Supporting Information for

Single Fiber Identification with Nondestructive Excitation-Emissions Spectral Cluster Analysis

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Analysis of single dyed fibers must account for variations in dye concentration and spectral intensity. To this end, all spectra were baseline corrected and normalized. This process is demonstrated in the Figure S-1, for which fibers from different regions of a cloth dyed with Direct Blue 1 show significant (20%) intensity variation. The data are subsequently normalized prior to calculation of principal component scores.

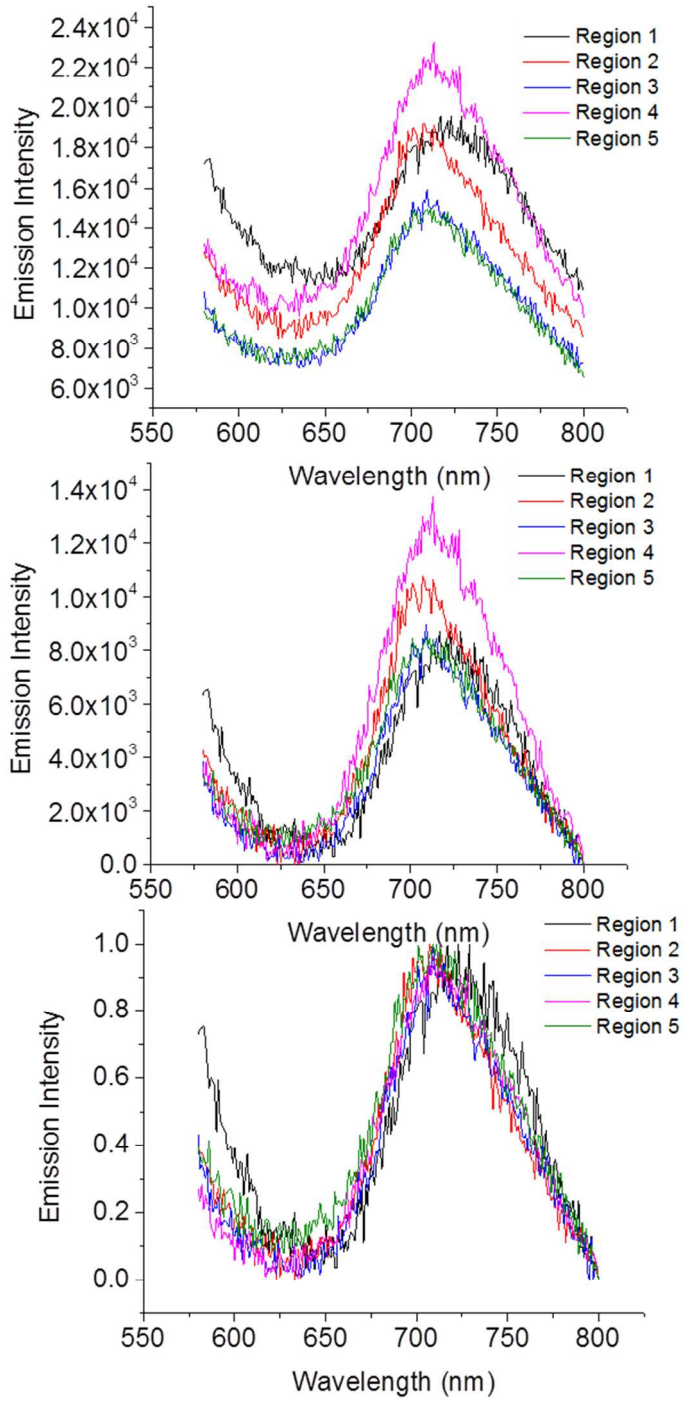

Figure S-1: A) Raw data emission spectra (λ_{exc} = 530 nm) from five fibers obtained from five different regions of the same cloth dyed with DB 1. Baseline correction (spectra shown in B) and normalization (spectra shown in C) are required pretreatment prior to cluster analysis.

Identification of fibers from cluster analysis required the calculation of an F-ratio for each point in the principal component scores plots. The distances of the fiber's point was determined on the scores plot to the center to each cluster, as was the distance to the elliptical boundary in the direction of the point. The calculated F-ratios for each fiber, thread and region is tabulated here. The critical F-value is 10.56 for 99% confidence

Table S-1. **F-test for Acid Blue 25 Fibers, Threads, and Regions**

	F (AB25)	**F (**AB41)	**Identification**
AB25 Fiber S1	4.75	63.0	AB25
AB25Fiber S2	0.51	51.4	AB25
AB25 Fiber S3	7.99	95.0	AB25
AB25 Fiber S4	3.47	61.4	AB25
AB25 Fiber S5	2.39	46.5	AB25
AB25 Fiber S6	1.78	24.0	AB25
AB25 Fiber S7	0.36	68.2	AB25
AB25 Fiber S8	1.95	46.1	AB25
AB25 Fiber S9	0.52	18.2	AB25
AB25 Fiber S10	0.52	55.4	AB25
AB25 Thread 1	4.75	62.9	AB25
AB25 Thread 2	0.95	55.7	AB25
AB25 Thread 3	1.33	48.1	AB25
AB25 Thread 4	0.14	17.5	AB25
AB25 Thread 5	3.35	30.7	AB25
AB25 Thread 6	4.83	17.8	AB25
AB25 Thread 7	4.00	37.2	AB25
AB25 Thread 8	1.34	43.7	AB25
AB25 Thread 9	3.21	58.2	AB25
AB25 Thread 10	0.86	42.8	AB25
AB25 Region1	0.95	55.7	AB25
AB25 Region 2	1.04	42.0	AB25
AB25 Region 3	1.04	28.9	AB25
AB25 Region 4	1.76	50.2	AB25
AB25 Region 5	1.02	52.3	AB25

Table S-2. F-test for Acid Blue 41 Fibers, Threads, and Regions

	F (AB41)	**F** (AB25)	**Identification**
AB41Fiber S1	0.24	132	AB41
AB41Fiber S2	0.20	112	AB41
AB41 Fiber S3	2.30	28.8	AB41
AB41Fiber S4	0.62	53.6	AB41
AB41 Fiber S5	0.38	66.5	AB41
AB41 Fiber S6	4.29	135	AB41
AB41 Fiber S7	0.19	149	AB41
AB41 Fiber S8	0.99	92.3	AB41
AB41 Fiber S9	8.34	167	AB41
AB41 Fiber S10	0.97	138	AB41
AB25 Thread 1	0.24	132	AB41
AB41 Thread	0.43	141	AB41
AB41Thread	0.35	105	AB41
AB41 Thread 4	9.69	148	AB41
AB41 Thread 5	23.2	146	Unclassified
AB41 Thread 6	10.1	109	AB41
AB41 Thread 7	1.11	181	AB41
AB41 Thread 8	0.59	169	AB41
AB41 Thread 9	0.88	143	AB41
AB41 Thread 10	0.70	131	AB41
AB41 Region1	0.43	141	AB41
AB41 Region 2	0.77	188	AB41
AB41 Region 3	4.40	179	AB41
AB41 Region 4	0.26	192	AB41
AB41 Region 5	0.52	168	AB41

Table S-3. F-test for Direct Blue 1 Fibers, Threads and Regions

	F (DB1)	**F** (DB53)	**Identification**
DB1 Fiber S1	3.21	43.6	DB1
DB1 Fiber S2	1.55	29.2	DB1
DB1 Fiber S3	2.28	39.4	DB1
DB1 Fiber S4	7.42	21.7	DB1
DB1 Fiber S5	0.82	70.6	DB1
DB1 Fiber S6	9.64	91.8	DB1
DB1 Fiber S7	1.24	36.7	DB1
DB1 Fiber S8	2.36	50.0	DB1
DB1 Fiber S9	16.0	64.7	Unclassified
DB1 Fiber S10	16.6	47.3	Unclassified
DB1 Thread 1	8.83	53.3	DB1
DB1 Thread 2	2.55	37.3	DB1
DB1 Thread 3	1.96	31.5	DB1
DB1 Thread 4	0.02	28.1	DB1
DB1 Thread 5	0.07	54.7	DB1
DB1 Thread 6	4.70	40.6	DB1
DB1 Thread 7	0.77	48.3	DB1
DB1 Thread 8	0.88	43.9	DB1
DB1 Thread 9	0.61	36.1	DB1
DB1 Thread 10	3.05	29.0	DB1
DB1 Region1	8.84	53.3	DB1
DB1 Region 2	3.40	61.8	DB1
DB1 Region 3	1.53	47.8	DB1
DB1 Region 4	5.73	84.8	DB1
DB1 Region 5	3.88	48.3	DB1

Table S-4. F-test for Direct Blue 53 Fibers, Threads and Regions

	F (DB53)	**F** (DB1)	**Identification**
DB53 Fiber S1	2.56	96.0	DB53
DB53 Fiber S2	7.97	118	DB53
DB53 Fiber S3	1.67	154	DB53
DB53 Fiber S4	17.1	60.8	Unclassified
DB53 Fiber S5	6.11	142	DB53
DB53 Fiber S6	23.2	61.5	Unclassified
DB53 Fiber S7	2.60	123	DB53
DB53 Fiber S8	0.30	113	DB53
DB53 Fiber S9	4.71	45.3	DB53
DB53 Fiber S10	0.08	40.4	DB53
DB53 Thread 1	1.42	328	DB53
DB53 Thread 2	4.12	221	DB53
DB53 Thread 3	7.07	123	DB53
DB53 Thread 4	8.75	168	DB53
DB53 Thread 5	0.48	189	DB53
DB53 Thread 6	4.80	90.6	DB53
DB53 Thread 7	0.22	221	DB53
DB53 Thread 8	2.03	229	DB53
DB53 Thread 9	2.92	140	DB53
DB53 Thread 10	9.73	111	DB53
DB53 Region1	1.42	328	DB53
DB53 Region 2	2.61	110	DB53
DB53 Region 3	2.21	117	DB53
DB53 Region 4	14.34	73.4	Unclassified DB53
DB53 Region 5	0.21	96.7	DB53