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APPENDICES

Appendix A The Optical Scanning Method

The amount of ink present on each sample, before and after deinking, was determined by using an optical scanning method. The steps involved the optical scanning process is shown in Figures A1 to A6.

For optical scanning, each plastic sample was carefully on the scanner and scanned at optimum conditions (standardized) using a HP LaserJet 4c scanner. In order to prevent the reflection from the white surface of the scanner cover, a black poster board was placed behind the sample during scanning. After scanning, an image file was imported into an Adobe PhotoShop program to quantify the amount of ink (pixels) present on the plastic surface.

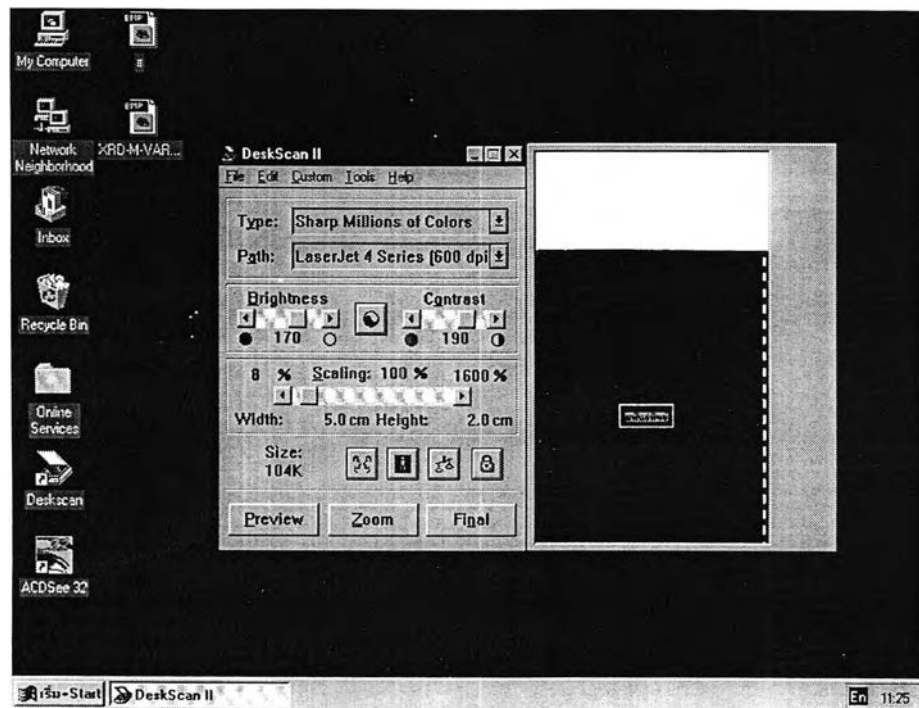


Figure A1 Scanning of a sample of printed plastic sheet

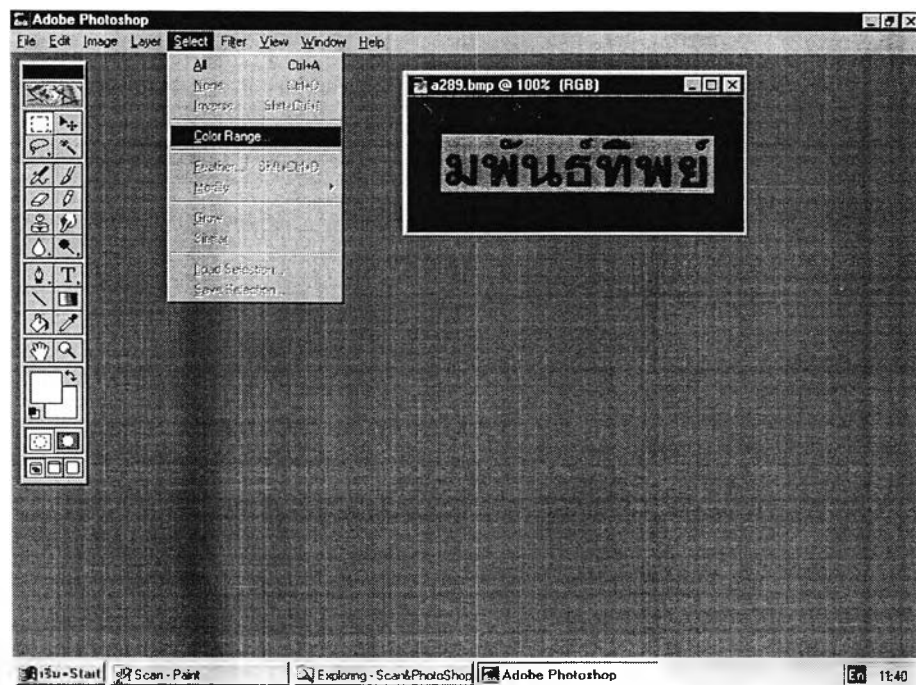


Figure A2 An image file opened in Adobe Photoshop program

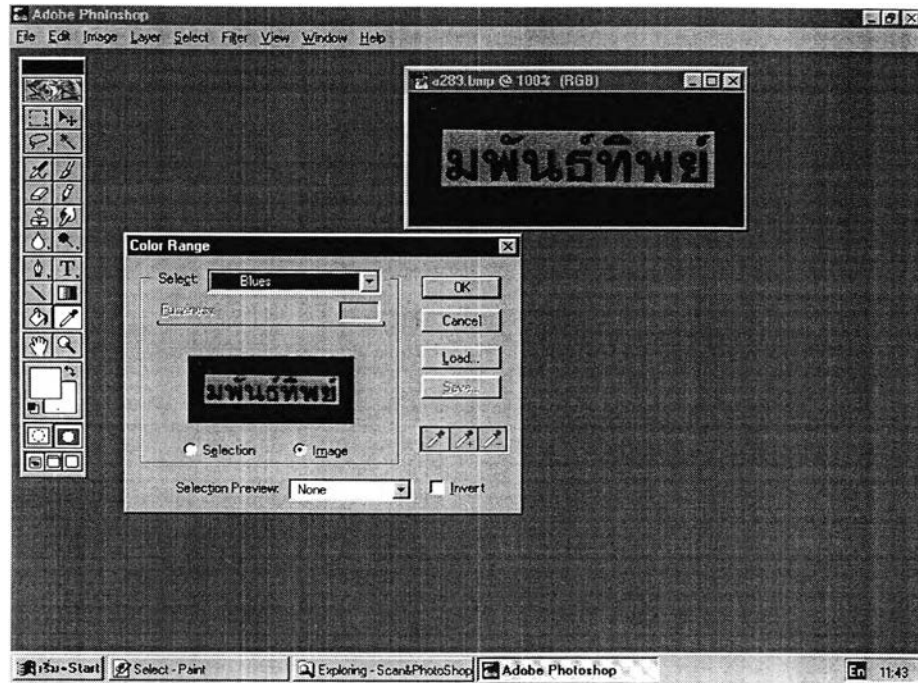


Figure A3 Selection of the specified color (blue)

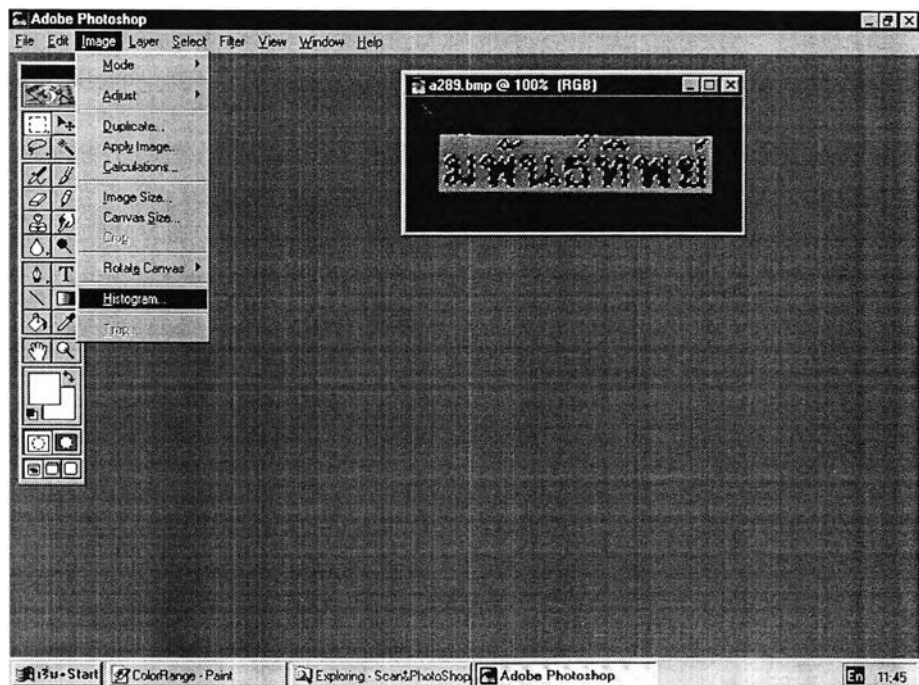


Figure A4 Selected blue ink area

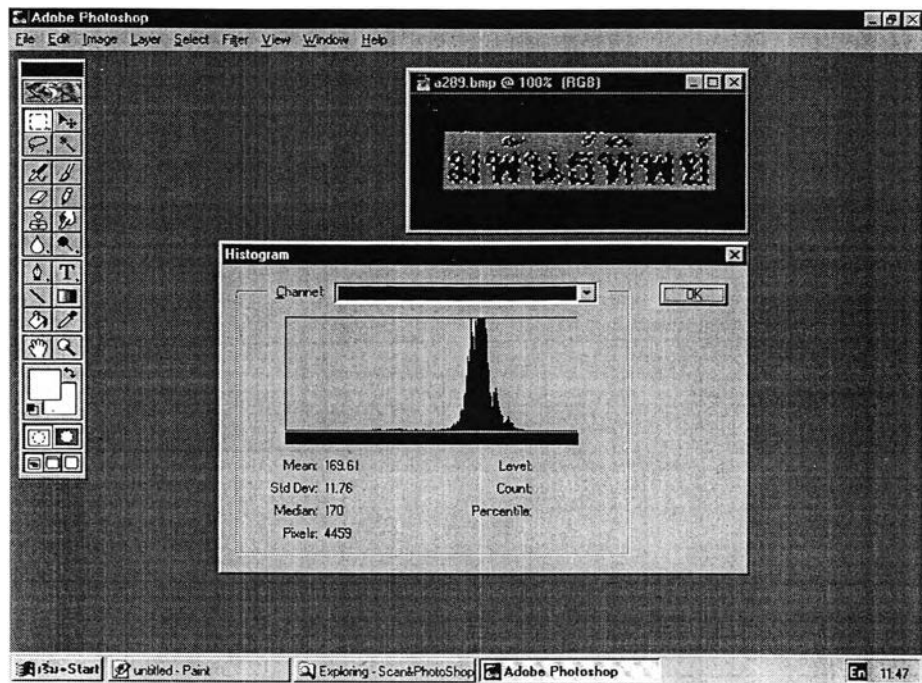


Figure A5 Histogram and data values showing the distribution of blue ink on printed plastic sheet

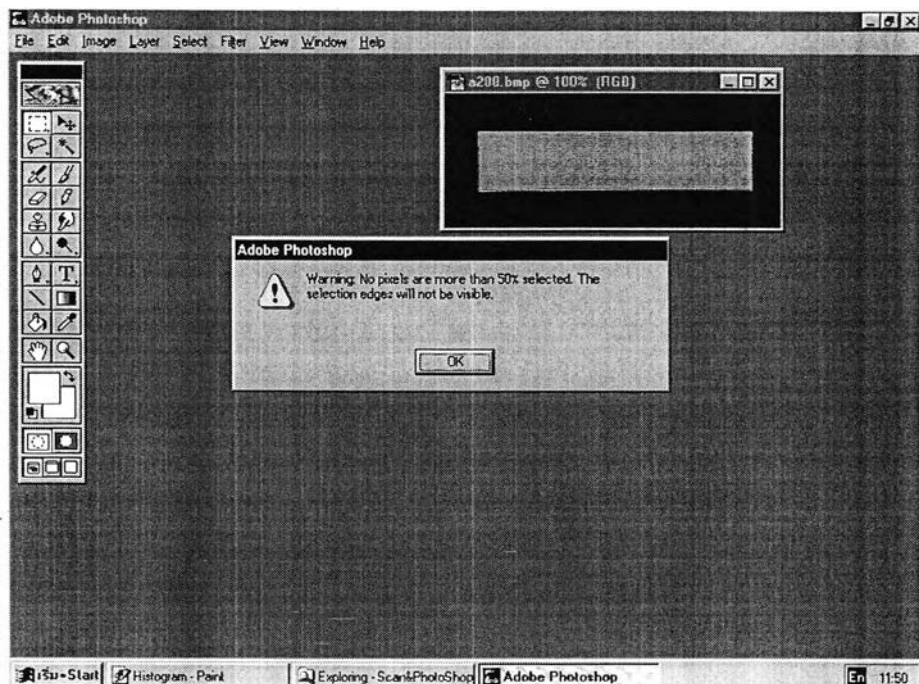


Figure A6 Window giving a warning that no pixels are present for a completely deinked sample

Appendix B Examples of Calculated Results from the Optical Scanning Method

A number of experiments were conducted using the surfactant CTAB to remove solvent-based ink from high density polyethylene surfaces. Each experiment was repeated at least twice. After knowing the amount of ink (pixels) present on each sample before and after deinking process the amount of ink removed was determined using the following relationship:

$$\text{Ink removed (\%)} = \frac{\text{Pixels}_{\text{before}} - \text{Pixels}_{\text{after}}}{\text{Pixels}_{\text{before}}} \times 100$$

Some examples of the calculated results from the optical scanning method are shown in Tables B1 to B5.

Table B1 Effect of CTAB concentration and abrasive

CTAB Concentration (CMC=0.92mM)	Deinking without abrasive			Deinking with abrasive		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
none	4495	4416	1.76	4477	4317	3.57
25% CMC	4406	4318	2.00	4451	3931	11.68
50% CMC	4396	4268	2.91	4502	2925	35.03
75% CMC	4445	4037	9.18	4447	2450	44.91
CMC	4719	3937	16.57	4551	2277	49.97
3 * CMC	4469	2006	55.11	4317	805	81.35
5 * CMC	4460	111	97.51	4514	27	99.40
7 * CMC	4430	30	99.32	4531	19	99.58
10 * CMC	4580	21	99.54	4424	17	99.62

Conditions: Pre-soaking time = 2 hrs, Shaking time = 2 hrs, pH = 12, and T = 30° C

Table B2 Effect of pre-soaking time

Pre-soaking Time (hr)	25% CMC			CMC			2 x CMC		
	Scanned pixels			Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)	Before	After	Ink removed (%)
0	4293	4293	0.00	4548	4133	9.12	4378	3815	12.86
1	4397	4382	0.34	4672	3989	14.62	4492	2945	34.44
2	4307	4224	1.93	4446	3437	22.69	4666	2012	56.88
3	4469	4404	1.45	4293	3142	26.81	4487	654	85.42
4	4481	4384	2.16	4517	1597	64.64	4458	604	86.45
5	4526	4113	9.13	4410	337	92.36	4463	145	96.75
6	4442	3900	12.20	4570	314	93.13	4387	86	98.04
7	4527	3718	17.87	4577	94	97.95	4495	23	99.49

Pre-soaking Time (hr)	5 x CMC			10 x CMC		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
0	4479	935	79.12	4252	75	98.24
1	4679	129	97.24	4511	69	98.47
2	4598	29	99.37	4573	35	99.23
3	4395	23	99.48	4576	32	99.30
4	4693	18	99.62	4478	20	99.55
5	4483	11	99.75	4474	24	99.46
6	4657	23	99.51	4527	17	99.62
7	4642	18	99.61	4564	4	99.91

Conditions: Shaking time = 2 hrs, pH = 12, T = 30°C, and no abrasive material present

Table B3 Effect of shaking time

Shaking Time (hr)	25% CMC			CMC		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
0	4587	4568	0.41	4490	4447	0.96
1	4614	4603	0.24	4500	4326	3.87
2	4387	4378	0.21	4372	2990	31.61
3	4579	4333	5.37	4611	1217	73.61
4	4459	3219	27.81	4487	177	96.06
5	4492	2579	42.59	4569	65	98.58
6	4582	2292	49.98	4569	26	99.43
7	4340	1761	59.42	4442	10	99.77

Shaking Time (hr)	5 x CMC			10 x CMC		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
0	4534	4084	9.93	4543	3128	31.15
1	4527	2090	53.83	4687	63	98.66
2	4566	163	96.43	4616	22	99.52
3	4644	39	99.16	4705	10	99.79
4	4407	35	99.21	4595	29	99.37
5	4416	32	99.28	4552	22	99.52
6	4635	26	99.44	4534	11	99.76
7	4635	26	99.44	4426	25	99.44

Conditions: Pre-soaking time = 2 hrs, pH = 12, T = 30°C, and no abrasive material present

Table B4 Effect of pH

pH	25% CMC			CMC			2 x CMC		
	Scanned pixels			Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)	Before	After	Ink removed (%)
11.00	4581	4573	0.17	4446	4394	1.17	4425	4374	1.15
11.25	4593	4537	1.22	4478	4383	2.12	4521	4412	2.41
11.50	4705	4624	1.72	4815	4623	3.99	4530	4277	5.58
11.75	4553	4498	1.21	4623	4076	11.83	4579	3635	20.62
12.00	4475	4391	1.88	4598	3684	19.88	4635	2739	40.91

pH	5 x CMC			10 x CMC		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
11.00	4545	4498	1.03	4544	4303	5.30
11.25	4710	4612	2.08	4671	4390	6.02
11.50	4545	4083	10.17	4761	3978	16.45
11.75	4524	184	95.93	4617	63	98.64
12.00	4551	166	96.35	4419	45	98.98

Conditions: Pre-soaking time = 2 hrs, Shaking time = 2 hrs, T = 30°C, and no abrasive material present

Table B5 Effect of temperature

T (°C)	25% CMC			CMC			2 x CMC		
	Scanned pixels			Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)	Before	After	Ink removed (%)
30	4658	4589	1.48	4636	3852	16.91	4628	1528	66.98
35	4724	4500	4.74	4631	3321	28.29	4571	249	94.55
40	4476	2338	47.77	4491	504	88.78	4524	50	98.89
45	4731	94	98.01	4656	102	97.81	4353	27	99.38

T (°C)	5 x CMC			10 x CMC		
	Scanned pixels			Scanned pixels		
	Before	After	Ink removed (%)	Before	After	Ink removed (%)
30	4581	110	97.60	4567	42	99.08
35	4711	93	98.03	4493	43	99.04
40	4660	57	98.78	4756	16	99.66
45	4649	27	99.42	4489	50	98.89

Conditions: Pre-soaking time = 2 hrs, Shaking time = 2 hrs, pH = 12, and no abrasive material present

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