquv(2)(cycles,PETG_QUV)
% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[468 161 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

% --- Plot data originally in dataset "PETG_QUV vs. cycles"
cycles = cycles(:);
PETG_QUV = PETG_QUV(:);
h_     =     line(cycles,PETG_QUV,'Parent',ax_,'Color',[0.333333     0
0.666667],...
    'LineStyle','none', 'LineWidth',1,...
    'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(cycles));
xlim_(2) = max(xlim_(2),max(cycles));
legh_(end+1) = h_;
legt_{end+1} = 'PETG_QUV vs. cycles';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
    xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
    set(ax_,'XLim',xlim_)
else
    set(ax_, 'XLim',[-0.14999999999999999, 15.15]);
end

% --- Create fit "fit 10"
ok_ = isfinite(cycles) & isfinite(PETG_QUV);
if ~all( ok_ )
    warning( 'GenerateMFile:IgnoringNansAndInfs', ...
        'Ignoring NaNs and Infs in data' );
end
st_ = [0.4034236681765504 0.40579578503099578 0.10374116504003539 ];
ft_ = fittype('a*exp(-b*x)+c',...
    'dependent',{'y'},'independent',{'x'},...
    'coefficients',{'a', 'b', 'c'});

% Fit this model using new data
cf_ = fit(cycles(ok_),PETG_QUV(ok_),ft_,'Startpoint',st_);

% Or use coefficients from the original fit:
if 0
    cv_     =     {     -149.48706291622028,     -0.0023122487718120546,
199.97154482709175};
    cf_ = cfit(ft_,cv_{:});
```

```
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
set(h_(1),'Color',[1 0 0],...
    'LineStyle','-', 'LineWidth',2,...
    'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'fit 10';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');               % remove x label
ylabel(ax_,'');               % remove y label
```

Curve fitting of PETG in outdoor exposure condition

```
function PETGoutdoor(months,PETGoutdoor)
% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[445 130 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

% --- Plot data originally in dataset "PETGoutdoor vs. months"
months = months(:);
PETGoutdoor = PETGoutdoor(:);
h_ = line(months,PETGoutdoor,'Parent',ax_,'Color',[0.333333 0 0.666667],...
   'LineStyle','none', 'LineWidth',1,...
   'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(months));
xlim_(2) = max(xlim_(2),max(months));
legh_(end+1) = h_;
legt_{end+1} = 'PETGoutdoor vs. months';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
   xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
   set(ax_,'XLim',xlim_)
else
   set(ax_, 'XLim',[-0.059999999999999998, 6.0599999999999996]);
end

% --- Create fit "PETGoutdoor"
ok_ = isfinite(months) & isfinite(PETGoutdoor);
if ~all( ok_ )
   warning( 'GenerateMFile:IgnoringNansAndInfs', ...
      'Ignoring NaNs and Infs in data' );
end
st_ = [0.81356611039825466 0.78989849854332905 0 ];
ft_ = fittype('a*exp(-b*x)+c',...
   'dependent',{'y'},'independent',{'x'},...
   'coefficients',{'a', 'b', 'c'});

% Fit this model using new data
cf_ = fit(months(ok_),PETGoutdoor(ok_),ft_,'Startpoint',st_);

% Or use coefficients from the original fit:
```

```
if 0
   cv_ = { 35.392820291069128, 0.22246979603131042, 18.122280013205163};
   cf_ = cfit(ft_,cv_{:});
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
set(h_(1),'Color',[1 0 0],...
   'LineStyle','-', 'LineWidth',2,...
   'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'PETGoutdoor';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');               % remove x label
ylabel(ax_,'');               % remove y label
```

Curve fitting of PVC in QUV accelerated weathering tester condition

```
function PVC_QUV(2) (cycles,PVC_quv)

% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[468 161 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

% --- Plot data originally in dataset "PVC_quv vs. cycles"
cycles = cycles(:);
PVC_quv = PVC_quv(:);
h_     =     line(cycles,PVC_quv,'Parent',ax_,'Color',[0.333333     0
0.666667],...
    'LineStyle','none', 'LineWidth',1,...
    'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(cycles));
xlim_(2) = max(xlim_(2),max(cycles));
legh_(end+1) = h_;
legt_{end+1} = 'PVC_quv vs. cycles';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
    xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
    set(ax_,'XLim',xlim_)
else
    set(ax_, 'XLim',[-0.14999999999999999, 15.15]);
end

% --- Create fit "fit 8"
ok_ = isfinite(cycles) & isfinite(PVC_quv);
if ~all( ok_ )
    warning( 'GenerateMFile:IgnoringNansAndInfs', ...
        'Ignoring NaNs and Infs in data' );
end
st_ = [49.484912646585578 -0.00023531204776019597 ];
ft_ = fittype('exp1');

% Fit this model using new data
cf_ = fit(cycles(ok_),PVC_quv(ok_),ft_,'Startpoint',st_);

% Or use coefficients from the original fit:
if 0
    cv_ = { 50.240822811048055, -0.0035081032748280352};
    cf_ = cfit(ft_,cv_{:});
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
```

```
set(h_(1),'Color',[1 0 0],...
    'LineStyle','-', 'LineWidth',2,...
    'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'fit 8';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');                % remove x label
ylabel(ax_,'');                % remove y label
```

Curve fitting of PVC in outdoor exposure condition

```
function PVCoutdoor(months,PVC_outdoor)

% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[445 130 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

% --- Plot data originally in dataset "PVC_outdoor vs. months"
months = months(:);
PVC_outdoor = PVC_outdoor(:);
h_ = line(months,PVC_outdoor,'Parent',ax_,'Color',[0.333333 0 0.666667],...
   'LineStyle','none', 'LineWidth',1,...
   'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(months));
xlim_(2) = max(xlim_(2),max(months));
legh_(end+1) = h_;
legt_{end+1} = 'PVC_outdoor vs. months';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
   xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
   set(ax_,'XLim',xlim_)
else
   set(ax_, 'XLim',[-0.059999999999999998, 6.0599999999999996]);
end

% --- Create fit "fit 1"
ok_ = isfinite(months) & isfinite(PVC_outdoor);
if ~all( ok_ )
   warning( 'GenerateMFile:IgnoringNansAndInfs', ...
      'Ignoring NaNs and Infs in data' );
end
st_ = [0.17784684516935712 0.045968267438073251 0 ];
ft_ = fittype('a*exp(-b*x)+c',...
   'dependent',{'y'},'independent',{'x'},...
   'coefficients',{'a', 'b', 'c'});

% Fit this model using new data
cf_ = fit(months(ok_),PVC_outdoor(ok_),ft_,'Startpoint',st_);
```

```
% Or use coefficients from the original fit:
if 0
   cv_ = { 31.37143679394331, 0.24117156383780222, 21.778061385272551};
   cf_ = cfit(ft_,cv_{:});
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
set(h_(1),'Color',[1 0 0],...
   'LineStyle','-', 'LineWidth',2,...
   'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'fit 1';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');            % remove x label
ylabel(ax_,'');            % remove y label
```

Curve fitting of PC in QUV accelerated weathering tester condition

```
function PCquv(cycles,PCquv)

% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[445 130 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

 % --- Plot data originally in dataset "PCquv vs. cycles"
cycles = cycles(:);
PCquv = PCquv(:);
h_ = line(cycles,PCquv,'Parent',ax_,'Color',[0.333333 0 0.666667],...
   'LineStyle','none', 'LineWidth',1,...
   'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(cycles));
xlim_(2) = max(xlim_(2),max(cycles));
legh_(end+1) = h_;
legt_{end+1} = 'PCquv vs. cycles';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
   xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
   set(ax_,'XLim',xlim_)
else
   set(ax_, 'XLim',[-0.14999999999999999, 15.15]);
end

% --- Create fit "PCquv"
ok_ = isfinite(cycles) & isfinite(PCquv);
if ~all( ok_ )
   warning( 'GenerateMFile:IgnoringNansAndInfs', ...
      'Ignoring NaNs and Infs in data' );
end
st_ = [0.97608318138190564 0.33351083638846934 0 ];
ft_ = fittype('a*exp(-b*x)+c',...
   'dependent',{'y'},'independent',{'x'},...
   'coefficients',{'a', 'b', 'c'});

% Fit this model using new data
cf_ = fit(cycles(ok_),PCquv(ok_),ft_,'Startpoint',st_);
```

```
% Or use coefficients from the original fit:
if 0
   cv_ = { 0.15787490096316306, -0.19674672010657249, 63.362743688993163};
   cf_ = cfit(ft_,cv_{:});
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
set(h_(1),'Color',[1 0 0],...
   'LineStyle','-', 'LineWidth',2,...
   'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'PCquv';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');               % remove x label
ylabel(ax_,'');               % remove y label
```

Curve fitting of PC in outdoor exposure condition

```
function PCoutdoor(months,PC_outdoor)

% Set up figure to receive datasets and fits
f_ = clf;
figure(f_);
set(f_,'Units','Pixels','Position',[525 159 688 486]);
legh_ = []; legt_ = {};   % handles and text for legend
xlim_ = [Inf -Inf];       % limits of x axis
ax_ = axes;
set(ax_,'Units','normalized','OuterPosition',[0 0 1 1]);
set(ax_,'Box','on');
axes(ax_); hold on;

% --- Plot data originally in dataset "PC_outdoor vs. months"
months = months(:);
PC_outdoor = PC_outdoor(:);
h_ = line(months,PC_outdoor,'Parent',ax_,'Color',[0.333333 0 0.666667],...
   'LineStyle','none', 'LineWidth',1,...
   'Marker','.', 'MarkerSize',12);
xlim_(1) = min(xlim_(1),min(months));
xlim_(2) = max(xlim_(2),max(months));
legh_(end+1) = h_;
legt_{end+1} = 'PC_outdoor vs. months';

% Nudge axis limits beyond data limits
if all(isfinite(xlim_))
   xlim_ = xlim_ + [-1 1] * 0.01 * diff(xlim_);
   set(ax_,'XLim',xlim_)
else
   set(ax_, 'XLim',[-0.059999999999999998, 6.0599999999999996]);
end

% --- Create fit "PCoutdoor"
ok_ = isfinite(months) & isfinite(PC_outdoor);
if ~all( ok_ )
   warning( 'GenerateMFile:IgnoringNansAndInfs', ...
      'Ignoring NaNs and Infs in data' );
end
st_ = [0.073460944365362879 0.31894325856326611 0.41569900270098725 ];
ft_ = fittype('a*exp(-b*x)+c',...
   'dependent',{'y'},'independent',{'x'},...
   'coefficients',{'a', 'b', 'c'});

% Fit this model using new data
cf_ = fit(months(ok_),PC_outdoor(ok_),ft_,'Startpoint',st_);
```

```
% Or use coefficients from the original fit:
if 0
   cv_ = { 4.2898841519258122, 0.53601696113118547, 65.259105235906503};
   cf_ = cfit(ft_,cv_{:});
end

% Plot this fit
h_ = plot(cf_,'fit',0.95);
legend off;  % turn off legend from plot method call
set(h_(1),'Color',[1 0 0],...
   'LineStyle','-', 'LineWidth',2,...
   'Marker','none', 'MarkerSize',6);
legh_(end+1) = h_(1);
legt_{end+1} = 'PCoutdoor';

% Done plotting data and fits.  Now finish up loose ends.
hold off;
leginfo_ = {'Orientation', 'vertical', 'Location', 'NorthEast'};
h_ = legend(ax_,legh_,legt_,leginfo_{:});  % create legend
set(h_,'Interpreter','none');
xlabel(ax_,'');               % remove x label
ylabel(ax_,'');               % remove y label
```

Appendix C The goodness of curve fitting in MATLAB application

Table C1 The goodness of curve fitting in MATLAB application

Material	Exposing	R-square	Adjusted R-square	Sum of squares due to error	Root mean squared error (standard error)
PC	Outdoor	0.2027	-0.1959	52.72	3.63
	QUV	0.6297	-0.4055	98.87	4.972
PVC	Outdoor	0.9834	0.9752	7.569	1.376
	QUV	0.1482	-0.06478	26.86	2.591
PETG	Outdoor	0.8846	0.827	69.24	4.16
	QUV	0.7537	0.5074	5.391	1.642

Appendix D The daily integral UV radiation in Bangkok

Daily Integral UV-A Radiation, Joule/m^2

Station	Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)									Country		Thailand
Instrument	UV-A Radiometer (MS-212A)									Year		2010
Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	630,596	781,350	891,341	1,019,527	641,715		601,372	981,407	1,105,100	907,116	596,778	915,718
2	666,835	832,297	1,089,096	1,157,238	947,217		634,718	525,012	990,444	1,028,547	656,948	826,558
3	725,302	848,429	1,071,215	1,164,067	573,071		752,305	703,735	924,142	919,894	550,094	903,737
4	665,499	897,404	1,175,657	1,024,949			946,207	732,784	950,836	566,744	945,561	783,009
5	733,831	982,664	898,790	1,091,641			776,750	907,767	1,193,089	419,455	768,828	768,216
6	464,618	869,013	724,186	1,190,943			929,694	731,899	1,021,651	673,723	824,840	492,506
7	733,644	929,940	758,679	1,196,053	1,033,496		1,212,182	827,838	901,648	922,287	562,555	584,139
8	597,382	884,668	974,111	1,185,287	1,064,799		1,078,602	944,453	964,098	870,969	923,309	689,005
9	720,810	799,692	984,002	1,064,034	1,267,073		1,137,832	1,027,458	1,013,582	407,566	789,720	824,100
10	709,802	919,105	586,023	995,994	1,264,929		1,151,656	1,051,139	459,572	1,006,474	865,824	628,000
11	600,207	822,337	812,868	1,126,755	1,125,866		1,143,048	491,169	576,754	741,226	423,512	785,145
12	653,236	830,404	881,779	1,114,463	621,027		1,222,529	942,018	860,223	637,686	492,638	756,255
13	732,820	820,221	1,005,540	1,138,057	1,198,330		951,923	479,208	819,062	756,388	703,376	728,204
14	689,748	882,930	1,091,012	1,070,077	1,276,772		776,394	692,500	604,361	511,067	983,169	832,244
15	656,708	982,808	1,033,544	1,222,916	1,181,075		632,137	914,128	831,789	393,784	825,741	734,730
16	756,450	833,955	985,495	960,981	391,629		777,742	892,688	656,790	370,123	725,416	496,194
17	833,070	847,472	309,426	503,245	899,500		756,225	747,359	646,145	418,879	899,714	526,379
18	881,496	671,811	822,316	1,078,551	652,529		766,608	668,034	627,562	713,323	700,166	760,843
19	681,826	679,706	732,392	1,238,680			334,061	1,105,365	774,377	713,860	858,802	724,242
20	628,206	797,821	962,905	1,099,785			1,224,316	709,363	1,056,016	626,353	713,800	708,200
21	481,245	173,365	887,021	1,102,890			1,164,430	580,227	1,103,788	589,347	709,196	752,688
22	417,696	993,744	1,028,317	1,082,373			912,459	941,627	876,890	895,047	644,523	704,080
23	758,722	1,085,799	1,105,408	1,174,607			919,692	883,980	634,853	1,017,863	884,136	696,249
24	525,445	1,038,089	1,088,766	525,038		1,098,536	936,593	1,017,076	1,154,119	1,037,129	854,678	447,712
25	648,945	1,106,863	1,076,810	1,179,740		1,318,034	892,503	1,102,493	945,371	820,100	851,683	499,208
26	806,184	1,113,589	714,989	1,236,491		1,087,185	748,682	1,173,449	939,836	652,831	860,809	841,650
27	688,870	1,042,261	853,562	1,178,689		1,012,393	865,796	1,128,250	766,380	928,934	842,716	877,794
28	639,792	950,262	814,244			839,283	1,232,446	642,772	835,194	907,611	806,371	775,272
29	665,893		705,569			647,081	976,119	742,394	899,989	1,065,470	895,128	659,229
30	479,938		987,092	1,136,967		784,767	976,926	826,504	997,467	885,414	837,283	781,725
31	840,100		1,007,274				1,109,148	1,005,284		660,547		833,670
N	31	28	31	28	15	7	31	31	30	31	30	31
AVG	**668,223**	**872,071**	**905,143**	**1,080,716**	**942,602**	**969,611**	**920,680**	**842,561**	**871,038**	**744,057**	**766,577**	**720,539**
MAX	**881,496**	**1,113,589**	**1,175,657**	**1,238,680**	**1,276,772**	**1,318,034**	**1,232,446**	**1,173,449**	**1,193,089**	**1,065,470**	**983,169**	**915,718**
MIN	417,696	173,365	309,426	503,245	391,629	647,081	334,061	479,208	459,572	370,123	423,512	447,712

Daily Integral UV-A Radiation, Joule/m^2

Station	Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)									Country		Thailand
Instrument	UV-A Radiometer (MS-212A)									Year		2011
Date	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
1	842,689	705,322										
2	830,485	720,169										
3	798,129	763,110										
4	834,166	872,723										
5	839,255	516,490										
6	760,762	690,214										
7	865,753	803,852										
8	794,917	895,102										
9	876,861	933,044										
10	850,861	875,867										
11	677,529	913,184										
12	494,375	789,118										
13	805,540	877,426										
14	694,031	784,810										
15	783,216	610,300										
16	778,279	951,917										
17	750,344	1,008,939										
18	807,281	996,996										
19	795,697	958,595										
20	689,935	888,990										
21	831,318	495,657										
22	712,293	549,924										
23	726,633	665,031										
24	821,075	799,000										
25	860,564	867,459										
26	854,715	617,131										
27	778,457	512,949										
28	653,791	840,919										
29	787,173											
30	717,177											
31	787,609											
N	31	28	-	-	-	-	-	-	-	-	-	-
AVG	**777,449**	**782,294**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
MAX	**876,861**	**1,008,939**	-	-	-	-	-	-	-	-	-	-
MIN	494,375	495,657	-	-	-	-	-	-	-	-	-	-

Daily Integral UV-B Radiation, Joule/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-B Radiometer (MS-212W)**	**Year**	**2010**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	16,492	22,206	29,055	29,496	17,350		18,735	33,055	35,497	27,071	16,254	24,787
2	17,242	24,277	35,855	35,775	27,309		18,920	16,678	32,245	32,349	16,806	22,558
3	18,481	24,009	34,553	36,291	13,817		23,020	23,717	30,888	30,017	14,735	24,325
4	16,873	27,606	37,886	32,849			30,870	23,681	30,518	17,033	25,289	20,603
5	19,810	29,177	26,154	35,476			23,454	30,167	38,302	12,744	20,955	21,239
6	12,375	25,666	18,386	40,144			29,953	23,689	33,484	19,170	23,150	12,931
7	19,665	28,013	20,272	39,150	41,020		37,564	27,805	29,026	27,341	16,182	16,342
8	17,102	26,643	28,625	37,107	32,761		34,512	31,686	32,640	26,190	26,733	18,658
9	19,700	22,703	28,690	31,856	40,462		35,994	31,777	35,558	11,131	23,155	22,107
10	18,254	28,280	15,873	29,419	37,616		35,592	34,706	14,063	30,415	25,201	16,229
11	14,074	23,999	21,818	33,581	32,821		36,512	16,108	17,372	23,090	11,851	23,114
12	16,188	23,873	23,470	32,653	17,784		39,199	33,146	29,066	20,077	13,509	21,781
13	18,781	23,503	29,060	32,823	37,105		31,065	13,438	26,872	21,356	18,292	20,483
14	17,371	26,228	33,168	31,936	39,853		24,623	22,260	17,793	13,296	26,397	22,822
15	17,571	29,917	29,689	37,646	37,539		18,118	30,006	26,380	11,932	22,738	19,310
16	20,453	24,809	27,400	29,050	10,070		22,826	28,176	20,000	10,635	20,589	13,514
17	22,134	24,327	6,858	13,320	30,615		24,363	26,824	19,183	11,196	25,896	14,163
18	23,893	18,508	22,011	32,477	16,943		25,372	21,675	19,670	20,852	19,488	18,612
19	17,804	17,863	19,141	39,794			9,582	36,366	27,109	19,324	24,242	18,041
20	18,180	23,223	27,501	31,371			39,683	22,929	33,567	17,362	20,065	17,669
21	15,925	2,984	25,076	32,084			35,302	17,326	36,170	15,810	19,242	20,284
22	11,919	30,186	30,711	30,570			29,997	31,729	28,157	25,333	17,142	18,381
23	21,359	33,633	33,537	35,105			31,030	28,634	19,651	30,165	24,355	18,287
24	12,334	32,847	32,671	14,465		36,853	29,601	32,137	37,497	29,556	24,312	10,507
25	17,070	35,227	32,049	35,296		43,533	28,003	37,191	30,262	22,178	23,556	11,961
26	21,973	34,437	20,316	37,721		37,596	25,166	38,302	28,478	17,508	23,029	21,518
27	17,243	30,641	24,497	36,543		34,143	27,522	36,252	22,764	25,636	22,659	21,799
28	16,434	30,899	21,556			26,637	42,472	19,674	25,506	24,951	23,349	19,816
29	18,790		18,719			21,340	33,994	24,871	27,732	29,248	24,597	16,967
30	13,550		28,006	37,196		22,343	33,799	26,876	29,562	23,093	23,501	19,801
31	24,202		28,837				37,817	33,085		17,229		22,064
N	31	28	31	28	15	7	31	31	30	31	30	31
AVG	**17,847**	**25,917**	**26,176**	**32,900**	**28,871**	**31,778**	**29,505**	**27,547**	**27,834**	**21,396**	**21,242**	**19,054**
MAX	24,202	35,227	37,886	40,144	41,020	43,533	42,472	38,302	38,302	32,349	26,733	24,787
MIN	11,919	2,984	6,858	13,320	10,070	21,340	9,582	13,438	14,063	10,635	11,851	10,507

Daily Integral UV-B Radiation, Joule/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-B Radiometer (MS-212W)**	**Year**	**2011**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	23,180	19,371										
2	22,973	18,924										
3	22,100	20,058										
4	22,209	24,400										
5	22,478	12,959										
6	21,126	18,845										
7	23,159	22,791										
8	21,517	26,135										
9	24,033	28,370										
10	22,043	27,436										
11	17,282	28,528										
12	13,401	24,064										
13	19,729	26,203										
14	16,657	22,613										
15	18,756	16,588										
16	18,480	27,897										
17	17,592	29,034										
18	19,657	29,110										
19	19,950	26,672										
20	16,923	25,725										
21	21,007	14,706										
22	17,458	15,437										
23	17,945	18,932										
24	21,775	24,016										
25	22,645	26,741										
26	23,802	18,319										
27	22,160	13,536										
28	17,790	25,543										
29	21,714											
30	19,104											
31	21,317											
N	31	28	-	-	-	-	-	-	-	-	-	-
AVG	**20,321**	**22,605**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**	**#DIV/0!**
MAX	24,033	29,110	-	-	-	-	-	-	-	-	-	-
MIN	13,401	12,959	-	-	-	-	-	-	-	-	-	-

Daily Integral UV-AB Radiation, Joule/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-A Radiometer (MS-212A), UV-B Radiometer (MS-212W)**	**Year**	**2010**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	647,088	803,556	920,395	1,049,022	659,065		620,107	1,014,462	1,140,596	934,187	613,032	940,505
2	684,077	856,574	1,124,951	1,193,013	974,527		653,637	541,691	1,022,689	1,060,896	673,754	849,116
3	743,783	872,438	1,105,768	1,200,358	586,889		775,325	727,452	955,031	949,911	564,829	928,062
4	682,372	925,010	1,213,543	1,057,799			977,077	756,465	981,354	583,776	970,850	803,612
5	753,641	1,011,841	924,944	1,127,118			800,204	937,934	1,231,390	432,199	789,784	789,455
6	476,992	894,679	742,572	1,231,087			959,646	755,588	1,055,135	692,893	847,990	505,437
7	753,309	957,953	778,951	1,235,203	1,074,516		1,249,746	855,644	930,674	949,628	578,736	600,481
8	614,484	911,311	1,002,736	1,222,394	1,097,560		1,113,114	976,139	996,738	897,160	950,042	707,662
9	740,510	822,395	1,012,692	1,095,890	1,307,535		1,173,825	1,059,235	1,049,140	418,697	812,875	846,207
10	728,056	947,385	601,896	1,025,413	1,302,545		1,187,248	1,085,845	473,634	1,036,889	891,024	644,230
11	614,280	846,336	834,686	1,160,335	1,158,687		1,179,560	507,277	594,126	764,316	435,363	808,260
12	669,424	854,277	905,249	1,147,116	638,811		1,261,728	975,164	889,289	657,762	506,147	778,035
13	751,601	843,724	1,034,600	1,170,880	1,235,435		982,987	492,646	845,933	777,745	721,667	748,687
14	707,118	909,158	1,124,180	1,102,014	1,316,625		801,017	714,759	622,154	524,363	1,009,566	855,066
15	674,278	1,012,725	1,063,232	1,260,562	1,218,614		650,255	944,134	858,169	405,716	848,479	754,040
16	776,903	858,764	1,012,895	990,031	401,699		800,568	920,864	676,790	380,757	746,005	509,708
17	855,204	871,799	316,284	516,565	930,115		780,588	774,183	665,328	430,075	925,610	540,541
18	905,389	690,319	844,328	1,111,027	669,471		791,980	689,709	647,232	734,174	719,654	779,456
19	699,629	697,569	751,533	1,278,474			343,642	1,141,730	801,486	733,183	883,044	742,283
20	646,386	821,043	990,407	1,131,156			1,264,000	732,291	1,089,583	643,715	733,866	725,869
21	497,169		912,097	1,134,974			1,199,732	597,552	1,139,957	605,157	728,438	772,972
22	429,616	1,023,930	1,059,028	1,112,943			942,456	973,355	905,047	920,380	661,665	722,462
23	780,081	1,119,432	1,138,945	1,209,712			950,722	912,614	654,504	1,048,027	908,491	714,536
24	537,779	1,070,936	1,121,437	539,502		1,135,389	966,194	1,049,214	1,191,616	1,066,684	878,990	458,220
25	666,015	1,142,090	1,108,860	1,215,035		1,361,568	920,506	1,139,684	975,633	842,278	875,239	511,168
26	828,157	1,148,026	735,305	1,274,211		1,124,781	773,848	1,211,750	968,314	670,339	883,839	863,168
27	706,113	1,072,902	878,059	1,215,232		1,046,537	893,318	1,164,502	789,145	954,571	865,375	899,593
28	656,227	981,161	835,799			865,920	1,274,917	662,446	860,700	932,562	829,720	795,088
29	684,683		724,288			668,421	1,010,113	767,265	927,721	1,094,718	919,725	676,195
30	493,488		1,015,058	1,174,164		807,110	1,010,725	853,379	1,027,029	908,507	860,784	801,526
31	864,302		1,036,111				1,146,966	1,038,368		677,775	-	855,735
N	31	27	31	28	15	7	31	31	30	31	31	31
AVG	**686,070**	**924,716**	**931,318**	**1,113,615**	**971,473**	**1,001,389**	**950,186**	**870,108**	**898,871**	**765,453**	**762,406**	**739,593**
MAX	905,389	1,148,026	1,213,543	1,278,474	1,316,625	1,361,568	1,274,917	1,211,750	1,231,390	1,094,718	1,009,566	940,505
MIN	429,616	690,319	316,284	516,565	401,699	668,421	343,642	492,646	473,634	380,757	-	458,220

Daily Integral UV-AB Radiation, Joule/m^2

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-A Radiometer (MS-212A), UV-B Radiometer (MS-212W)**	**Year**	**2011**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	865,869	724,693	-	-	-		-	-	-	-	-	-
2	853,458	739,093	-	-	-		-	-	-	-	-	-
3	820,228	783,168	-	-	-		-	-	-	-	-	-
4	856,375	897,123	-	-			-	-	-	-	-	-
5	861,733	529,449	-	-			-	-	-	-	-	-
6	781,888	709,059	-	-			-	-	-	-	-	-
7	888,912	826,644	-	-	-		-	-	-	-	-	-
8	816,435	921,237	-	-	-		-	-	-	-	-	-
9	900,894	961,415	-	-	-		-	-	-	-	-	-
10	872,904	903,304	-	-	-		-	-	-	-	-	-
11	694,811	941,712	-	-	-		-	-	-	-	-	-
12	507,776	813,182	-	-	-		-	-	-	-	-	-
13	825,269	903,629	-	-	-		-	-	-	-	-	-
14	710,688	807,422	-	-	-		-	-	-	-	-	-
15	801,972	626,888	-	-	-		-	-	-	-	-	-
16	796,759	979,814	-	-	-		-	-	-	-	-	-
17	767,936	1,037,973	-	-	-		-	-	-	-	-	-
18	826,938	1,026,106	-	-	-		-	-	-	-	-	-
19	815,647	985,267	-	-			-	-	-	-	-	-
20	706,858	914,715	-	-			-	-	-	-	-	-
21	852,326		-	-			-	-	-	-	-	-
22	729,751	565,362	-	-			-	-	-	-	-	-
23	744,579	683,963	-	-			-	-	-	-	-	-
24	842,850	823,016	-	-		-	-	-	-	-	-	-
25	883,209	894,200	-	-		-	-	-	-	-	-	-
26	878,517	635,450	-	-		-	-	-	-	-	-	-
27	800,618	526,485	-	-		-	-	-	-	-	-	-
28	671,581	866,462	-			-	-	-	-	-	-	-
29	808,887		-			-	-	-	-	-	-	-
30	736,282		-	-		-	-	-	-	-	-	-
31	808,926		-				-	-		-	-	-
N	31	27	31	28	15	7	31	31	30	31	31	31
AVG	**797,770**	**815,808**	-	-	-	-	-	-	-	-	-	-
MAX	900,894	1,037,973	-	-	-	-	-	-	-	-	-	-
MIN	507,776	526,485	-	-	-	-	-	-	-	-	-	-

Daily Integral UV-A Radiation, MJ/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-A Radiometer (MS-212A)**	**Year**	**2010**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.6306	0.7814	0.8913	1.0195	0.6417		0.6014	0.9814	1.1051	0.9071	0.5968	0.9157
2	0.6668	0.8323	1.0891	1.1572	0.9472		0.6347	0.5250	0.9904	1.0285	0.6569	0.8266
3	0.7253	0.8484	1.0712	1.1641	0.5731		0.7523	0.7037	0.9241	0.9199	0.5501	0.9037
4	0.6655	0.8974	1.1757	1.0249			0.9462	0.7328	0.9508	0.5667	0.9456	0.7830
5	0.7338	0.9827	0.8988	1.0916			0.7767	0.9078	1.1931	0.4195	0.7688	0.7682
6	0.4646	0.8690	0.7242	1.1909			0.9297	0.7319	1.0217	0.6737	0.8248	0.4925
7	0.7336	0.9299	0.7587	1.1961	1.0335		1.2122	0.8278	0.9016	0.9223	0.5626	0.5841
8	0.5974	0.8847	0.9741	1.1853	1.0648		1.0786	0.9445	0.9641	0.8710	0.9233	0.6890
9	0.7208	0.7997	0.9840	1.0640	1.2671		1.1378	1.0275	1.0136	0.4076	0.7897	0.8241
10	0.7098	0.9191	0.5860	0.9960	1.2649		1.1517	1.0511	0.4596	1.0065	0.8658	0.6280
11	0.6002	0.8223	0.8129	1.1268	1.1259		1.1430	0.4912	0.5768	0.7412	0.4235	0.7851
12	0.6532	0.8304	0.8818	1.1145	0.6210		1.2225	0.9420	0.8602	0.6377	0.4926	0.7563
13	0.7328	0.8202	1.0055	1.1381	1.1983		0.9519	0.4792	0.8191	0.7564	0.7034	0.7282
14	0.6897	0.8829	1.0910	1.0701	1.2768		0.7764	0.6925	0.6044	0.5111	0.9832	0.8322
15	0.6567	0.9828	1.0335	1.2229	1.1811		0.6321	0.9141	0.8318	0.3938	0.8257	0.7347
16	0.7564	0.8340	0.9855	0.9610	0.3916		0.7777	0.8927	0.6568	0.3701	0.7254	0.4962
17	0.8331	0.8475	0.3094	0.5032	0.8995		0.7562	0.7474	0.6461	0.4189	0.8997	0.5264
18	0.8815	0.6718	0.8223	1.0786	0.6525		0.7666	0.6680	0.6276	0.7133	0.7002	0.7608
19	0.6818	0.6797	0.7324	1.2387			0.3341	1.1054	0.7744	0.7139	0.8588	0.7242
20	0.6282	0.7978	0.9629	1.0998			1.2243	0.7094	1.0560	0.6264	0.7138	0.7082
21	0.4812		0.8870	1.1029			1.1644	0.5802	1.1038	0.5893	0.7092	0.7527
22	0.4177	0.9937	1.0283	1.0824			0.9125	0.9416	0.8769	0.8950	0.6445	0.7041
23	0.7587	1.0858	1.1054	1.1746			0.9197	0.8840	0.6349	1.0179	0.8841	0.6962
24	0.5254	1.0381	1.0888	0.5250		1.0985	0.9366	1.0171	1.1541	1.0371	0.8547	0.4477
25	0.6489	1.1069	1.0768	1.1797		1.3180	0.8925	1.1025	0.9454	0.8201	0.8517	0.4992
26	0.8062	1.1136	0.7150	1.2365		1.0872	0.7487	1.1734	0.9398	0.6528	0.8608	0.8417
27	0.6889	1.0423	0.8536	1.1787		1.0124	0.8658	1.1282	0.7664	0.9289	0.8427	0.8778
28	0.6398	0.9503	0.8142			0.8393	1.2324	0.6428	0.8352	0.9076	0.8064	0.7753
29	0.6659		0.7056			0.6471	0.9761	0.7424	0.9000	1.0655	0.8951	0.6592
30	0.4799		0.9871	1.1370		0.7848	0.9769	0.8265	0.9975	0.8854	0.8373	0.7817
31	0.8401		1.0073				1.1091	1.0053		0.6605	0.0000	0.8337
N	31	27	31	28	15	7	31	31	30	31	31	31
AVG	**0.6682**	**0.8979**	**0.9051**	**1.0807**	**0.9426**	**0.9696**	**0.9207**	**0.8426**	**0.8710**	**0.7441**	**0.7418**	**0.7205**
MAX	**0.8815**	**1.1136**	**1.1757**	**1.2387**	**1.2768**	**1.3180**	**1.2324**	**1.1734**	**1.1931**	**1.0655**	**0.9832**	**0.9157**
MIN	0.4177	0.6718	0.3094	0.5032	0.3916	0.6471	0.3341	0.4792	0.4596	0.3701	0.0000	0.4477

Daily Integral UV-A Radiation, MJ/m^2

Station	Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)	Country	Thailand
Instrument	UV-A Radiometer (MS-212A)	Year	2011

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.8427	0.7053										
2	0.8305	0.7202										
3	0.7981	0.7631										
4	0.8342	0.8727										
5	0.8393	0.5165										
6	0.7608	0.6902										
7	0.8658	0.8039										
8	0.7949	0.8951										
9	0.8769	0.9330										
10	0.8509	0.8759										
11	0.6775	0.9132										
12	0.4944	0.7891										
13	0.8055	0.8774										
14	0.6940	0.7848										
15	0.7832	0.6103										
16	0.7783	0.9519										
17	0.7503	1.0089										
18	0.8073	0.9970										
19	0.7957	0.9586										
20	0.6899	0.8890										
21	0.8313											
22	0.7123	0.5499										
23	0.7266	0.6650										
24	0.8211	0.7990										
25	0.8606	0.8675										
26	0.8547	0.6171										
27	0.7785	0.5129										
28	0.6538	0.8409										
29	0.7872											
30	0.7172											
31	0.7876											
N	31	27										
AVG	**0.7774**	**0.7929**										
MAX	**0.8769**	**1.0089**										
MIN	0.4944	0.5129										

Daily Integral UV-B Radiation, MJ/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-B Radiometer (MS-212W)**	**Year**	**2010**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0165	0.0222	0.0291	0.0295	0.0173		0.0187	0.0331	0.0355	0.0271	0.0163	0.0248
2	0.0172	0.0243	0.0359	0.0358	0.0273		0.0189	0.0167	0.0322	0.0323	0.0168	0.0226
3	0.0185	0.0240	0.0346	0.0363	0.0138		0.0230	0.0237	0.0309	0.0300	0.0147	0.0243
4	0.0169	0.0276	0.0379	0.0328	0.0000		0.0309	0.0237	0.0305	0.0170	0.0253	0.0206
5	0.0198	0.0292	0.0262	0.0355	0.0000		0.0235	0.0302	0.0383	0.0127	0.0210	0.0212
6	0.0124	0.0257	0.0184	0.0401	0.0000		0.0300	0.0237	0.0335	0.0192	0.0231	0.0129
7	0.0197	0.0280	0.0203	0.0391	0.0410		0.0376	0.0278	0.0290	0.0273	0.0162	0.0163
8	0.0171	0.0266	0.0286	0.0371	0.0328		0.0345	0.0317	0.0326	0.0262	0.0267	0.0187
9	0.0197	0.0227	0.0287	0.0319	0.0405		0.0360	0.0318	0.0356	0.0111	0.0232	0.0221
10	0.0183	0.0283	0.0159	0.0294	0.0376		0.0356	0.0347	0.0141	0.0304	0.0252	0.0162
11	0.0141	0.0240	0.0218	0.0336	0.0328		0.0365	0.0161	0.0174	0.0231	0.0119	0.0231
12	0.0162	0.0239	0.0235	0.0327	0.0178		0.0392	0.0331	0.0291	0.0201	0.0135	0.0218
13	0.0188	0.0235	0.0291	0.0328	0.0371		0.0311	0.0134	0.0269	0.0214	0.0183	0.0205
14	0.0174	0.0262	0.0332	0.0319	0.0399		0.0246	0.0223	0.0178	0.0133	0.0264	0.0228
15	0.0176	0.0299	0.0297	0.0376	0.0375		0.0181	0.0300	0.0264	0.0119	0.0227	0.0193
16	0.0205	0.0248	0.0274	0.0291	0.0101		0.0228	0.0282	0.0200	0.0106	0.0206	0.0135
17	0.0221	0.0243	0.0069	0.0133	0.0306		0.0244	0.0268	0.0192	0.0112	0.0259	0.0142
18	0.0239	0.0185	0.0220	0.0325	0.0169		0.0254	0.0217	0.0197	0.0209	0.0195	0.0186
19	0.0178	0.0179	0.0191	0.0398			0.0096	0.0364	0.0271	0.0193	0.0242	0.0180
20	0.0182	0.0232	0.0275	0.0314			0.0397	0.0229	0.0336	0.0174	0.0201	0.0177
21	0.0159		0.0251	0.0321			0.0353	0.0173	0.0362	0.0158	0.0192	0.0203
22	0.0119	0.0302	0.0307	0.0306			0.0300	0.0317	0.0282	0.0253	0.0171	0.0184
23	0.0214	0.0336	0.0335	0.0351			0.0310	0.0286	0.0197	0.0302	0.0244	0.0183
24	0.0123	0.0328	0.0327	0.0145		0.0369	0.0296	0.0321	0.0375	0.0296	0.0243	0.0105
25	0.0171	0.0352	0.0320	0.0353		0.0435	0.0280	0.0372	0.0303	0.0222	0.0236	0.0120
26	0.0220	0.0344	0.0203	0.0377		0.0376	0.0252	0.0383	0.0285	0.0175	0.0230	0.0215
27	0.0172	0.0306	0.0245	0.0365		0.0341	0.0275	0.0363	0.0228	0.0256	0.0227	0.0218
28	0.0164	0.0309	0.0216			0.0266	0.0425	0.0197	0.0255	0.0250	0.0233	0.0198
29	0.0188		0.0187			0.0213	0.0340	0.0249	0.0277	0.0292	0.0246	0.0170
30	0.0135		0.0280	0.0372		0.0223	0.0338	0.0269	0.0296	0.0231	0.0235	0.0198
31	0.0242		0.0288				0.0378	0.0331		0.0172	0.0000	0.0221
N	31	27	31	28	18	7	31	31	30	31	31	31
AVG	**0.0178**	**0.0268**	**0.0262**	**0.0329**	**0.0241**	**0.0318**	**0.0295**	**0.0275**	**0.0278**	**0.0214**	**0.0206**	**0.0191**
MAX	**0.0242**	**0.0352**	**0.0379**	**0.0401**	**0.0410**	**0.0435**	**0.0425**	**0.0383**	**0.0383**	**0.0323**	**0.0267**	**0.0248**
MIN	0.0119	0.0179	0.0069	0.0133	0.0000	0.0213	0.0096	0.0134	0.0141	0.0106	0.0000	0.0105

Daily Integral UV-B Radiation, MJ/m^2

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-B Radiometer (MS-212W)**	**Year**	**2011**

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.0232	0.0194										
2	0.0230	0.0189										
3	0.0221	0.0201										
4	0.0222	0.0244										
5	0.0225	0.0130										
6	0.0211	0.0188										
7	0.0232	0.0228										
8	0.0215	0.0261										
9	0.0240	0.0284										
10	0.0220	0.0274										
11	0.0173	0.0285										
12	0.0134	0.0241										
13	0.0197	0.0262										
14	0.0167	0.0226										
15	0.0188	0.0166										
16	0.0185	0.0279										
17	0.0176	0.0290										
18	0.0197	0.0291										
19	0.0199	0.0267										
20	0.0169	0.0257										
21	0.0210											
22	0.0175	0.0154										
23	0.0179	0.0189										
24	0.0218	0.0240										
25	0.0226	0.0267										
26	0.0238	0.0183										
27	0.0222	0.0135										
28	0.0178	0.0255										
29	0.0217											
30	0.0191											
31	0.0213											
N	31	27										
AVG	**0.0203**	**0.0229**										
MAX	**0.0240**	**0.0291**										
MIN	0.0134	0.0130										

Daily Integral UV-AB Radiation, MJ/m²

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-A Radiometer (MS-212A), UV-B Radiometer (MS-212W)**	**Year**	**2010**

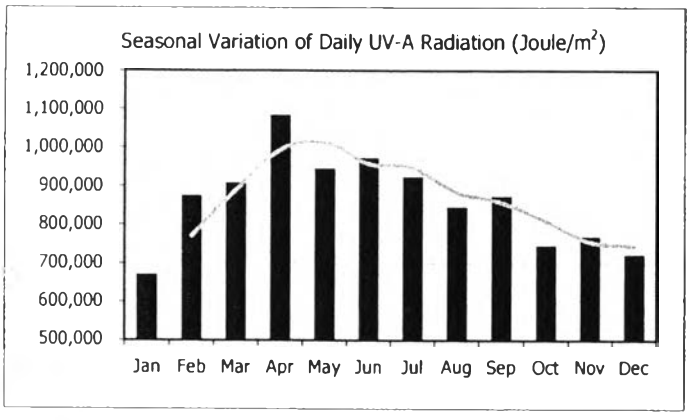
Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.6471	0.8036	0.9204	1.0490	0.6591		0.6201	1.0145	1.1406	0.9342	0.6130	0.9405
2	0.6841	0.8566	1.1250	1.1930	0.9745		0.6536	0.5417	1.0227	1.0609	0.6738	0.8491
3	0.7438	0.8724	1.1058	1.2004	0.5869		0.7753	0.7275	0.9550	0.9499	0.5648	0.9281
4	0.6824	0.9250	1.2135	1.0578	0.0000		0.9771	0.7565	0.9814	0.5838	0.9708	0.8036
5	0.7536	1.0118	0.9249	1.1271	0.0000		0.8002	0.9379	1.2314	0.4322	0.7898	0.7895
6	0.4770	0.8947	0.7426	1.2311	0.0000		0.9596	0.7556	1.0551	0.6929	0.8480	0.5054
7	0.7533	0.9580	0.7790	1.2352	1.0745		1.2497	0.8556	0.9307	0.9496	0.5787	0.6005
8	0.6145	0.9113	1.0027	1.2224	1.0976		1.1131	0.9761	0.9967	0.8972	0.9500	0.7077
9	0.7405	0.8224	1.0127	1.0959	1.3075		1.1738	1.0592	1.0491	0.4187	0.8129	0.8462
10	0.7281	0.9474	0.6019	1.0254	1.3025		1.1872	1.0858	0.4736	1.0369	0.8910	0.6442
11	0.6143	0.8463	0.8347	1.1603	1.1587		1.1796	0.5073	0.5941	0.7643	0.4354	0.8083
12	0.6694	0.8543	0.9052	1.1471	0.6388		1.2617	0.9752	0.8893	0.6578	0.5061	0.7780
13	0.7516	0.8437	1.0346	1.1709	1.2354		0.9830	0.4926	0.8459	0.7777	0.7217	0.7487
14	0.7071	0.9092	1.1242	1.1020	1.3166		0.8010	0.7148	0.6222	0.5244	1.0096	0.8551
15	0.6743	1.0127	1.0632	1.2606	1.2186		0.6503	0.9441	0.8582	0.4057	0.8485	0.7540
16	0.7769	0.8588	1.0129	0.9900	0.4017		0.8006	0.9209	0.6768	0.3808	0.7460	0.5097
17	0.8552	0.8718	0.3163	0.5166	0.9301		0.7806	0.7742	0.6653	0.4301	0.9256	0.5405
18	0.9054	0.6903	0.8443	1.1110	0.6695		0.7920	0.6897	0.6472	0.7342	0.7197	0.7795
19	0.6996	0.6976	0.7515	1.2785			0.3436	1.1417	0.8015	0.7332	0.8830	0.7423
20	0.6464	0.8210	0.9904	1.1312			1.2640	0.7323	1.0896	0.6437	0.7339	0.7259
21	0.4972		0.9121	1.1350			1.1997	0.5976	1.1400	0.6052	0.7284	0.7730
22	0.4296	1.0239	1.0590	1.1129			0.9425	0.9734	0.9050	0.9204	0.6617	0.7225
23	0.7801	1.1194	1.1389	1.2097			0.9507	0.9126	0.6545	1.0480	0.9085	0.7145
24	0.5378	1.0709	1.1214	0.5395		1.1354	0.9662	1.0492	1.1916	1.0667	0.8790	0.4582
25	0.6660	1.1421	1.1089	1.2150		1.3616	0.9205	1.1397	0.9756	0.8423	0.8752	0.5112
26	0.8282	1.1480	0.7353	1.2742		1.1248	0.7738	1.2118	0.9683	0.6703	0.8838	0.8632
27	0.7061	1.0729	0.8781	1.2152		1.0465	0.8933	1.1645	0.7891	0.9546	0.8654	0.8996
28	0.6562	0.9812	0.8358			0.8659	1.2749	0.6624	0.8607	0.9326	0.8297	0.7951
29	0.6847		0.7243			0.6684	1.0101	0.7673	0.9277	1.0947	0.9197	0.6762
30	0.4935		1.0151	1.1742		0.8071	1.0107	0.8534	1.0270	0.9085	0.8608	0.8015
31	0.8643		1.0361				1.1470	1.0384	0.0000	0.6778	0.0000	0.8557
N	31	27	31	28	18	7	31	31	31	31	31	31
AVG	**0.6861**	**0.9247**	**0.9313**	**1.1136**	**0.8096**	**1.0014**	**0.9502**	**0.8701**	**0.8699**	**0.7655**	**0.7624**	**0.7396**
MAX	**0.9054**	**1.1480**	**1.2135**	**1.2785**	**1.3166**	**1.3616**	**1.2749**	**1.2118**	**1.2314**	**1.0947**	**1.0096**	**0.9405**
MIN	0.4296	0.6903	0.3163	0.5166	0.0000	0.6684	0.3436	0.4926	0.0000	0.3808	0.0000	0.4582

Daily Integral UV-AB Radiation, MJ/m^2

Station	**Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m)**	**Country**	**Thailand**
Instrument	**UV-A Radiometer (MS-212A), UV-B Radiometer (MS-212W)**	**Year**	**2011**

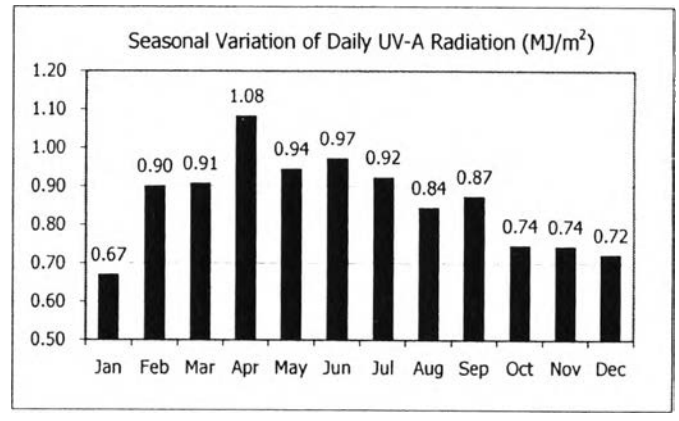
Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.8659	0.7247										
2	0.8535	0.7391										
3	0.8202	0.7832										
4	0.8564	0.8971										
5	0.8617	0.5294										
6	0.7819	0.7091										
7	0.8889	0.8266										
8	0.8164	0.9212										
9	0.9009	0.9614										
10	0.8729	0.9033										
11	0.6948	0.9417										
12	0.5078	0.8132										
13	0.8253	0.9036										
14	0.7107	0.8074										
15	0.8020	0.6269										
16	0.7968	0.9798										
17	0.7679	1.0380										
18	0.8269	1.0261										
19	0.8156	0.9853										
20	0.7069	0.9147										
21	0.8523											
22	0.7298	0.5654										
23	0.7446	0.6840										
24	0.8428	0.8230										
25	0.8832	0.8942										
26	0.8785	0.6355										
27	0.8006	0.5265										
28	0.6716	0.8665										
29	0.8089											
30	0.7363											
31	0.8089											
N	31	27										
AVG	**0.7978**	**0.8158**										
MAX	**0.9009**	**1.0380**										
MIN	0.5078	0.5265										

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2010**



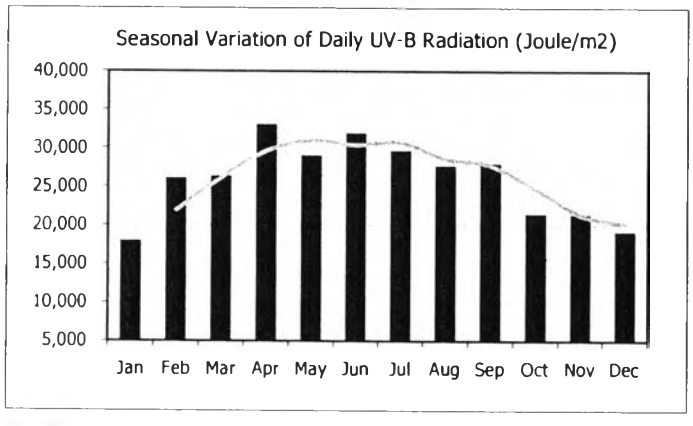
Daily Max.	**1,318,034**	Joules/m²
Monthly Max.	**1,080,716**	Joules/m²
Monthly Avg.	**858,651**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2010**



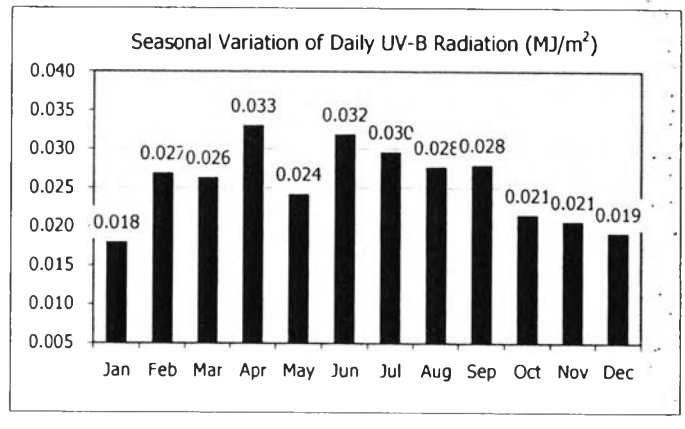
Daily Max.	**1.318**	Joules/m²
Monthly Max.	**1.081**	Joules/m²
Monthly Avg.	**0.859**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2010**



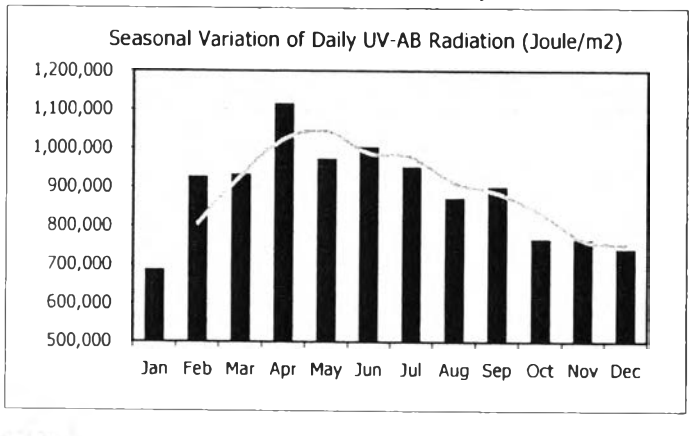
Daily Max.	**43,533**	Joules/m²
Monthly Max.	**32,900**	Joules/m²
Monthly Avg.	**25,839**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2010**



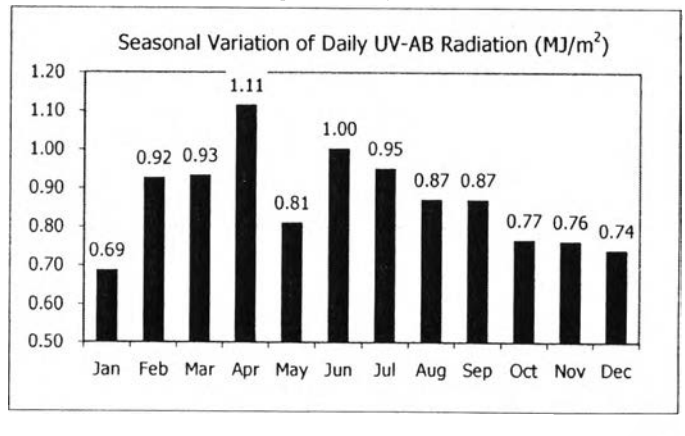
Daily Max.	**0.044**	Joules/m²
Monthly Max.	**0.033**	Joules/m²
Monthly Avg.	**0.025**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2010**



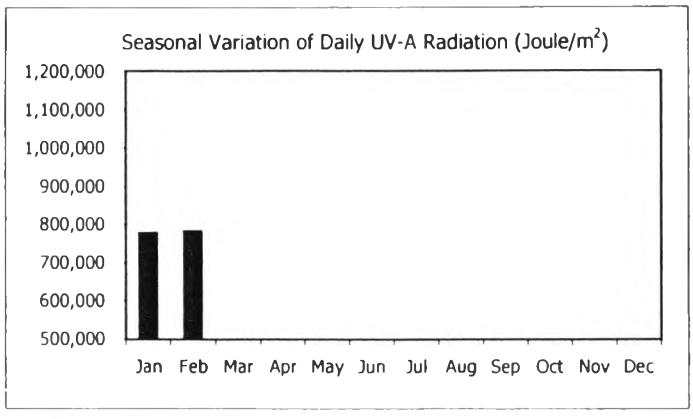
Daily Max.	**1,361,568**	Joules/m²
Monthly Max.	**1,113,615**	Joules/m²
Monthly Avg.	**884,600**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2010**



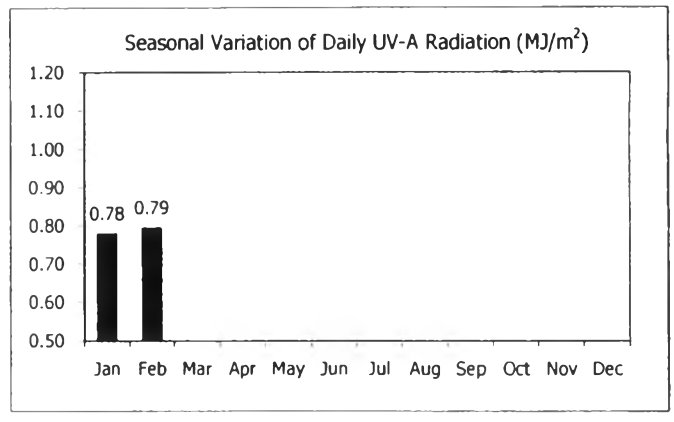
Daily Max.	**1.362**	MJ/m²
Monthly Max.	**1.114**	MJ/m²
Monthly Avg.	**0.869**	MJ/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2011**



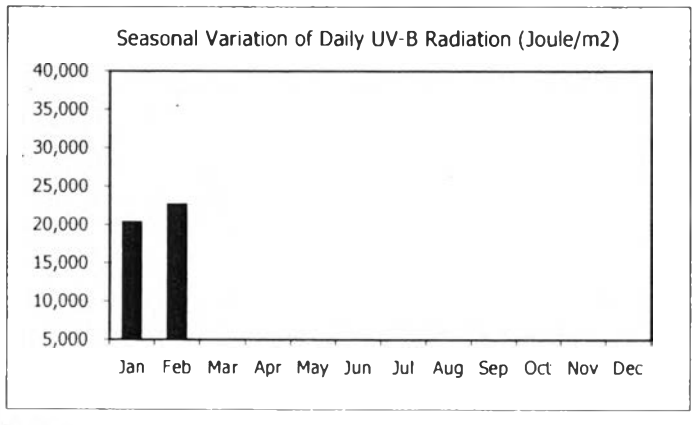
Daily Max.	**1,008,939**	Joules/m²
Monthly Max.	**#DIV/0!**	Joules/m²
Monthly Avg.	**#DIV/0!**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2011**



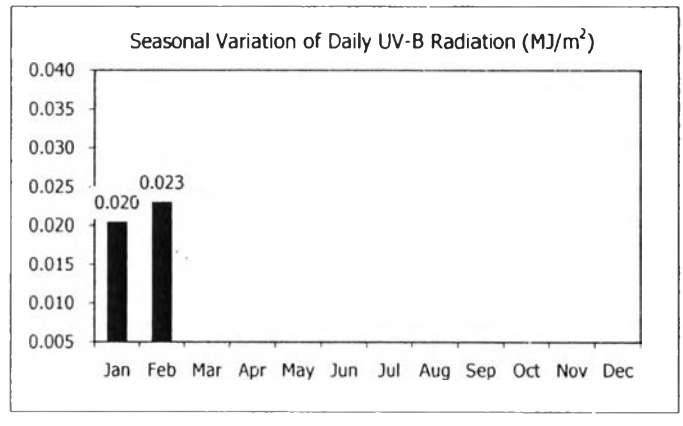
Daily Max.	**1.009**	Joules/m²
Monthly Max.	**0.793**	Joules/m²
Monthly Avg.	**0.785**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2011**



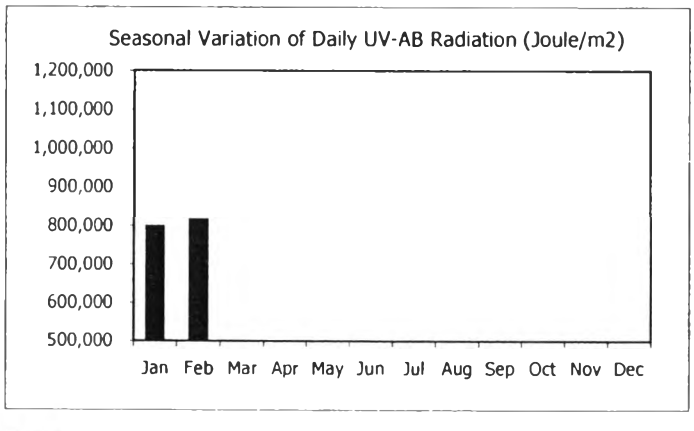
Daily Max.	**29,110**	Joules/m²
Monthly Max.	**#DIV/0!**	Joules/m²
Monthly Avg.	**#DIV/0!**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2011**



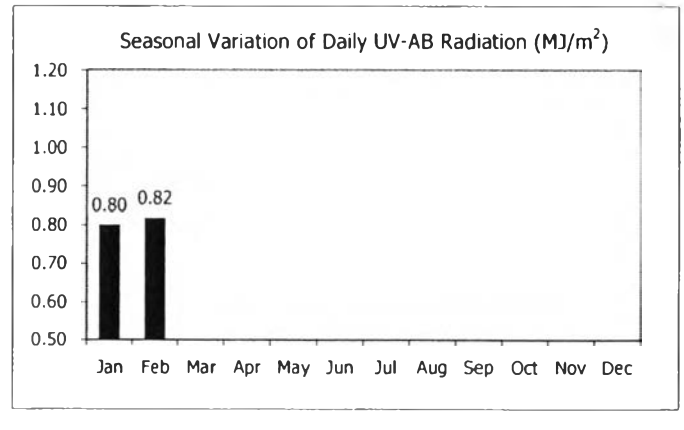
Daily Max.	**0.029**	Joules/m²
Monthly Max.	**0.023**	Joules/m²
Monthly Avg.	**0.022**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m) **2011**



Daily Max.	**1,037,973**	Joules/m²
Monthly Max.	**815,808**	Joules/m²
Monthly Avg.	**134,465**	Joules/m²

Bangkok (Lat. 13 40' N, Long. 100 37' E, Elev.60m **2011**



Daily Max.	**1.038**	MJ/m²
Monthly Max.	**0.816**	MJ/m²
Monthly Avg.	**0.807**	MJ/m²

CURRICULUM VITAE

Name: Mr. Thamrong Chansawang

Date of Birth: December 16, 1986

Nationality: Thai

University Education:

2005–2009 Bachelor Degree of Materials Engineering, Faculty of Engineering, Kasetsart University, Bangkok, Thailand

Work Experience:

2007-2008	Position:	Assistant Reseacher
	Company name:	National Metal and Materials Technology Center

Publications:

1. Euvananont, C.; Chansawang, T.; Boontongkong, Y.; and Thanachayanont, C. (2009) Microstructural and electrical investigation of SnO_2 twinned crystalline thin films deposited by spraypyrolysis. Journal of Microscopy Society of Thailand, 23(1): 79-82.

Proceedings:

1. Chansawang, T.; and Manuspiya, H. (2011, April 26) Correlation of outdoor exposure and accelerated weathering test in degradation of plastic cards. Proceedings of the 2nd research symposium on petroleum, petrochemicals and advanced materials and the 17th PPC symposium on petroleum, petrochemicals and polymer, Bangkok, Thailand.

Presentations:

1. Chansawang, T.; and Manuspiya, H. (2011, January 5-7) Effect of outdoor exposure and accelerated weathering test in degradation of plastic cards. Poster presented at the Pure and Applied Chemistry International Conference 2011, Bangkok, Thailand.
2. Chansawang, T.; and Manuspiya, H. (2011, March 27-31) Comparison of outdoor exposure and accelerated weathering test in degradation of plastic cards. Poster

presented at the 241st ACS National Meeting & Exposion, Anaheim, California, USA.

3. Chansawang, T.; and Manuspiya, H. (2011, April 26) Correlation of outdoor exposure and accelerated weathering test in degradation of plastic cards. Poster presented at the 2nd research symposium on petroleum, petrochemicals and advanced materials and the 17th PPC symposium on petroleum, petrochemicals and polymer, Bangkok, Thailand.