New Evaluation Method for the Lightfastness of Colored Papers by Radiant Energy

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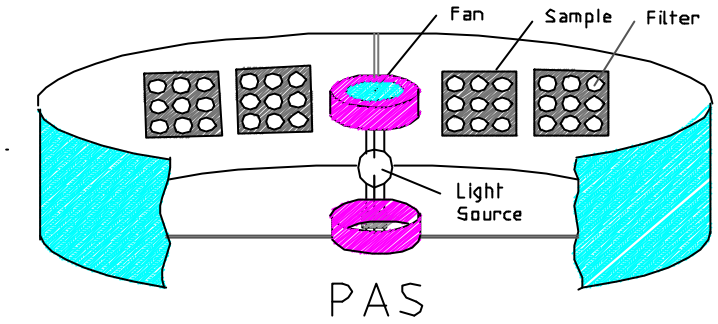


Figure 1—The arrangements of the irradiating apparatus.

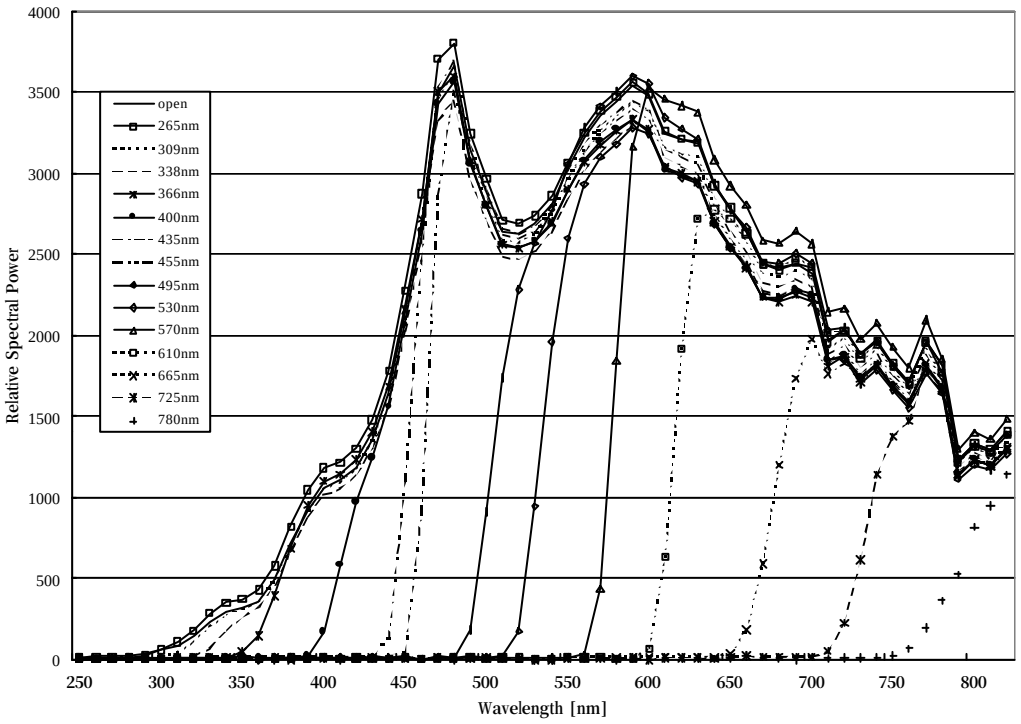
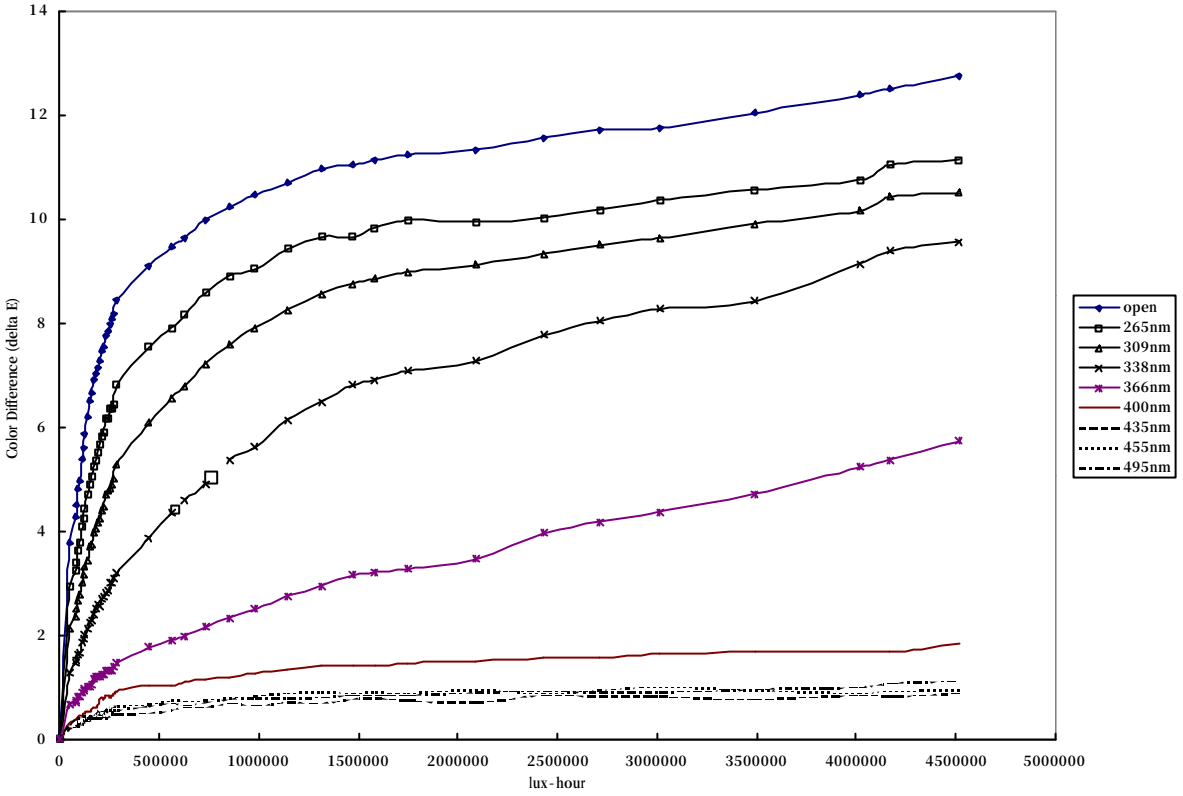
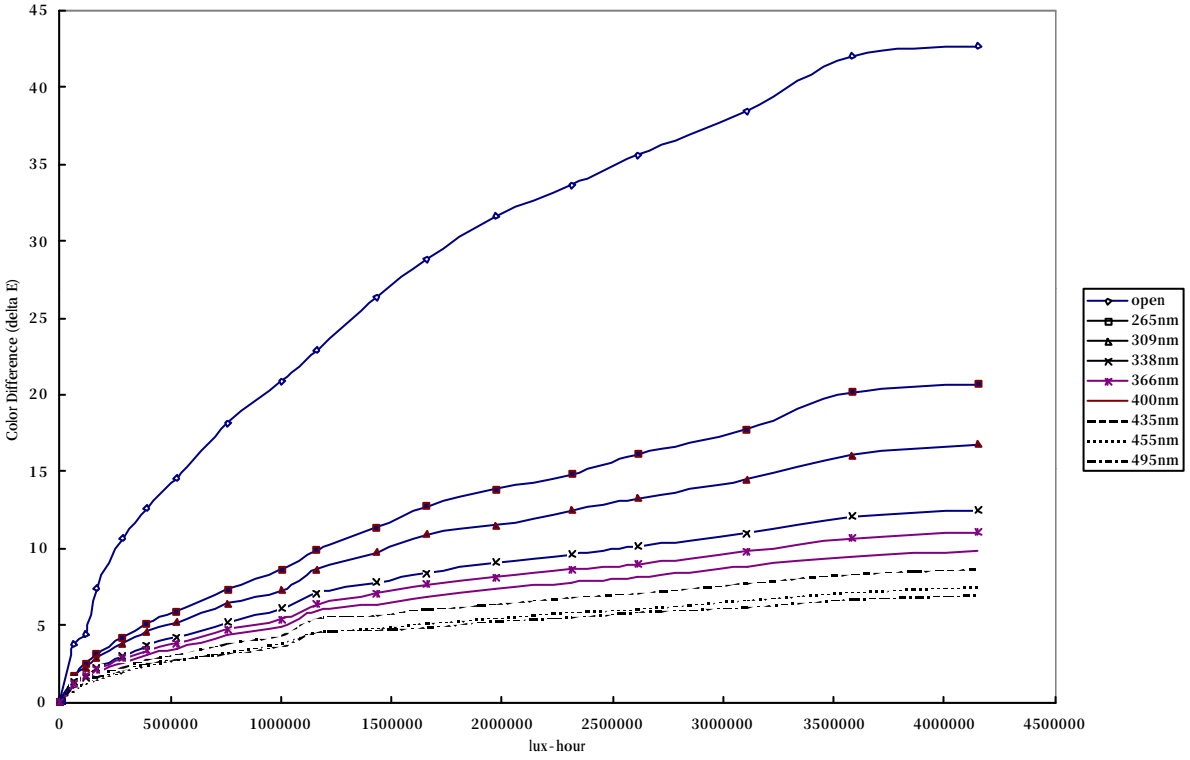


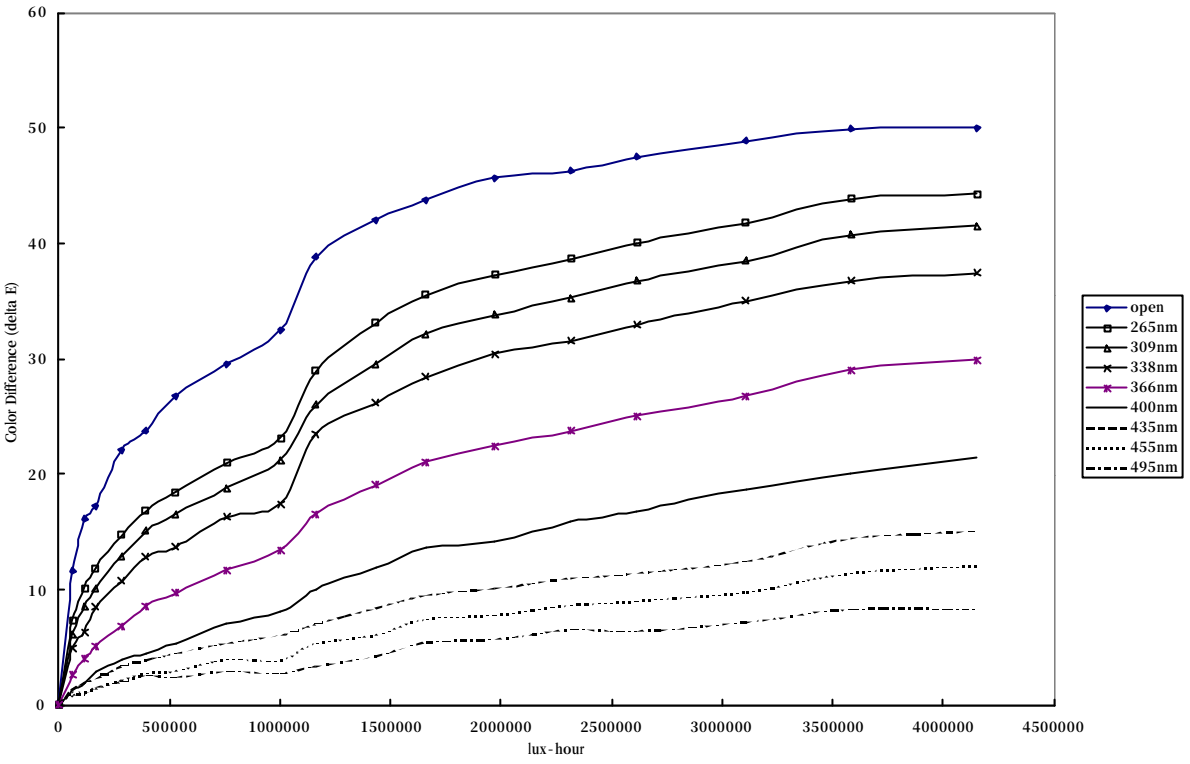
Figure 2 —The relative spectral power distributions of the radiation from the Xenon lamp through the filters.


Color Difference (delta E)
lux-hour
0
2
4
6
8
10
12
14
0
500000
1000000
1500000
2000000
2500000
3000000
3500000
4000000
4500000
5000000
open
265nm
309nm
338nm
366nm
400nm
435nm
455nm
495nm

(a)


Color Difference (delta E)
lux-hour
0
5
10
15
20
25
30
35
40
45
0
500000
1000000
1500000
2000000
2500000
3000000
3500000
4000000
4500000
open
265nm
309nm
338nm
366nm
400nm
435nm
455nm
495nm

(b)



(c)

Figure 3 –The color change of the samples. (a) White pulp paper (b) Red paper (c) Korean paper. (Color changes beneath the filters with longer cut-off wavelength than 495[nm] are omitted to simplify the graph.)

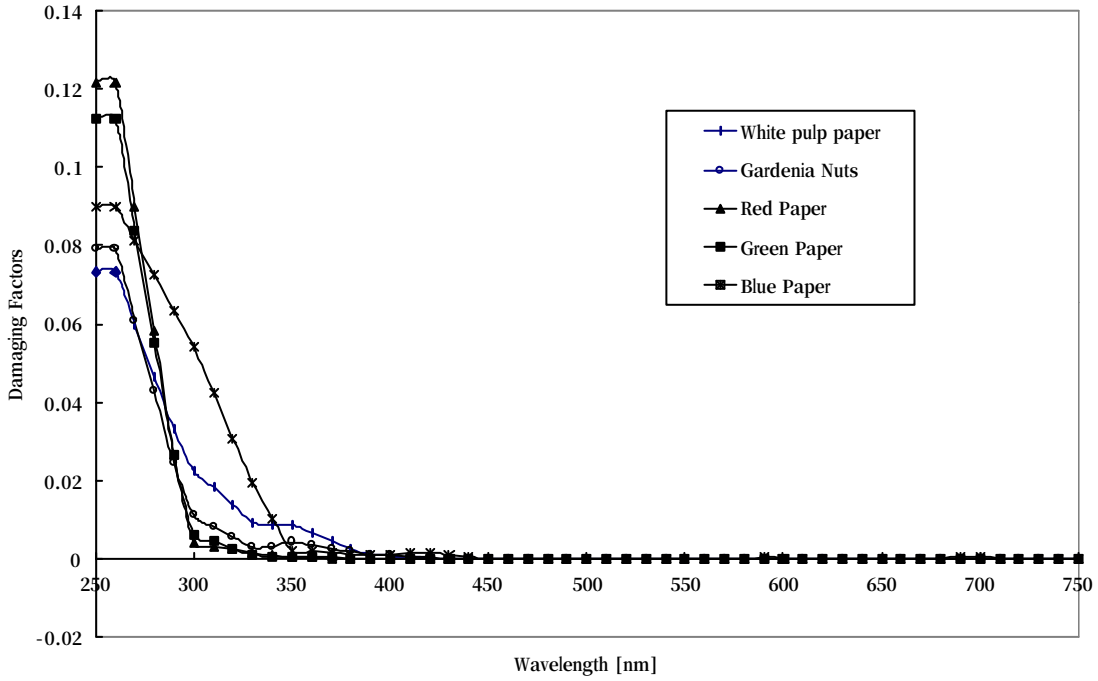
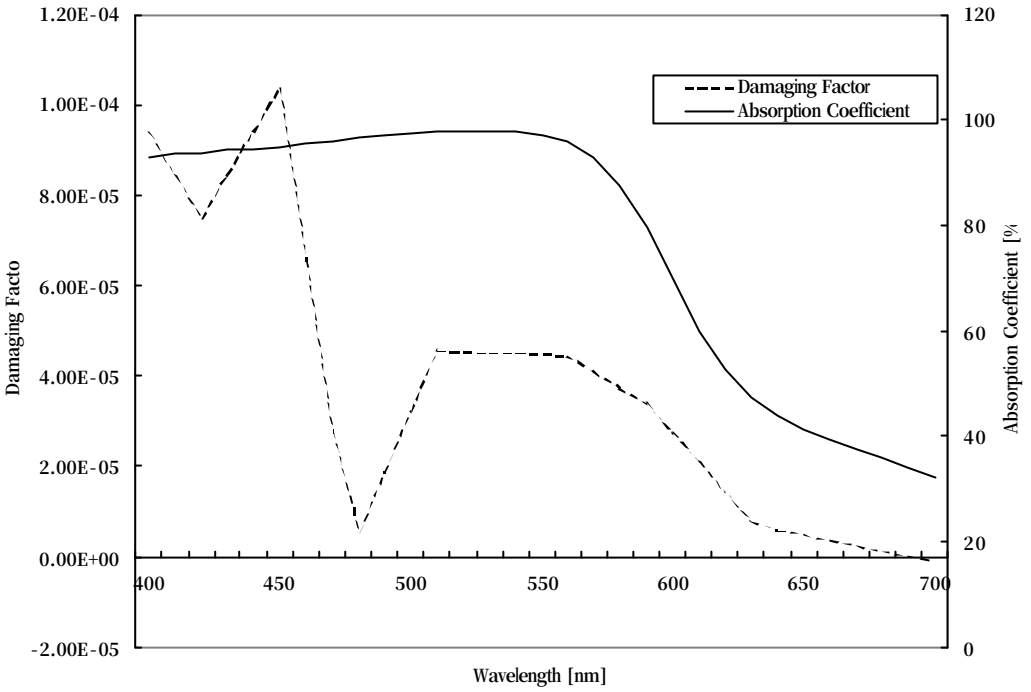
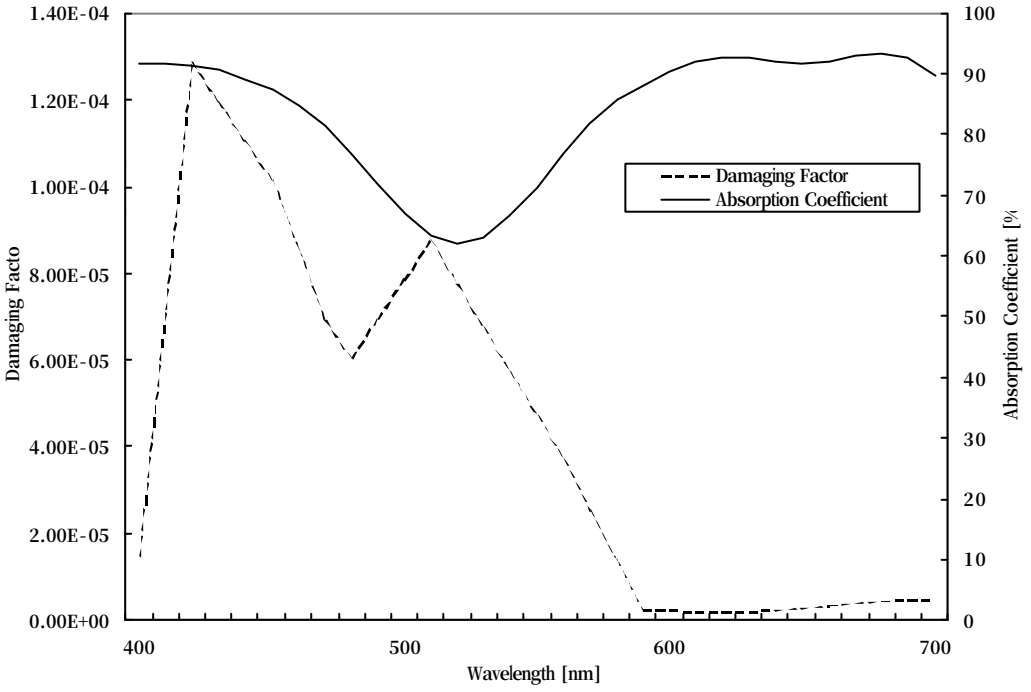


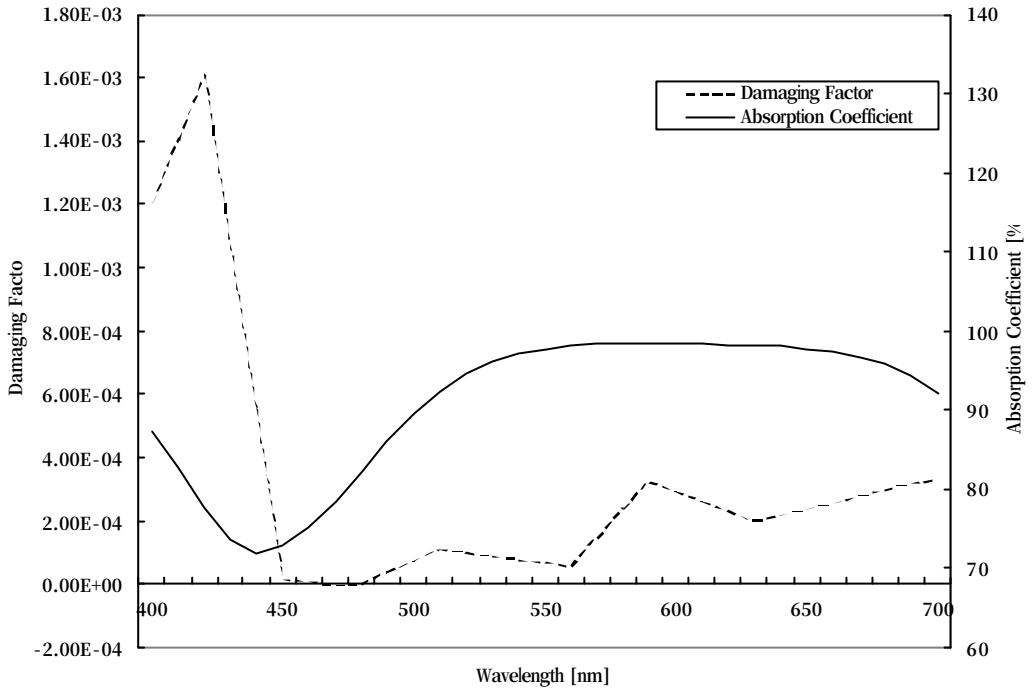
Figure 4–The damaging factors of the samples as function of wavelength.


1.20E-04
1.00E-04
8.00E-05
6.00E-05
4.00E-05
2.00E-05
0.00E+00
-2.00E-05
Damaging Facto
120
100
80
60
40
20
0
Absorption Coefficient [%
400
450
500
550
600
650
700
Wavelength [nm]
Damaging Factor
Absorption Coefficient

(a)

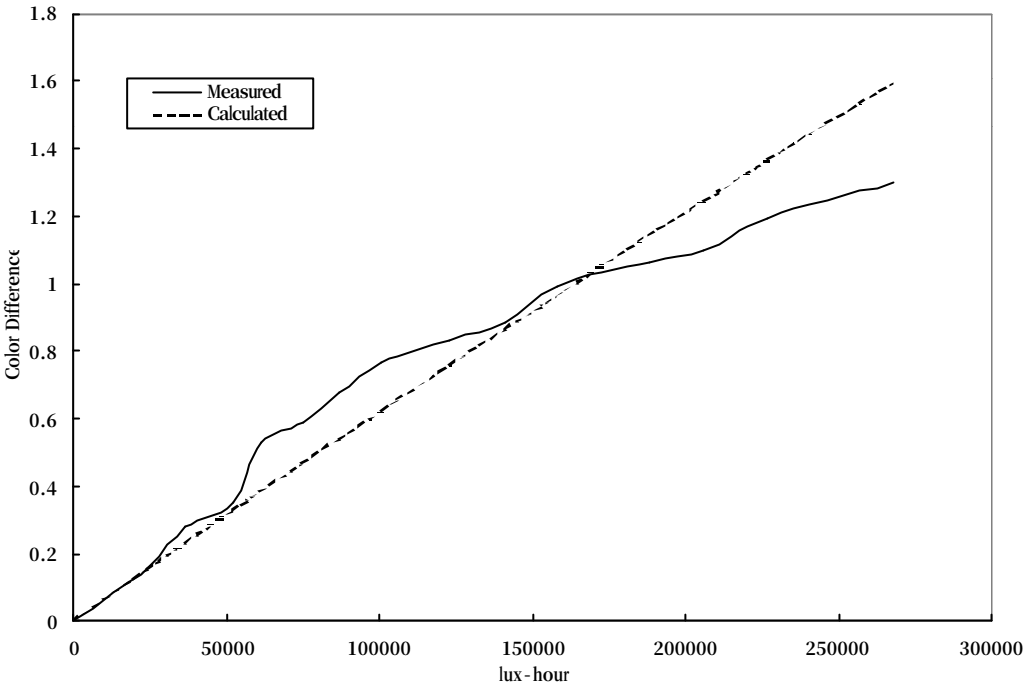

1.40E-04
1.20E-04
1.00E-04
8.00E-05
6.00E-05
4.00E-05
2.00E-05
0.00E+00
Damaging Facto
100
90
80
70
60
50
40
30
20
10
0
Absorption Coefficient [%
400
500
600
700
Wavelength [nm]
Damaging Factor
Absorption Coefficient

(b)

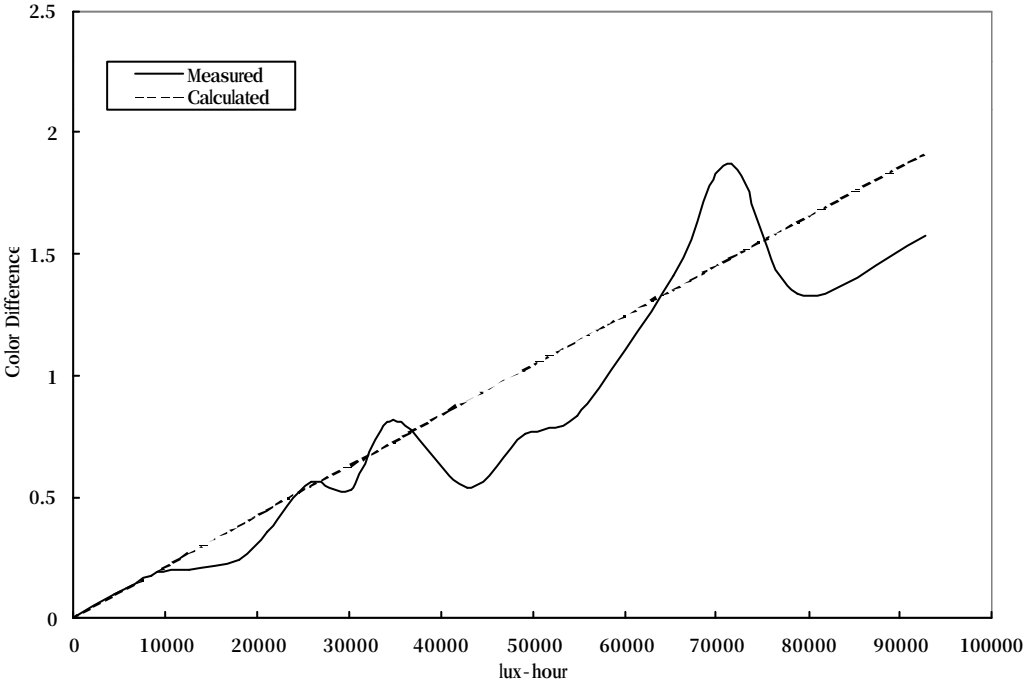


(c)

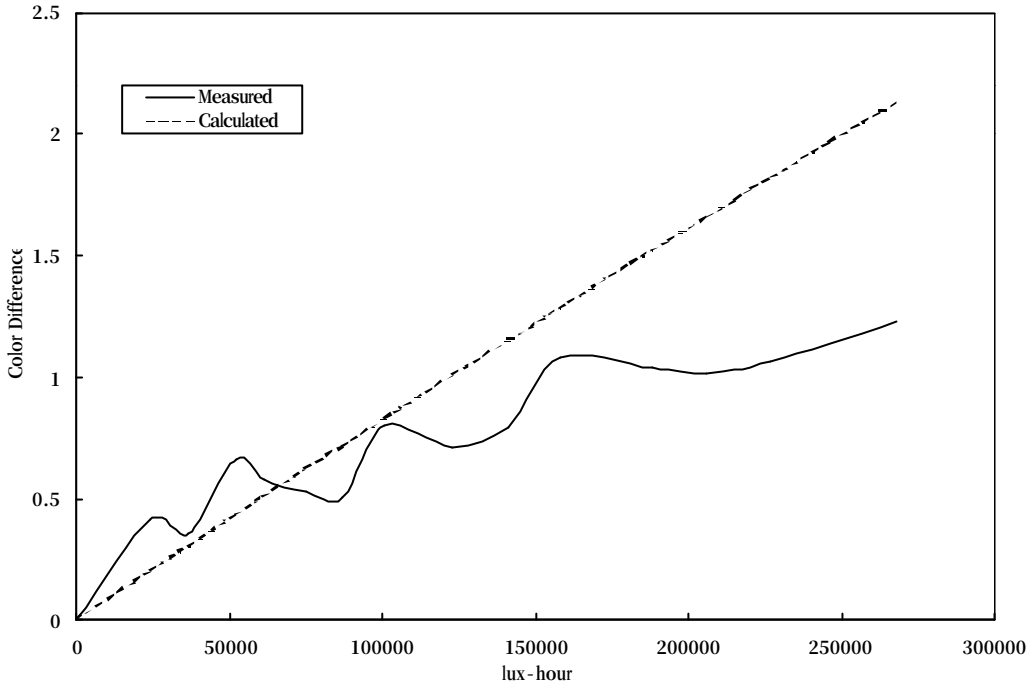
Figure 5 —The absorption coefficient and the damaging factor in the visible wavelength range. (a) Red paper (b) Green paper (c) Blue paper.


Measured
Calculated
Color Difference
lux-hour
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
0
50000
100000
150000
200000
250000
300000

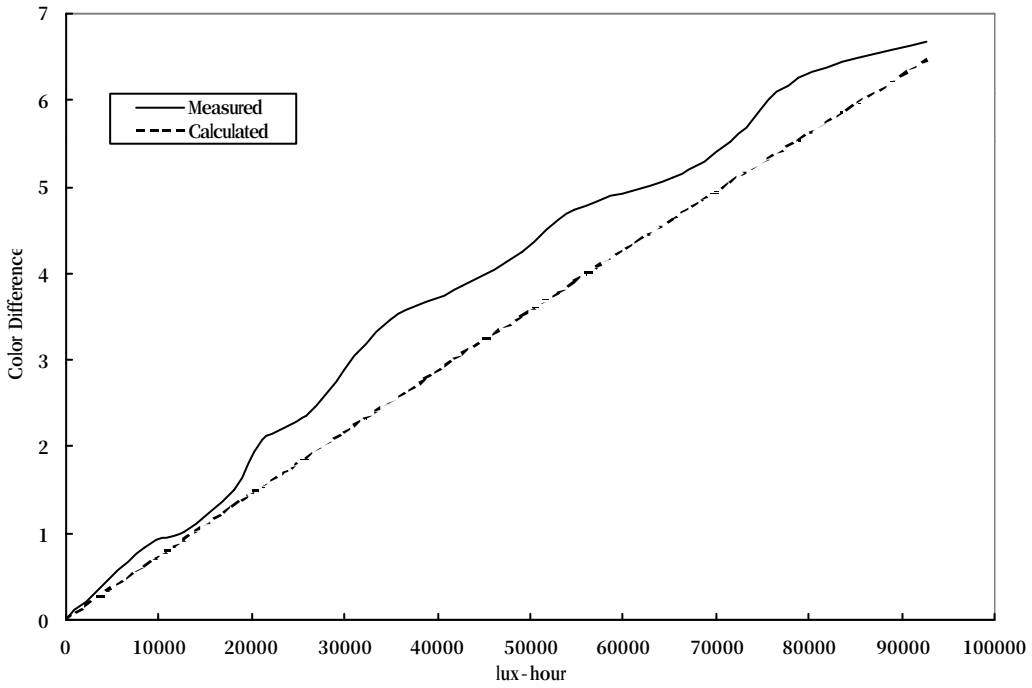
(a)


Measured
Calculated
Color Difference
lux-hour
0
0.5
1
1.5
2
2.5
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000

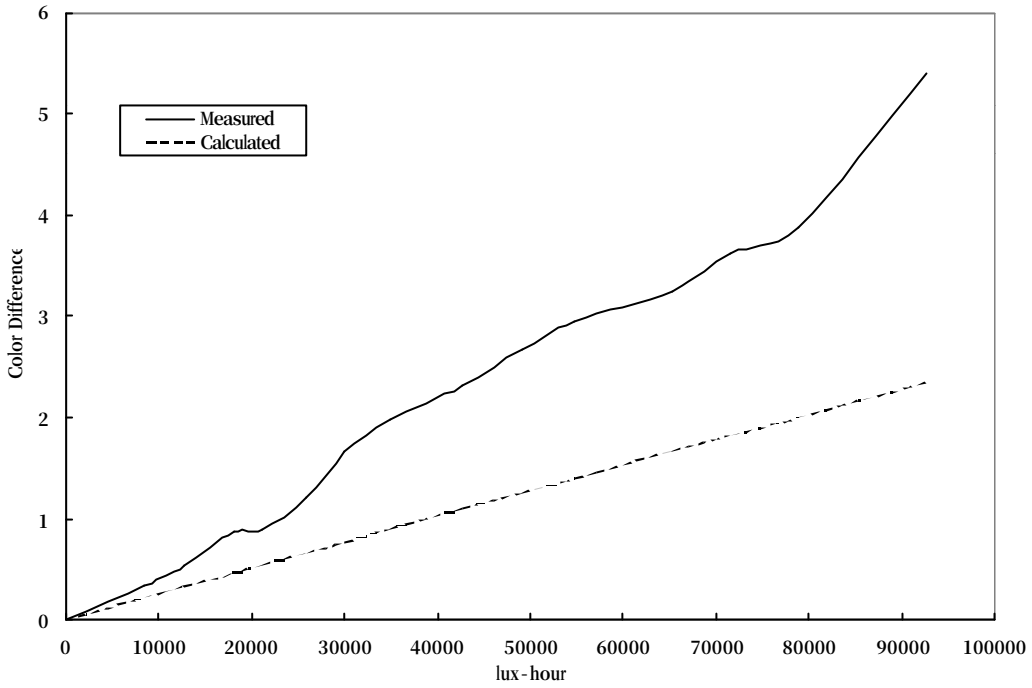
(b)


Measured
Calculated
Color Difference
lux-hour
0
0.5
1
1.5
2
2.5
0
50000
100000
150000
200000
250000
300000

(c)


Measured
Calculated
Color Difference
lux-hour
0
1
2
3
4
5
6
7
0
10000
20000
30000
40000
50000
60000
70000
80000
90000
100000

(d)



(e)

Figure 6 —The measured and calculated color changes of the samples. (a) White pulp paper (b) Red paper (c) Green paper (d) Blue paper (e) Korean paper dyed with gardenia nuts

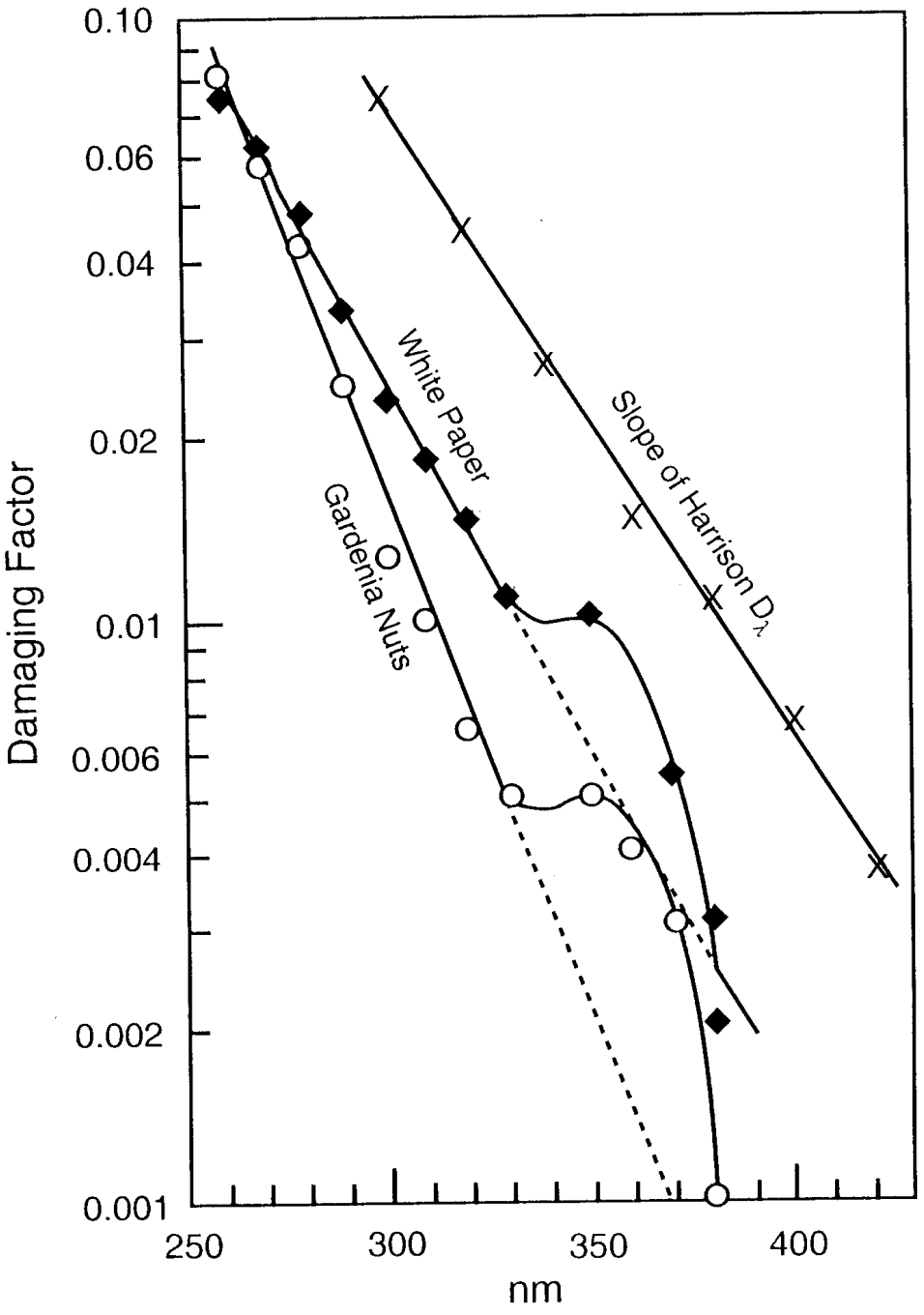

0.10
0.06
0.04
0.02
0.01
0.006
0.004
0.002
0.001
Damaging Factor
250
300
350
400
nm
White Paper
Gardenia Nuts
Slope of Harrison D_λ

Figure A1

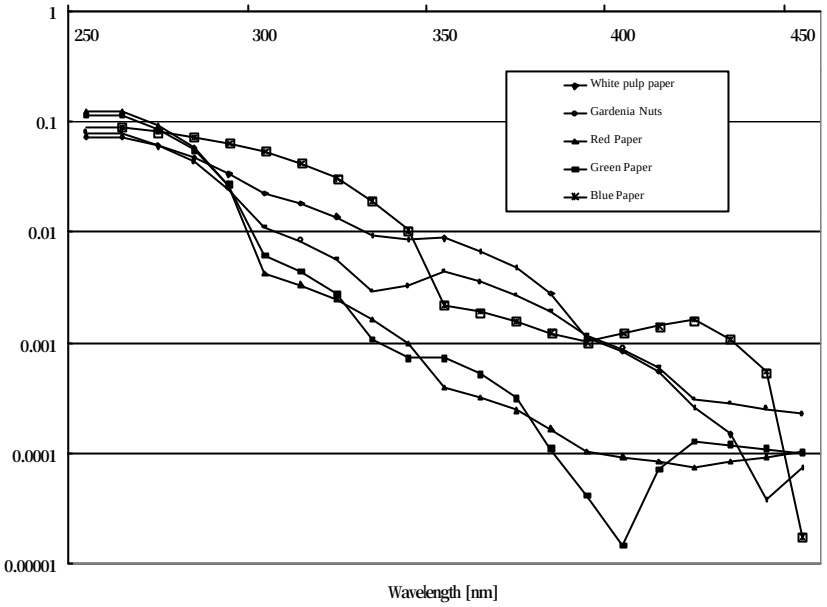


Figure A2—The log plot of the damaging factors in UV range