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Appendices

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APPENDIX A

FOR OUTDOOR EXPOSURE

TABLE A.1-1.1 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.81	38.92	1.0294	0.723	0.734
0.0800	37.81	40.04	1.0590	0.716	0.737
0.1200	37.81	41.17	1.0889	0.709	0.741
0.2000	37.81	43.46	1.1494	0.696	0.747

TABLE A.1-1.2 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.87	38.98	1.0293	0.722	0.733
0.0800	37.87	40.10	1.0589	0.715	0.736
0.1200	37.87	41.23	1.0887	0.708	0.739
0.2000	37.87	43.51	1.1489	0.694	0.745

TABLE A.1-1.3 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.71	38.81	1.0292	0.718	0.729
0.0801	37.71	39.92	1.0586	0.711	0.732
0.1201	37.71	41.04	1.0883	0.704	0.735
0.2002	37.71	43.30	1.1482	0.690	0.740

TABLE A.1-1.4 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.86	38.96	1.0291	0.716	0.726
0.0800	37.86	40.07	1.0584	0.709	0.730
0.1200	37.86	41.19	1.0880	0.703	0.733
0.2000	37.86	43.46	1.1479	0.690	0.740

TABLE A.1-1.5 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.81	38.90	1.0288	0.711	0.721
0.0800	37.81	40.00	1.0579	0.704	0.724
0.1200	37.81	41.11	1.0873	0.697	0.727
0.2000	37.81	43.35	1.1465	0.684	0.733

TABLE A.1-1.6 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.65	38.71	1.0282	0.693	0.703
0.0801	37.65	39.78	1.0566	0.687	0.706
0.1201	37.65	40.86	1.0853	0.681	0.710
0.2002	37.65	43.05	1.1434	0.669	0.716

TABLE A.1-1.7 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.87	38.95	1.0285	0.702	0.712
0.0801	37.87	40.04	1.0573	0.696	0.716
0.1201	37.87	41.14	1.0863	0.689	0.719
0.2002	37.87	43.36	1.1450	0.676	0.724

TABLE A.1-1.8 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	391.25	402.04	1.0276	0.680	0.689
0.0800	391.25	412.93	1.0554	0.674	0.693
0.1200	391.25	423.95	1.0836	0.669	0.696
0.2000	391.25	446.25	1.1406	0.658	0.703

TABLE A.1-1.9 Viscosity Measurement of 0 % photosensitizer
for outdoor exposure at 30°C [9 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	391.19	401.73	1.0269	0.664	0.673
0.0801	391.19	412.40	1.0542	0.659	0.677
0.1201	391.19	423.16	1.0817	0.654	0.680
0.2002	391.19	444.98	1.1375	0.644	0.687

TABLE A.1-2.1 Viscosity Measurement of 0.1 % Anthraquinone
for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.75	38.88	1.0299	0.737	0.748
0.0801	37.75	40.02	1.0601	0.729	0.751
0.1201	37.75	41.17	1.0906	0.722	0.754
0.2002	37.75	43.49	1.1521	0.707	0.760

TABLE A.1-2.2 Viscosity Measurement of 0.1 % Anthraquinone
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.88	39.00	1.0296	0.728	0.738
0.0801	37.88	40.13	1.0594	0.721	0.742
0.1201	37.88	41.27	1.0895	0.714	0.745
0.2002	37.88	43.58	1.1505	0.700	0.752

TABLE A.1-2.3 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.7	38.79	1.0289	0.713	0.723
0.0800	37.7	39.89	1.0581	0.706	0.726
0.1200	37.7	41.00	1.0875	0.699	0.729
0.2000	37.7	43.24	1.1469	0.686	0.735

TABLE A.1-2.4 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.88	38.96	1.0285	0.702	0.712
0.0801	37.88	40.05	1.0573	0.696	0.715
0.1201	37.88	41.15	1.0863	0.689	0.719
0.2002	37.88	43.38	1.1452	0.677	0.725

TABLE A.1-2.5 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.71	38.76	1.0278	0.687	0.696
0.0800	37.71	39.82	1.0560	0.681	0.699
0.1200	37.71	40.89	1.0843	0.675	0.703
0.2000	37.71	43.06	1.1419	0.663	0.709

TABLE A.1-2.6 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.88	38.91	1.0272	0.671	0.680
0.0800	37.88	39.95	1.0546	0.665	0.683
0.1200	37.88	41.00	1.0824	0.660	0.686
0.2000	37.88	43.12	1.1383	0.648	0.692

TABLE A.1-2.7 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30 C [6 months]

conc. (g/100 ml)	to	tav	nrel	ninh	nred
0.0400	37.76	38.76	1.0265	0.653	0.661
0.0801	37.76	39.77	1.0532	0.648	0.665
0.1201	37.76	40.79	1.0802	0.643	0.668
0.2002	37.76	42.86	1.1351	0.633	0.675

TABLE A.1-2.8 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30 C [7.5 months]

conc. (g/100 ml)	to	tav	nrel	ninh	nred
0.0400	391.97	402.02	1.0256	0.633	0.641
0.0800	391.97	412.17	1.0515	0.628	0.644
0.1200	391.97	422.42	1.0777	0.623	0.647
0.2000	391.97	443.12	1.1305	0.613	0.652

TABLE A.1-2.9 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30 C [9 months]

conc. (g/100 ml)	to	tav	nrel	ninh	nred
0.0400	66.92	68.58	1.0248	0.613	0.620
0.0800	66.92	70.26	1.0499	0.609	0.624
0.1200	66.92	71.96	1.0753	0.605	0.628
0.2000	66.92	75.42	1.1270	0.598	0.635

TABLE A.1-3.1 Viscosity Measurement of 0.5 % Anthraquinone for outdoor exposure at 30 C [control]

conc. (g/100 ml)	to	tav	nrel	ninh	nred
0.0400	394.34	406.26	1.0302	0.745	0.756
0.0799	394.34	418.33	1.0608	0.739	0.761
0.1199	394.34	430.57	1.0919	0.733	0.766
0.1998	394.34	455.47	1.1550	0.721	0.776

TABLE A.1-2.7 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.76	38.76	1.0265	0.653	0.661
0.0801	37.76	39.77	1.0532	0.648	0.665
0.1201	37.76	40.79	1.0802	0.643	0.668
0.2002	37.76	42.86	1.1351	0.633	0.675

TABLE A.1-2.8 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	391.97	402.02	1.0256	0.633	0.641
0.0800	391.97	412.17	1.0515	0.628	0.644
0.1200	391.97	422.42	1.0777	0.623	0.647
0.2000	391.97	443.12	1.1305	0.613	0.652

TABLE A.1-2.9 Viscosity Measurement of 0.1 % Anthraquinone for outdoor exposure at 30°C [9 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	66.92	68.58	1.0248	0.613	0.620
0.0800	66.92	70.26	1.0499	0.609	0.624
0.1200	66.92	71.96	1.0753	0.605	0.628
0.2000	66.92	75.42	1.1270	0.598	0.635

TABLE A.1-3.1 Viscosity Measurement of 0.5 % Anthraquinone for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	394.34	406.26	1.0302	0.745	0.756
0.0799	394.34	418.33	1.0608	0.739	0.761
0.1199	394.34	430.57	1.0919	0.733	0.766
0.1998	394.34	455.47	1.1550	0.721	0.776

TABLE A.1-3.2 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	392.49	404.42	1.0304	0.749	0.760
0.0800	392.49	416.52	1.0612	0.743	0.765
0.1200	392.49	428.76	1.0924	0.737	0.770
0.2000	392.49	453.75	1.1561	0.725	0.780

TABLE A.1-3.3 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0512	389.65	404.61	1.0384	0.735	0.749
0.1025	389.65	419.84	1.0775	0.728	0.756
0.1537	389.65	435.34	1.1173	0.721	0.763
0.2562	389.65	467.07	1.1987	0.707	0.776

TABLE A.1-3.4 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0487	393.39	407.44	1.0357	0.720	0.733
0.0974	393.39	421.72	1.0720	0.714	0.739
0.1462	393.39	436.25	1.1090	0.708	0.745
0.2436	393.39	466.01	1.1846	0.695	0.758

TABLE A.1-3.5 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0484	391.42	404.97	1.0346	0.704	0.716
0.0967	391.42	418.74	1.0698	0.698	0.722
0.1451	391.42	432.76	1.1056	0.692	0.728
0.2418	391.42	461.42	1.1788	0.680	0.740

TABLE A.1-3.6 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [5 months]

conc. (g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0470	390.34	403.16	1.0328	0.687	0.698
0.0941	390.34	416.16	1.0661	0.681	0.703
0.1411	390.34	429.34	1.0999	0.675	0.708
0.2352	390.34	456.30	1.1690	0.664	0.718

TABLE A.1-3.7 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [6 months]

conc. (g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0495	392.54	405.68	1.0335	0.665	0.676
0.0990	392.54	419.02	1.0675	0.659	0.681
0.1486	392.54	432.55	1.1019	0.653	0.686
0.2476	392.54	460.12	1.1722	0.642	0.695

TABLE A.1-3.8 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [7.5 months]

conc. (g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0546	389.75	403.54	1.0354	0.637	0.648
0.1092	389.75	417.55	1.0713	0.631	0.653
0.1638	389.75	431.77	1.1078	0.625	0.658
0.2730	389.75	460.88	1.1825	0.614	0.669

TABLE A.1-3.9 Viscosity Measurement of 0.5 % Anthraquinone
for outdoor exposure at 30°C [9 months]

conc. (g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0608	66.82	69.34	1.0377	0.609	0.621
0.1215	66.82	71.90	1.0760	0.603	0.626
0.1823	66.82	74.50	1.1149	0.597	0.631
0.3038	66.82	79.82	1.1946	0.585	0.640

TABLE A.1-4.1 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	394.34	406.39	1.0306	0.753	0.765
0.0799	394.34	418.60	1.0615	0.747	0.770
0.1199	394.34	430.98	1.0929	0.741	0.775
0.1998	394.34	456.21	1.1569	0.729	0.785

TABLE A.1-4.2 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0454	391.46	404.88	1.0343	0.742	0.754
0.0909	391.46	418.51	1.0691	0.735	0.760
0.1363	391.46	432.36	1.1045	0.729	0.766
0.2272	391.46	460.58	1.1766	0.716	0.777

TABLE A.1-4.3 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0435	391.33	403.89	1.0321	0.726	0.737
0.0870	391.33	416.65	1.0647	0.720	0.743
0.1306	391.33	429.56	1.0977	0.714	0.748
0.2176	391.33	455.93	1.1651	0.702	0.759

TABLE A.1-4.4 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0423	392.11	404.04	1.0304	0.709	0.720
0.0846	392.11	416.15	1.0613	0.704	0.725
0.1268	392.11	428.45	1.0927	0.699	0.731
0.2114	392.11	453.57	1.1567	0.689	0.741

TABLE A.1-4.5 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0455	392.5	404.96	1.0317	0.687	0.698
0.0910	392.5	417.60	1.0639	0.681	0.703
0.1364	392.5	430.42	1.0966	0.676	0.708
0.2274	392.5	456.57	1.1632	0.665	0.718

TABLE A.1-4.6 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0471	389.89	402.31	1.0319	0.666	0.677
0.0942	389.89	414.93	1.0642	0.661	0.682
0.1412	389.89	427.73	1.0971	0.656	0.687
0.2354	389.89	453.88	1.1641	0.646	0.697

TABLE A.1-4.7 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0514	392.54	405.81	1.0338	0.646	0.657
0.1029	392.54	419.28	1.0681	0.641	0.662
0.1543	392.54	432.98	1.1030	0.635	0.668
0.2572	392.54	460.99	1.1744	0.625	0.678

TABLE A.1-4.8 Viscosity Measurement of 1.0 % Anthraquinone for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0612	392.82	408.12	1.0389	0.625	0.637
0.1223	392.82	423.70	1.0786	0.619	0.643
0.1835	392.82	439.55	1.1190	0.613	0.648
0.3058	392.82	472.05	1.2017	0.601	0.660

TABLE A.1-4.9 Viscosity Measurement of 1.0 % Anthraquinone
for outdoor exposure at 30°C [9 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0674	66.81	69.59	1.0416	0.605	0.617
0.1349	66.81	72.43	1.0841	0.599	0.624
0.2023	66.81	75.32	1.1274	0.593	0.630
0.3372	66.81	81.28	1.2166	0.581	0.642

TABLE A.1-5.1 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.75	38.88	1.0299	0.737	0.748
0.0801	37.75	40.03	1.0604	0.732	0.754
0.1201	37.75	41.20	1.0914	0.728	0.761
0.2002	37.75	43.60	1.1550	0.720	0.774

TABLE A.1-5.2 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.78	38.90	1.0296	0.730	0.740
0.0801	37.78	40.03	1.0596	0.722	0.744
0.1201	37.78	41.17	1.0897	0.715	0.747
0.2002	37.78	43.48	1.1509	0.702	0.754

TABLE A.1-5.3 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.63	38.73	1.0292	0.720	0.731
0.0800	37.63	39.84	1.0587	0.713	0.734
0.1200	37.63	40.96	1.0885	0.707	0.737
0.2000	37.63	43.23	1.1488	0.694	0.744

TABLE A.1-5.4 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.88	38.97	1.0288	0.709	0.719
0.0800	37.88	40.07	1.0578	0.703	0.723
0.1200	37.88	41.18	1.0871	0.696	0.726
0.2000	37.88	43.42	1.1463	0.682	0.731

TABLE A.1-5.5 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.85	38.92	1.0283	0.696	0.706
0.0801	37.85	40.00	1.0568	0.690	0.709
0.1201	37.85	41.09	1.0856	0.684	0.713
0.2002	37.85	43.30	1.1440	0.672	0.719

TABLE A.1-5.6 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.71	38.75	1.0276	0.679	0.689
0.0801	37.71	39.80	1.0554	0.674	0.692
0.1201	37.71	40.86	1.0835	0.668	0.695
0.2002	37.71	43.00	1.1403	0.656	0.701

TABLE A.1-5.7 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.84	38.86	1.0270	0.664	0.673
0.0801	37.84	39.89	1.0542	0.659	0.677
0.1201	37.84	40.93	1.0817	0.653	0.680
0.2002	37.84	43.04	1.1374	0.643	0.686

TABLE A.1-5.8 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	393.21	403.48	1.0261	0.644	0.652
0.0801	393.21	413.85	1.0525	0.639	0.655
0.1201	393.21	424.31	1.0791	0.634	0.658
0.2002	393.21	445.50	1.1330	0.624	0.664

TABLE A.1-5.9 Viscosity Measurement of 0.1 % Benzophenone
for outdoor exposure at 30°C [9 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	66.82	68.50	1.0251	0.620	0.628
0.0801	66.82	70.20	1.0506	0.616	0.632
0.1201	66.82	71.92	1.0763	0.612	0.635
0.2002	66.82	75.41	1.1286	0.604	0.642

TABLE A.1-6.1 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.84	38.98	1.0301	0.741	0.752
0.0801	37.84	40.13	1.0605	0.734	0.756
0.1201	37.84	41.29	1.0912	0.726	0.759
0.2002	37.84	43.64	1.1533	0.712	0.766

TABLE A.1-6.2 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.78	38.91	1.0299	0.737	0.748
0.0800	37.78	40.05	1.0601	0.729	0.751
0.1200	37.78	41.20	1.0905	0.722	0.754
0.2000	37.78	43.52	1.1519	0.707	0.760

TABLE A.1-6.3 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.12	38.22	1.0296	0.730	0.741
0.0800	37.12	39.33	1.0595	0.723	0.744
0.1200	37.12	40.45	1.0897	0.716	0.748
0.2000	37.12	42.72	1.1509	0.703	0.754

TABLE A.1-6.4 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.65	38.74	1.0290	0.713	0.723
0.0801	37.65	39.84	1.0582	0.706	0.726
0.1201	37.65	40.95	1.0876	0.699	0.730
0.2002	37.65	43.20	1.1474	0.687	0.736

TABLE A.1-6.5 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.82	38.89	1.0283	0.697	0.707
0.0800	37.82	39.97	1.0568	0.691	0.711
0.1200	37.82	41.06	1.0857	0.685	0.714
0.2000	37.82	43.27	1.1441	0.673	0.721

TABLE A.1-6.6 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30 C [5 months]

conc.(g/100 ml)	to	tav	nrel	ninh	nred
0.0400	37.73	38.77	1.0276	0.679	0.688
0.0801	37.73	39.82	1.0554	0.673	0.692
0.1201	37.73	40.88	1.0835	0.668	0.695
0.2002	37.73	43.03	1.1405	0.657	0.702

TABLE A.1-6.7 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30 C [6 months]

conc.(g/100 ml)	to	tav	nrel	ninh	nred
0.0400	37.72	38.73	1.0268	0.660	0.669
0.0801	37.72	39.75	1.0538	0.655	0.672
0.1201	37.72	40.78	1.0811	0.649	0.675
0.2002	37.72	42.86	1.1363	0.638	0.681

TABLE A.1-6.8 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30 C [7.5 months]

conc.(g/100 ml)	to	tav	nrel	ninh	nred
0.0400	390.33	400.38	1.0257	0.636	0.644
0.0799	390.33	410.50	1.0517	0.630	0.647
0.1199	390.33	420.70	1.0778	0.625	0.649
0.1998	390.33	441.31	1.1306	0.614	0.654

TABLE A.1-6.9 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30 C [9 months]

conc.(g/100 ml)	to	tav	nrel	ninh	nred
0.0400	66.85	68.51	1.0248	0.613	0.620
0.0801	66.85	70.19	1.0500	0.609	0.624
0.1201	66.85	71.89	1.0754	0.605	0.628
0.2002	66.85	75.35	1.1272	0.598	0.635

TABLE A.1-6.6 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.73	38.77	1.0276	0.679	0.688
0.0801	37.73	39.82	1.0554	0.673	0.692
0.1201	37.73	40.88	1.0835	0.668	0.695
0.2002	37.73	43.03	1.1405	0.657	0.702

TABLE A.1-6.7 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.72	38.73	1.0268	0.660	0.669
0.0801	37.72	39.75	1.0538	0.655	0.672
0.1201	37.72	40.78	1.0811	0.649	0.675
0.2002	37.72	42.86	1.1363	0.638	0.681

TABLE A.1-6.8 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	390.33	400.38	1.0257	0.636	0.644
0.0799	390.33	410.50	1.0517	0.630	0.647
0.1199	390.33	420.70	1.0778	0.625	0.649
0.1998	390.33	441.31	1.1306	0.614	0.654

TABLE A.1-6.9 Viscosity Measurement of 0.5 % Benzophenone
for outdoor exposure at 30°C [9 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	66.85	68.51	1.0248	0.613	0.620
0.0801	66.85	70.19	1.0500	0.609	0.624
0.1201	66.85	71.89	1.0754	0.605	0.628
0.2002	66.85	75.35	1.1272	0.598	0.635

TABLE A.1-7.1 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [control]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.82	38.97	1.0304	0.748	0.759
0.0801	37.82	40.13	1.0611	0.740	0.763
0.1201	37.82	41.30	1.0920	0.733	0.766
0.2002	37.82	43.67	1.1547	0.718	0.773

TABLE A.1-7.2 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [1 month]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.71	38.84	1.0300	0.738	0.749
0.0800	37.71	39.98	1.0602	0.731	0.752
0.1200	37.71	41.13	1.0907	0.723	0.756
0.2000	37.71	43.46	1.1525	0.710	0.762

TABLE A.1-7.3 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [2 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.68	38.79	1.0295	0.726	0.736
0.0800	37.68	39.91	1.0592	0.719	0.740
0.1200	37.68	41.04	1.0892	0.712	0.743
0.2000	37.68	43.33	1.1499	0.699	0.750

TABLE A.1-7.4 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [3 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.78	38.87	1.0289	0.711	0.721
0.0800	37.78	39.97	1.0580	0.704	0.725
0.1200	37.78	41.08	1.0873	0.698	0.728
0.2000	37.78	43.33	1.1469	0.685	0.735

TABLE A.1-7.5 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [4 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.86	38.93	1.0283	0.696	0.706
0.0801	37.86	40.01	1.0568	0.690	0.709
0.1201	37.86	41.10	1.0856	0.684	0.712
0.2002	37.86	43.31	1.1440	0.672	0.719

TABLE A.1-7.6 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.78	38.82	1.0275	0.679	0.688
0.0800	37.78	39.87	1.0553	0.673	0.692
0.1200	37.78	40.93	1.0834	0.667	0.695
0.2000	37.78	43.08	1.1403	0.656	0.701

TABLE A.1-7.7 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [6 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	37.71	38.72	1.0268	0.661	0.670
0.0800	37.71	39.74	1.0538	0.655	0.673
0.1200	37.71	40.77	1.0811	0.650	0.676
0.2000	37.71	42.85	1.1363	0.639	0.682

TABLE A.1-7.8 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [7.5 months]

conc.(g/100 ml)	to	tav	η_{rel}	η_{inh}	η_{red}
0.0400	394.34	404.52	1.0258	0.637	0.645
0.0800	394.34	414.78	1.0518	0.632	0.648
0.1200	394.34	425.17	1.0782	0.627	0.652
0.2000	394.34	446.20	1.1315	0.618	0.658

TABLE A.1-7.9 Viscosity Measurement of 1.0 % Benzophenone
for outdoor exposure at 30°C [9 months]

conc. (g/100 ml)	t_0	t_{av}	η_{rel}	η_{inh}	η_{red}
0.0400	66.89	68.55	1.0248	0.612	0.620
0.0801	66.89	70.23	1.0499	0.608	0.624
0.1201	66.89	71.93	1.0753	0.605	0.627
0.2002	66.89	75.38	1.1269	0.597	0.634

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Table A.2-1a Internal standard peak of PVC sample for outdoor exposure at 638 cm^{-1} (sensitizer : anthraquinone)

Irradiation time	% transmittance		% absorbance	
	0 %	0.1% A	0%	0.1% A
original	75.0	69.2	0.125	0.160
1 month	71.0	69.0	0.149	0.161
2 months	67.2	68.0	0.173	0.167
3 months	66.0	60.5	0.180	0.218
4 months	63.2	59.0	0.199	0.229
5 months	62.4	47.6	0.205	0.322
6 months	60.5	38.5	0.218	0.415
7.5 months	41.5	36.0	0.382	0.444

Table A.2-1b Internal standard peak of PVC sample for outdoor exposure at 638 cm^{-1} (senticizer : benzophenone)

Irradiation time	% absorbance			
	0 %	0.1% B	0.5 %B	1.0% B
original	0.125	0.137	0.097	0.134
1 month	0.149	0.146	0.138	0.149
2 months	0.173	0.155	0.147	0.149
3 months	0.180	0.155	0.149	0.180
4 months	0.201	0.194	0.161	0.222
5 months	0.205	0.248	1.690	0.321
6 months	0.218	0.260	0.199	0.363
7.5 months	0.382	0.268	0.367	0.367

Table A.2-2a Internal standard peak of PVC sample for accelerating exposure at 638 cm^{-1}
(sensitizer : anthraquinone)

Irradiation time	% absorbance			
	0 %	0.05% A	0.1% A	0.5% A
original	0.903	1.000	0.678	1.000
8 hours	0.959	1.125	0.757	1.022
24 hours	1.000	1.208	0.799	1.155
48 hours	1.097	1.324	1.046	1.222
72 hours	1.218	1.469	1.208	1.634
120 hours	1.357	1.569	1.589	1.978
168 hours	1.523	1.569	1.959	2.398
240 hours	1.602	1.679	2.097	2.899

Table A.2-2b Internal standard peak of PVC sample for accelerating exposure at 638 cm^{-1}
(sensitizer : benzophenone)

Irradiation time	% absorbance			
	0 %	0.05% B	0.1% B	0.5% B
original	0.903	0.971	1.076	0.936
8 hours	0.959	1.086	1.125	1.000
24 hours	1.000	1.092	1.243	1.013
48 hours	1.097	1.187	1.456	1.114
72 hours	1.218	1.388	1.495	1.222
120 hours	1.357	1.523	1.699	1.328
168 hours	1.523	1.602	1.959	1.596
240 hours	1.602	1.824	2.011	1.824

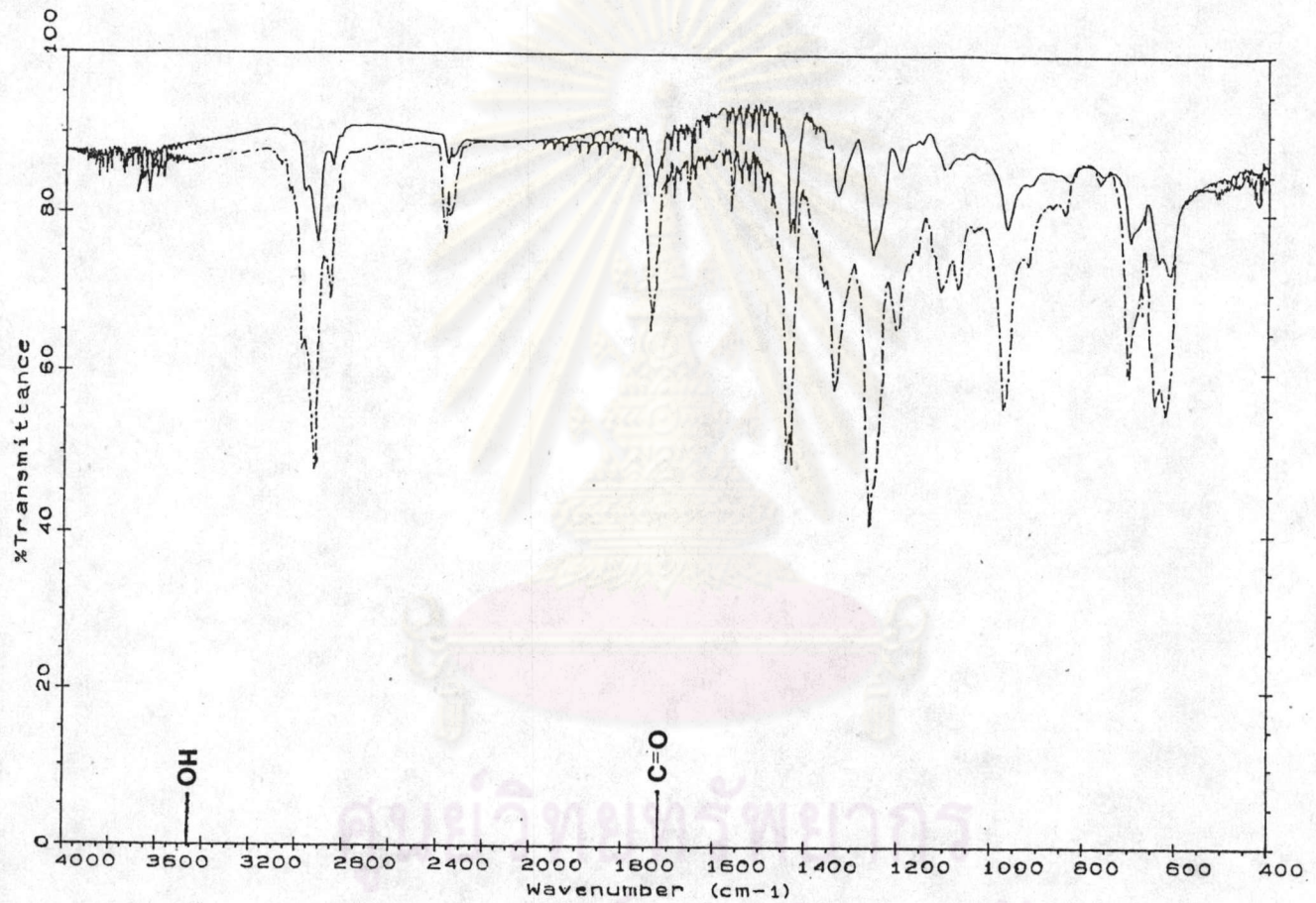


Fig. 4.5.2 FT-IR spectra of PVC outdoor exposure samples at 0.1 % anthraquinone
----- unirradiated , - - - - - irradiated for 6 months

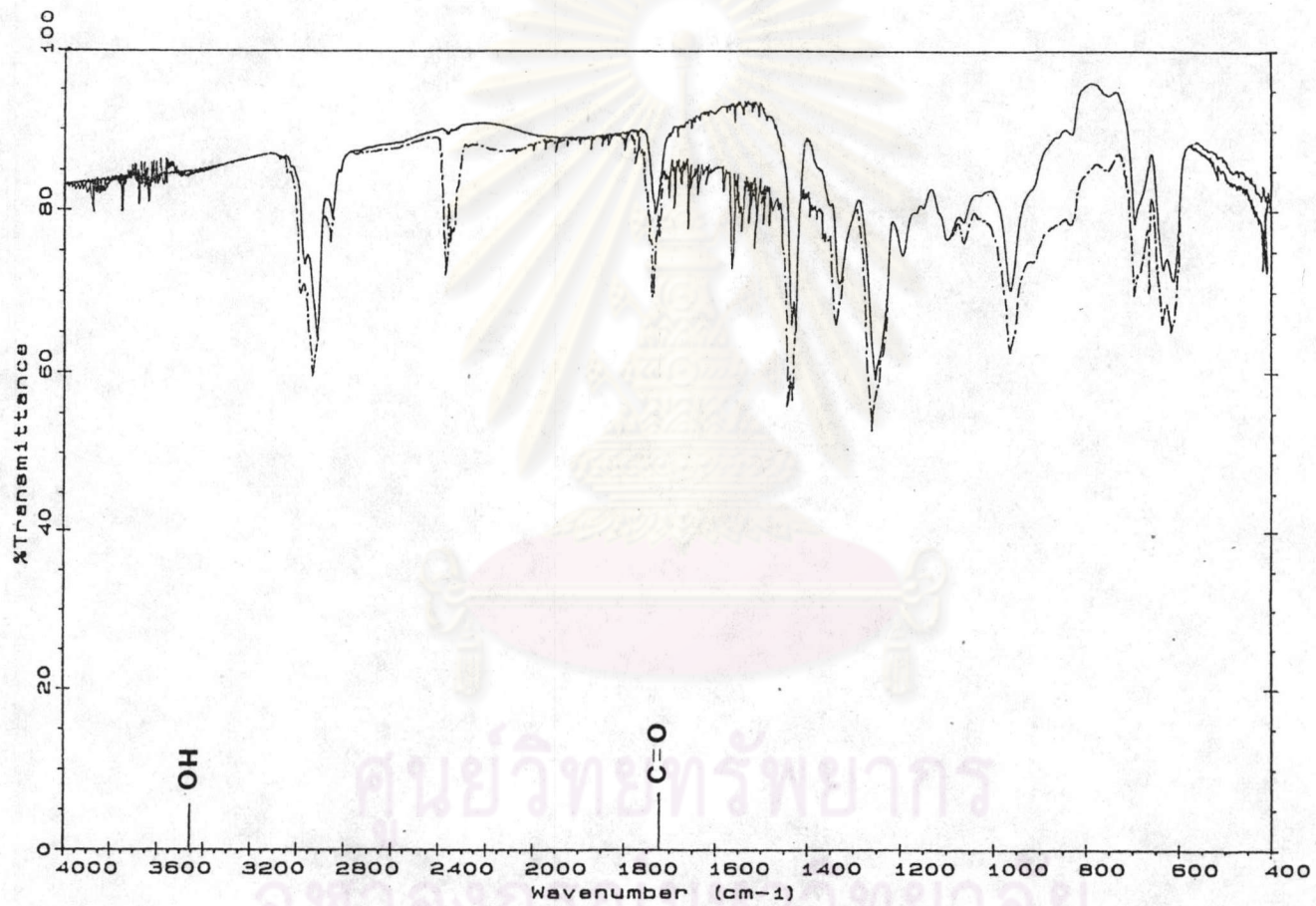


Fig. 4.5.3 FT-IR spectra of PVC outdoor exposure samples at 0.1 % benzophenone
 ----- unirradiated , - - - - - irradiated for 6 months

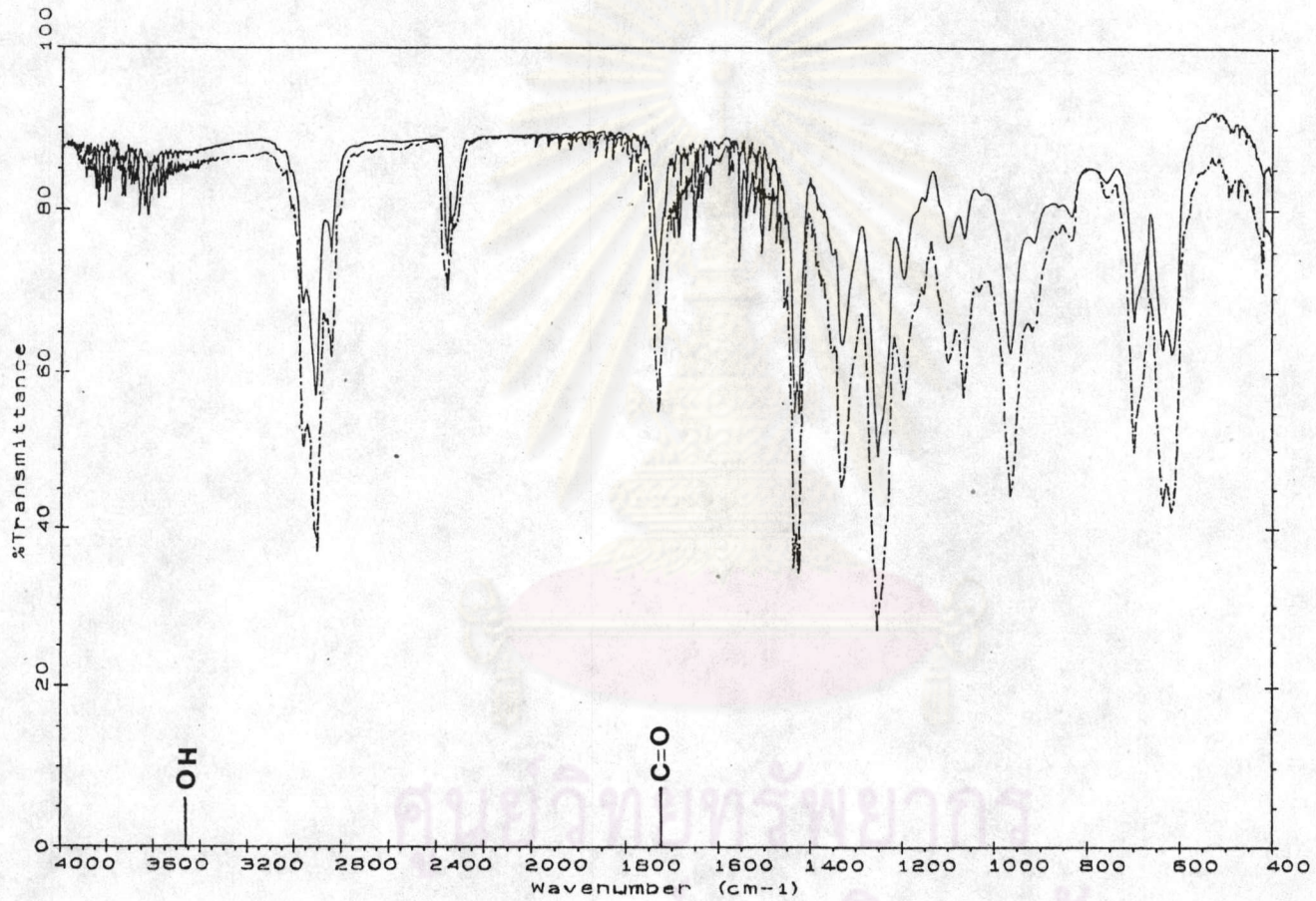


Fig. 4.5.4 FT-IR spectra of PVC outdoor exposure samples at 0.5 % benzophenone
 ----- unirradiated , - - - - - irradiated for 6 months

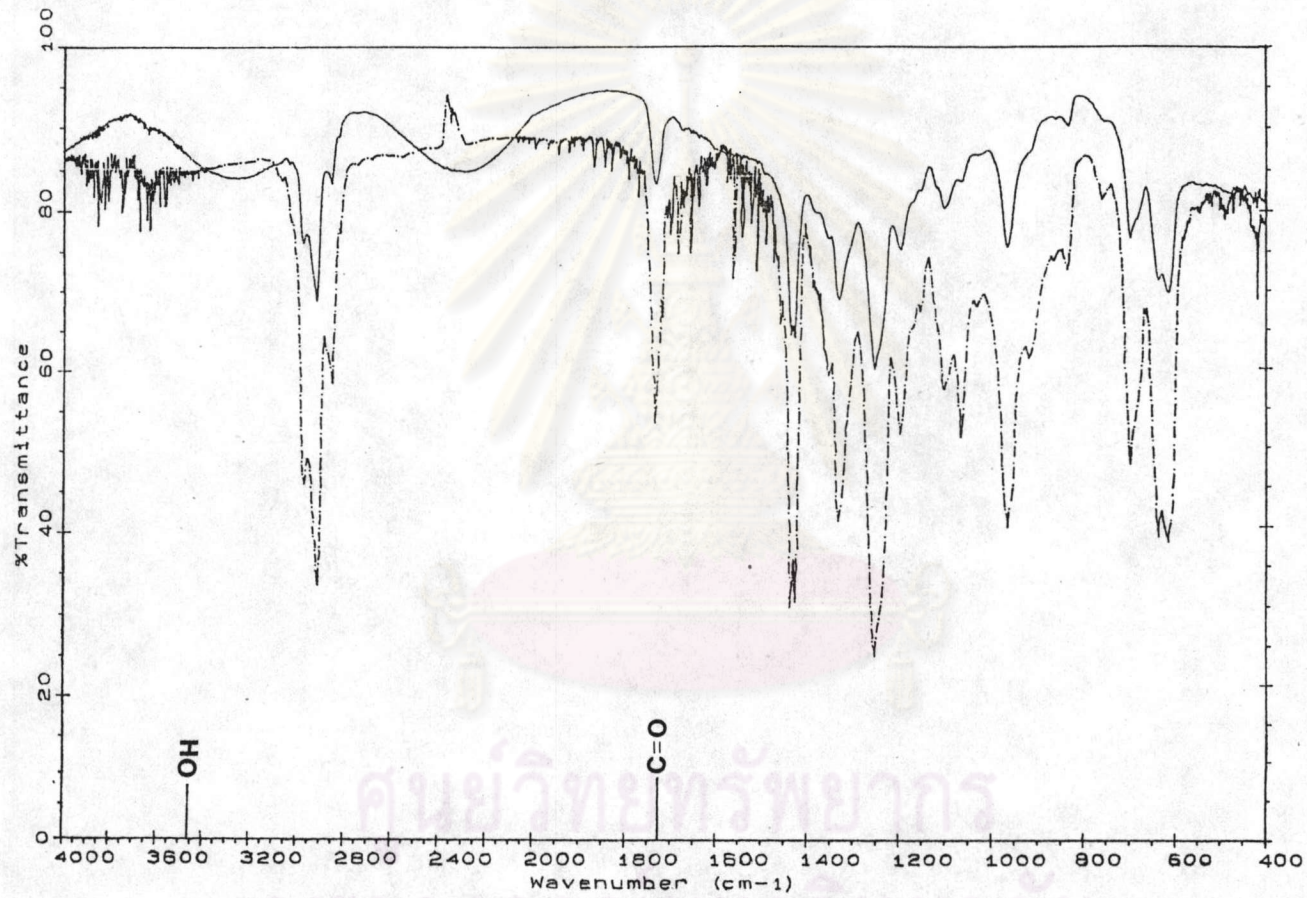


Fig. 4.5.5 FT-IR spectra of PVC outdoor exposure samples at 1.0 % benzophenone
----- unirradiated , - - - - - irradiated for 6 months

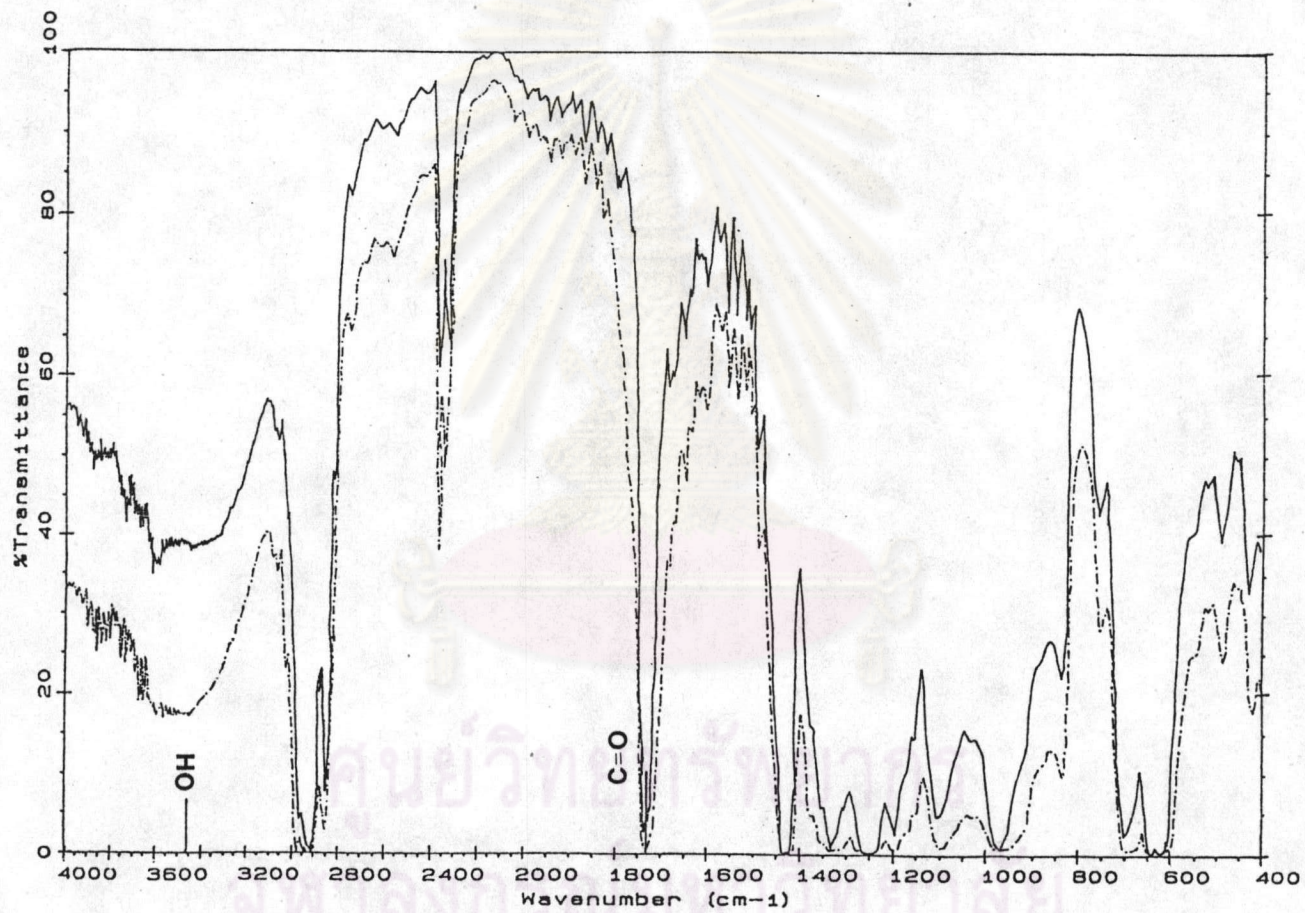


Fig. 4.13.2 FT-IR spectra of irradiated PVC samples at 0.05 % anthraquinone
----- unirradiated , - - - - - irradiated for 240 hours

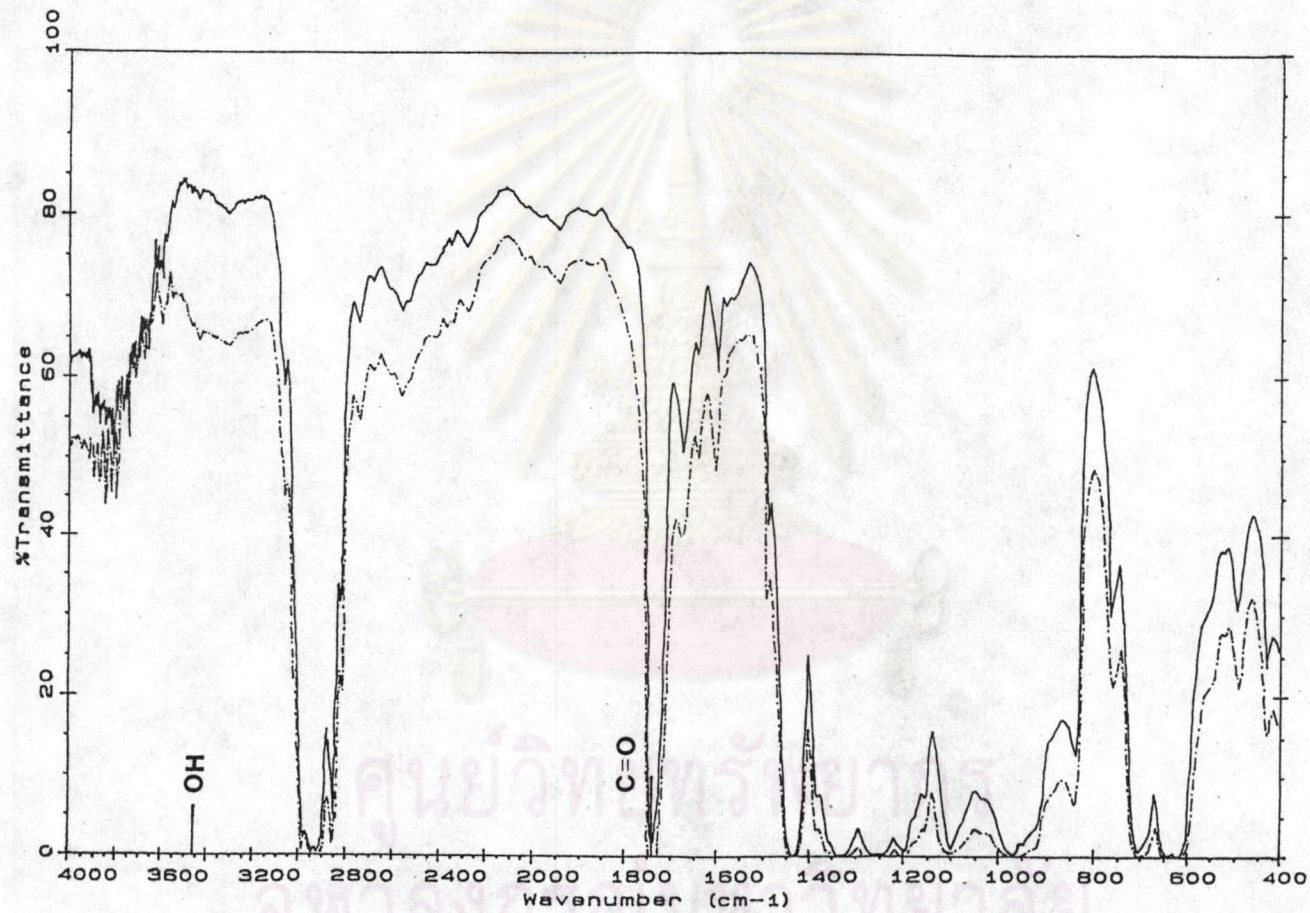


Fig. 4.13.3 FT-IR spectra of irradiated PVC samples at 0.1 % anthraquinone
----- unirradiated , - - - - - irradiated for 240 hours

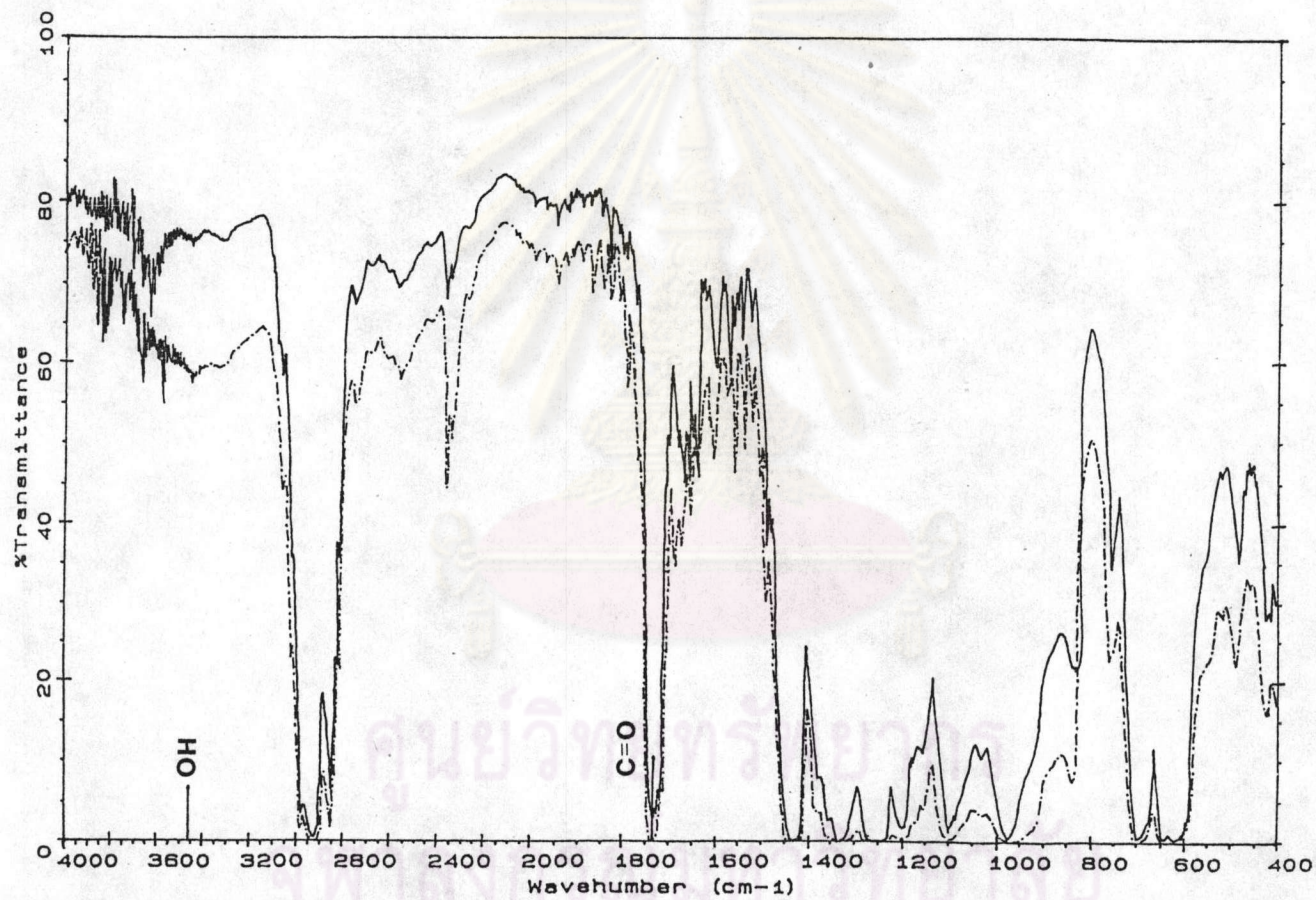


Fig. 4.13.4 FT-IR spectra of irradiated PVC samples at 0.5 % anthraquinone
----- unirradiated , - - - - - irradiated for 240 hours

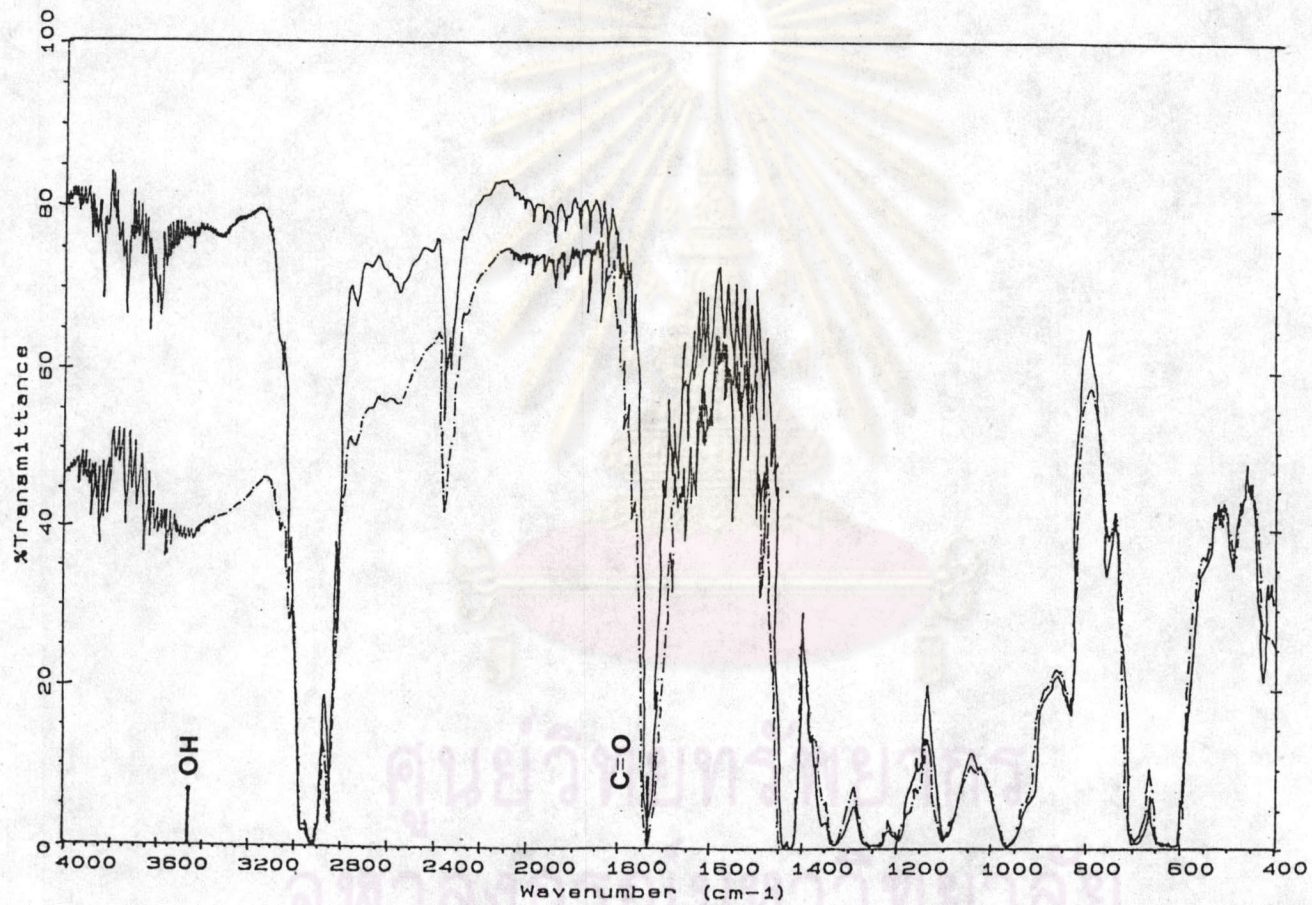


Fig. 4.13.5 FT-IR spectra of irradiated PVC samples at 0.05 % benzophenone
----- unirradiated , - - - - - irradiated for 240 hours

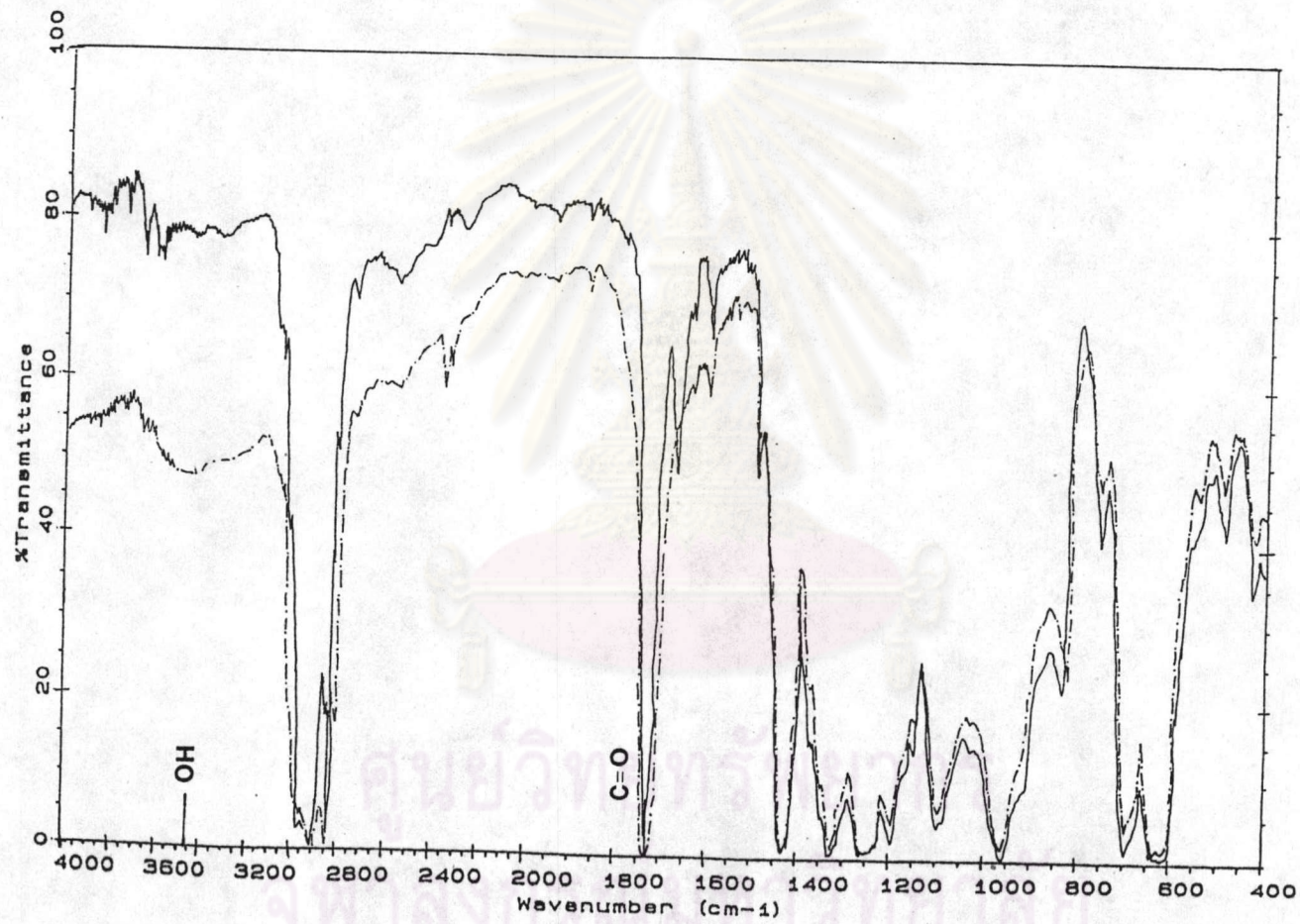


Fig. 4.13.6 FT-IR spectra of irradiated PVC samples at 0.1 % benzophenone
 ----- unirradiated , - - - - - irradiated for 240 hours

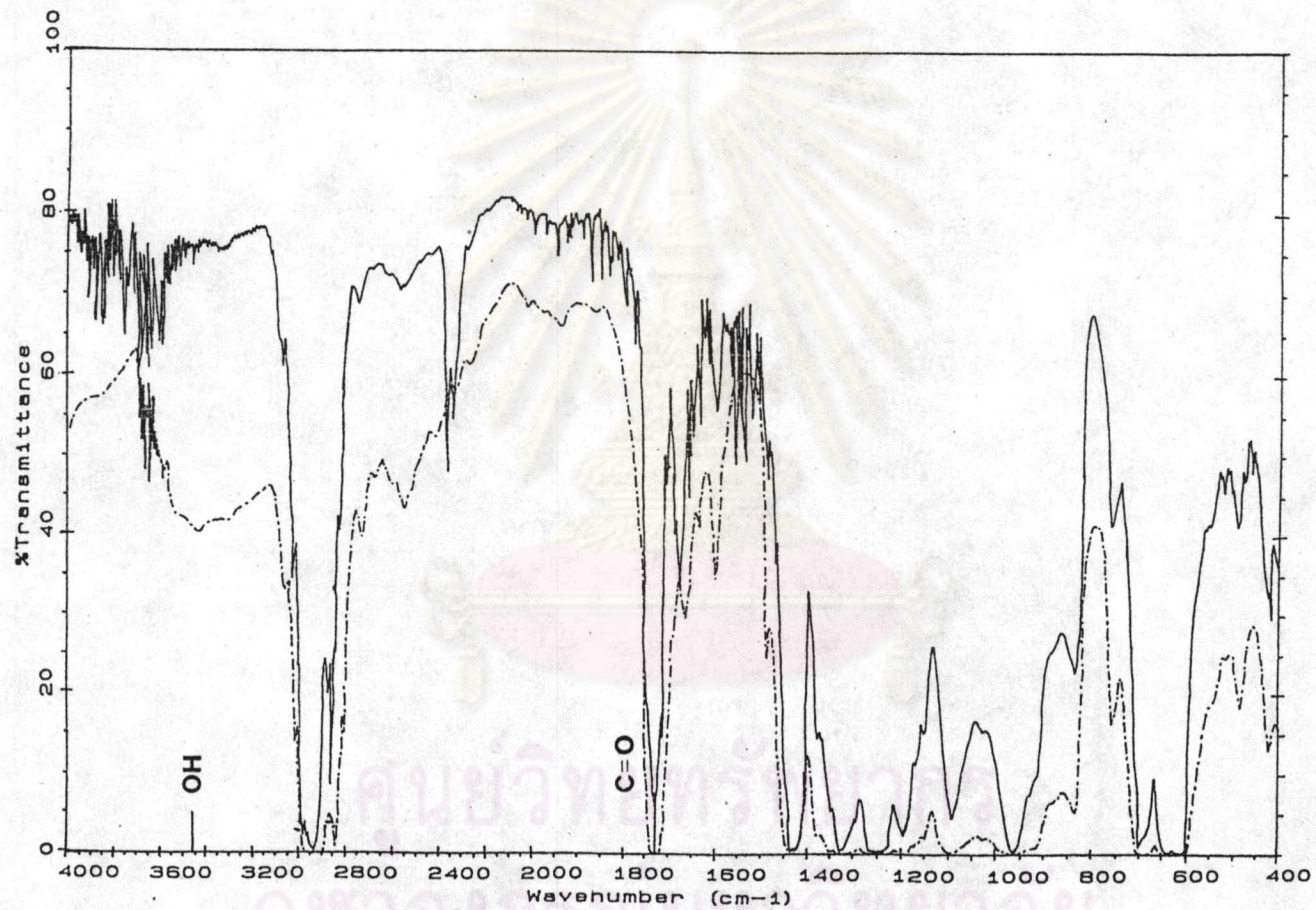


Fig. 4.13.7 FT-IR spectra of irradiated PVC samples at 0.5 % benzophenone

----- unirradiated , - - - - - irradiated for 240 hours

APPENDIX B

SAMPLES OF CALCULATION

1. Calculation of tensile strength

JIS K-6734

The tensile strength on the basis of the original cross-sectional area of the test specimen are calculated by the equation

$$\sigma = F/A$$

where

- σ = the tensile strength in kilograms per square millimeters
- F = the force in kilograms
- A = the initial cross-sectional area in square millimeters of the test sample

2. Calculation of elongation

JIS K-6734

The percentage elongation on the basis of the original gauge length are calculated by the equation

$$\varepsilon = \frac{(l - l_0) * 100}{l_0}$$

where

- ε = the elongation in percentage
- l = the distance in millimeters between the gauge marks
- l_0 = the original gauge length in millimeters

3. Calculation of intrinsic viscosity

ASTM D 1247

3.1 Relative viscosity (viscosity ratio)

The relative viscosity for each concentration are calculated from the efflux time ;

$$\eta_{rel} = t/t_0$$

where

η_{rel} = relative viscosity (viscosity ratio)

t = average efflux time of solution

t_0 = average efflux time of pure solvent

3.2 Intrinsic viscosity (logarithmic viscosity number)

The inherent viscosity for each concentration are calculate by the equation

$$\eta_{inh} = (\ln \eta_{rel})/C$$

where

η_{inh} = inherent viscosity at concentration C

$\ln \eta_{rel}$ = natural logarithm of the relative viscosity

C = concentration in grams/millilitre of solution

3.3 Specific viscosity

The specific viscosity of the solution are calculated by

$$\eta_{sp} = \eta_{rel} - 1$$

where

η_{sp} = specific viscosity

3.4 Reduced viscosity

The reduced viscosity of the solution are calculated by

$$\eta_{red} = \eta_{sp} / C$$

where

η_{red} = reduced viscosity

3.5 Intrinsic viscosity

The four logarithmic viscosity and the reduced viscosity value of the solution of various concentration of polymers are determined and plotted against their respect four concentrations. The intercept of the two lines at zero concentration is intrinsic viscosity $[\eta]$. As shown in Fig. B.1

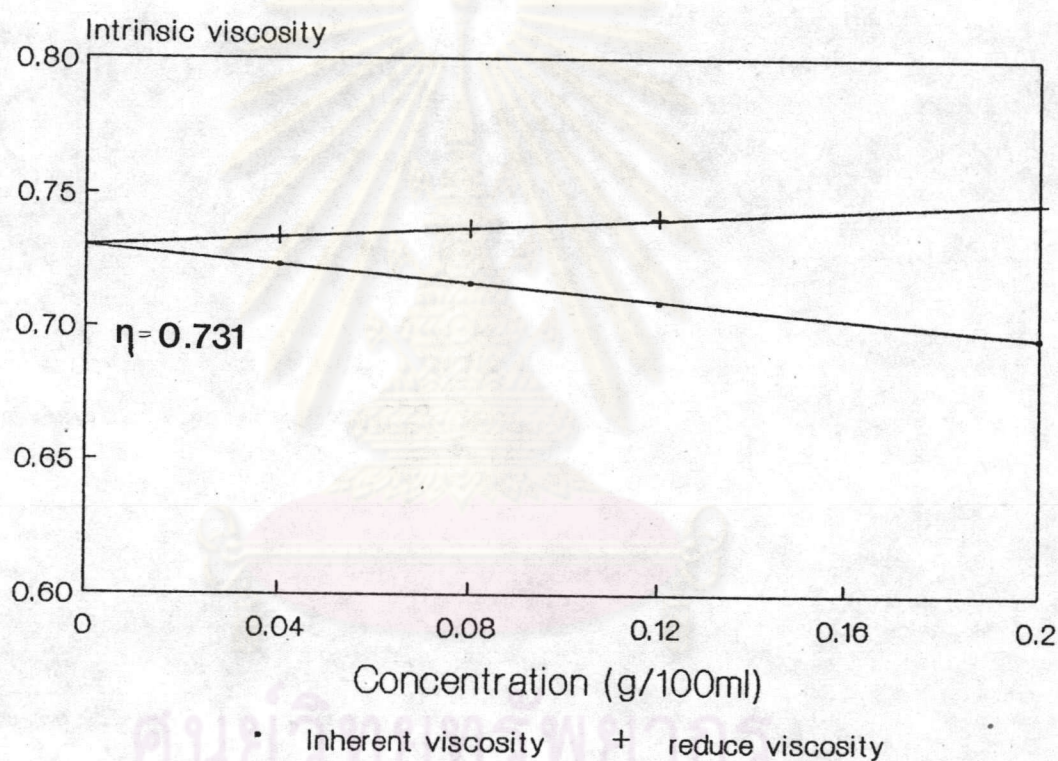


Fig. B-1 Intrinsic viscosity of 0 % photosensitizer for original PVC sample

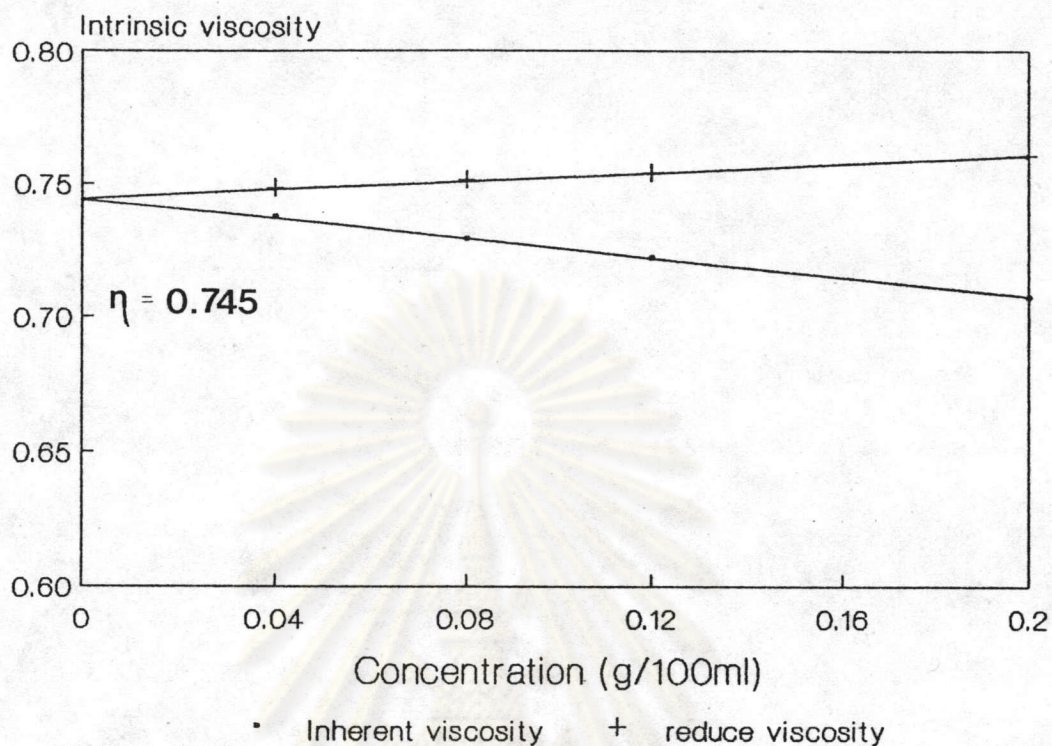


Fig. B-2 Intrinsic viscosity of 0.1 % anthraquinone for original PVC sample

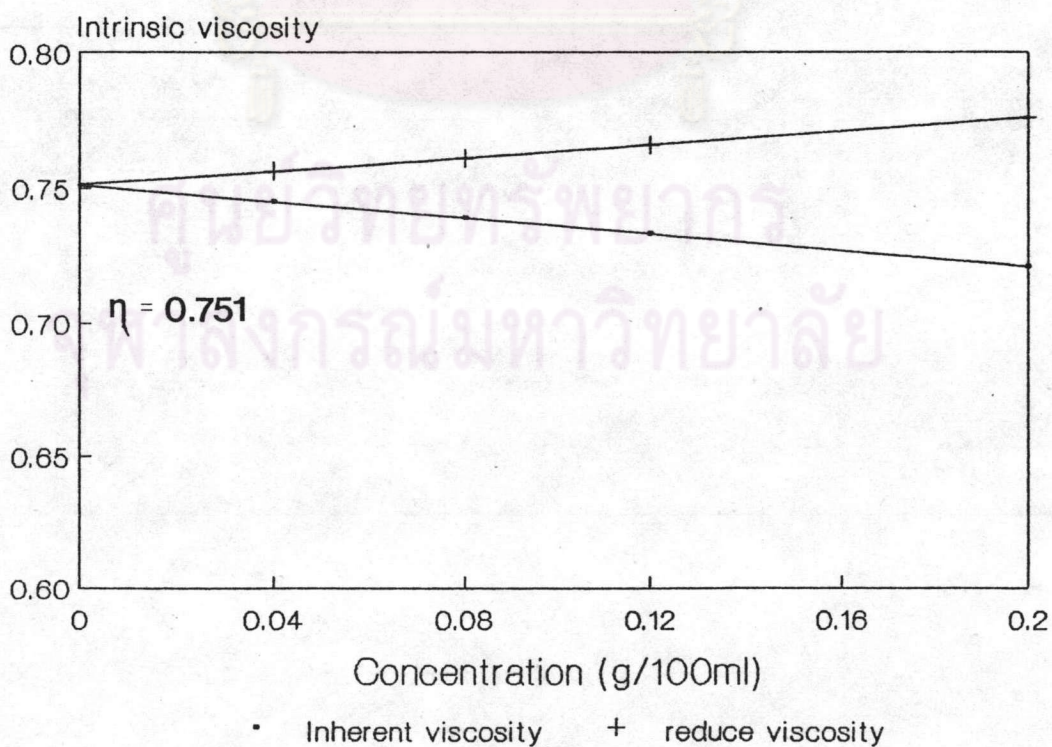


Fig. B-3 Intrinsic viscosity of 0.5 % anthraquinone for original PVC sample

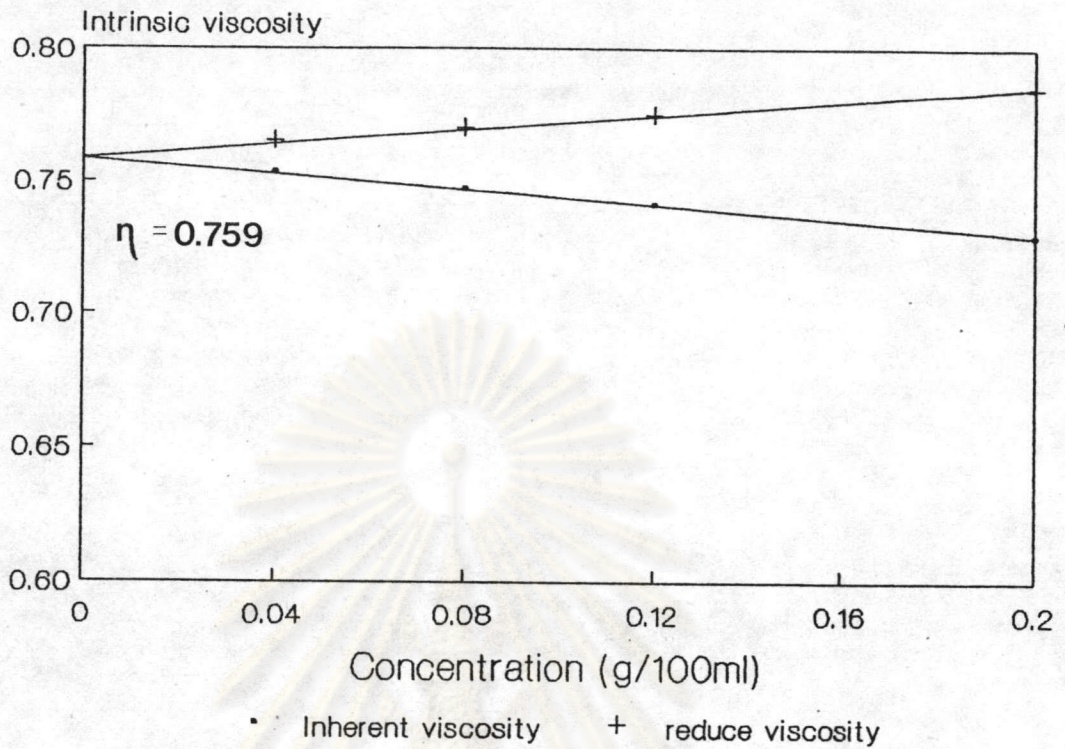


Fig. B-4 Intrinsic viscosity of 1.0 % anthraquinone for original PVC sample

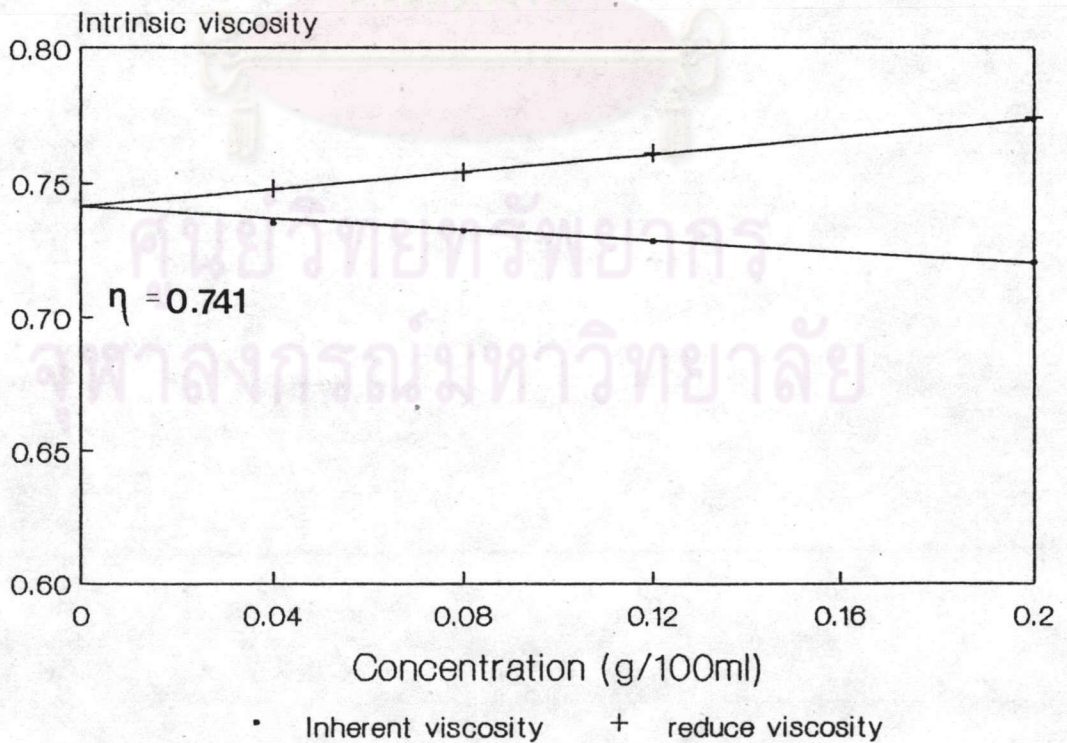


Fig. B-5 Intrinsic viscosity of 0.1 % benzophenone for original PVC sample

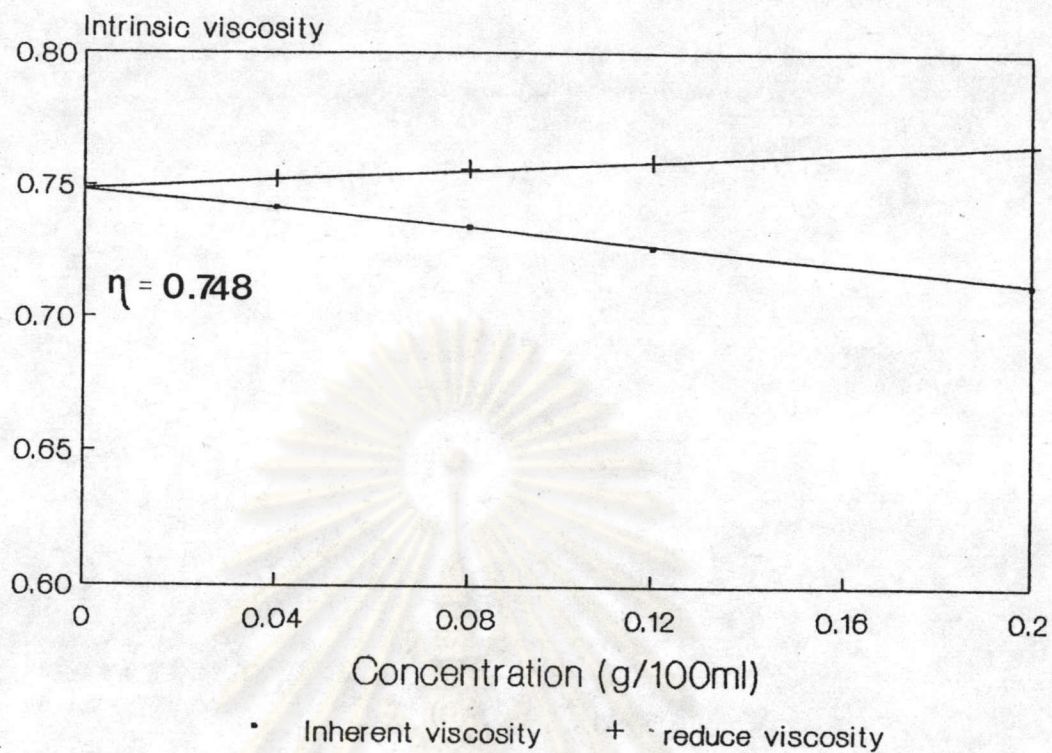


Fig. B-6 Intrinsic viscosity of 0.5 % benzophenone for original PVC sample

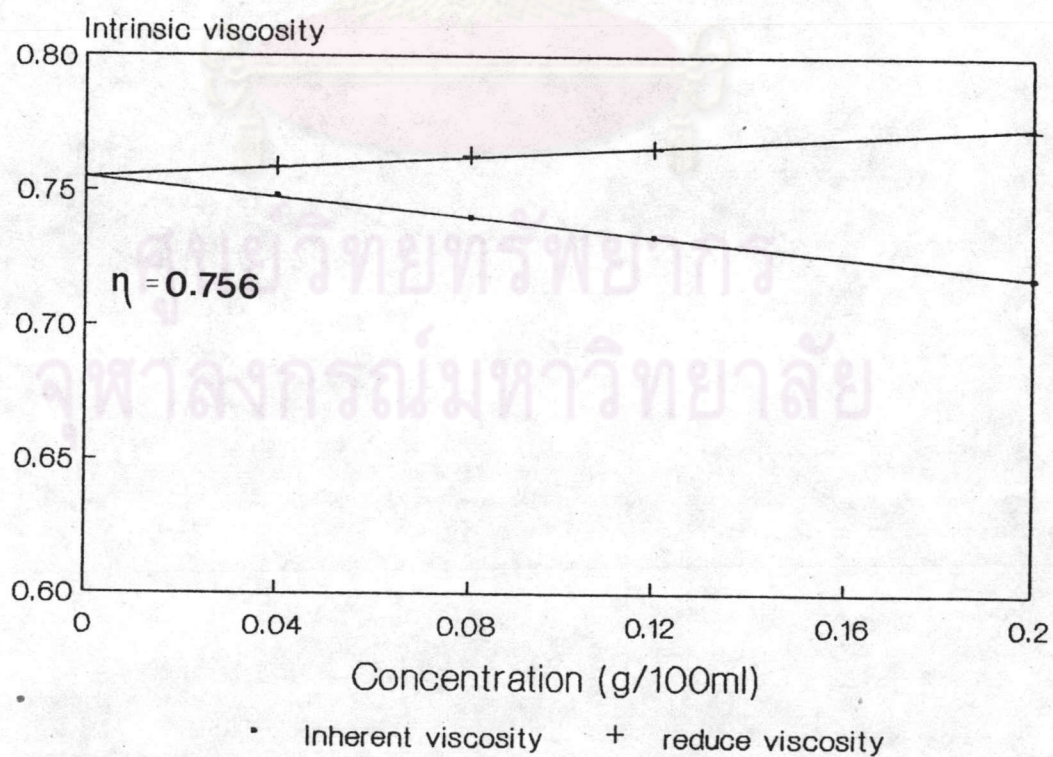


Fig. B-7 Intrinsic viscosity of 1.0 % benzophenone for original PVC sample

4. Calculation of molecular weight

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The measurement of $[\eta]$ alone give only a relative comparison of molecular weight between various samples of PVC. However, the intrinsic viscosity can be related to the molecular weight (M) as follows

$$[\eta] = KM_v^{-a}$$

The constants, K and a, are determined for a given polymer/solvent system. For PVC/cyclohexanone system at 30° C :

$$K = 16.3 * 10^{-3}$$

$$a = 0.77$$

Consequently, the molecular weight of PVC samples can be determined.

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