

# Supplementary Materials: Characterizing the Effects of Washing by Different Detergents on the Wavelength–Scale Microstructures of Silk Samples Using Mueller Matrix Polarimetry

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**Table S1.** Central moments of the Mueller matrix elements for silk sample washed by fabric softener.

Detergent/Parameter	m12	m13	m14	m21	m22	m23	m24	m31	m32	m33	m34	m41	m42	m43	m44
F/P1_0	0.030	0.002	-0.001	0.016	0.536	0.013	-0.010	0.001	0.008	0.039	0.001	-0.001	0.003	0.000	0.030
F/P1_1	0.029	0.002	-0.002	0.018	0.504	0.036	-0.011	0.002	0.030	0.043	0.000	-0.001	0.003	-0.001	0.032
F/P1_2	0.028	0.005	-0.005	0.017	0.492	-0.003	-0.008	-0.002	-0.005	0.042	-0.001	-0.000	0.005	-0.000	0.036
F/P1_3	0.029	-0.001	-0.002	0.017	0.526	0.009	-0.009	0.001	0.002	0.048	0.001	-0.001	0.003	-0.001	0.038
F/P1_4	0.030	0.001	-0.003	0.017	0.510	0.029	-0.008	0.002	0.023	0.045	0.001	-0.002	0.004	-0.001	0.037
F/P1_5	0.029	-0.002	-0.001	0.017	0.524	0.015	-0.009	0.001	0.009	0.048	0.001	-0.001	0.003	-0.001	0.038
F/P1_6	0.024	0.007	-0.005	0.016	0.485	-0.012	-0.007	0.002	-0.030	0.042	0.005	0.003	-0.001	-0.001	0.038
F/P2_0	0.011	0.009	0.005	0.011	0.022	0.018	0.008	0.009	0.022	0.016	0.009	0.010	0.010	0.010	0.009
F/P2_1	0.012	0.010	0.005	0.011	0.021	0.019	0.008	0.009	0.023	0.016	0.009	0.005	0.010	0.010	0.009
F/P2_2	0.011	0.009	0.005	0.011	0.022	0.019	0.008	0.008	0.022	0.016	0.010	0.005	0.010	0.010	0.009
F/P2_3	0.012	0.009	0.005	0.011	0.023	0.020	0.008	0.009	0.023	0.017	0.010	0.005	0.010	0.011	0.010
F/P2_4	0.011	0.009	0.005	0.011	0.022	0.019	0.008	0.009	0.023	0.017	0.010	0.005	0.010	0.010	0.010
F/P2_5	0.012	0.009	0.005	0.012	0.022	0.019	0.008	0.009	0.024	0.017	0.010	0.005	0.010	0.011	0.010
F/P2_6	0.011	0.009	0.005	0.011	0.022	0.018	0.008	0.0088	0.022	0.016	0.010	0.005	0.010	0.010	0.010
F/P3_0	0.018	0.009	0.008	0.034	-0.196	0.046	0.008	0.006	0.050	0.023	-0.020	0.001	0.028	0.009	0.152
F/P3_1	0.022	0.004	0.009	0.019	-0.090	0.021	0.002	-0.006	0.034	0.030	0.013	-0.005	0.002	-0.004	0.111
F/P3_2	0.042	0.021	-0.002	0.037	-0.251	0.010	0.000	-0.003	0.009	0.024	-0.013	0.006	-0.017	0.013	0.107
F/P3_3	0.026	0.011	0.002	0.029	-0.219	0.021	0.009	0.008	0.017	0.046	-0.015	0.014	-0.000	0.009	0.129
F/P3_4	0.036	0.004	0.007	0.039	-0.213	0.015	-0.005	0.004	0.033	0.035	0.000	-0.006	-0.001	-0.002	0.147
F/P3_5	0.033	0.004	-0.004	0.038	-0.210	0.046	-0.012	-0.001	0.035	0.038	-0.016	0.012	0.013	0.004	0.135
F/P3_6	0.021	-0.008	-0.009	0.025	-0.255	0.049	-0.007	-0.002	0.058	0.034	-0.007	0.013	-0.010	-0.000	0.138
F/P4_0	2.224	2.205	2.198	2.210	2.227	2.187	2.210	2.211	2.179	2.226	2.256	2.206	2.208	2.239	2.315
F/P4_1	2.223	2.205	2.209	2.213	2.209	2.185	2.204	2.195	2.191	2.204	2.222	2.206	2.193	2.220	2.298
F/P4_2	2.226	2.199	2.216	2.229	2.301	2.185	2.200	2.193	2.179	2.208	2.240	2.202	2.203	2.230	2.286
F/P4_3	2.211	2.195	2.200	2.218	2.249	2.199	2.223	2.201	2.187	2.210	2.244	2.215	2.211	2.237	2.312
F/P4_4	2.224	2.206	2.206	2.225	2.300	2.195	2.200	2.189	2.193	2.218	2.231	2.206	2.212	2.238	2.294
F/P4_5	2.232	2.202	2.209	2.245	2.284	2.199	2.203	2.190	2.181	2.217	2.240	2.209	2.207	2.246	2.293
F/P4_6	2.219	2.194	2.201	2.219	2.323	2.195	2.201	2.206	2.192	2.216	2.230	2.203	2.210	2.235	2.304

**Table S2.** Central moments of the Mueller matrix elements for silk sample washed by laundry powder.

Detergent/Parameter	m12	m13	m14	m21	m22	m23	m24	m31	m32	m33	m34	m41	m42	m43	m44
L/P1_0	0.032	0.004	-0.003	0.020	0.528	0.075	-0.011	0.003	0.071	0.049	-0.001	-0.001	0.003	-0.002	0.027
L/P1_1	0.029	0.003	0.004	0.019	0.552	0.019	-0.013	0.001	0.010	0.046	0.000	0.000	0.001	-0.004	0.032
L/P1_2	0.027	0.005	0.001	0.017	0.534	0.037	-0.008	-0.000	0.036	0.051	-0.002	0.002	-0.001	-0.011	0.036
L/P1_3	0.030	0.004	-0.002	0.020	0.515	0.044	-0.000	0.003	0.038	0.053	0.000	0.000	0.001	-0.001	0.036
L/P1_4	0.032	0.004	-0.002	0.021	0.512	0.056	-0.008	0.003	0.050	0.056	-0.001	-0.001	0.003	0.000	0.036
L/P1_5	0.034	0.002	-0.001	0.022	0.522	0.019	-0.009	0.002	0.013	0.049	0.001	-0.001	0.003	-0.001	0.034
L/P1_6	0.032	0.001	-0.006	0.021	0.482	0.004	-0.007	0.001	-0.002	0.044	0.001	-0.002	0.006	0.001	0.033
L/P2_0	0.012	0.010	0.005	0.011	0.019	0.023	0.008	0.009	0.027	0.018	0.010	0.005	0.010	0.010	0.009
L/P2_1	0.012	0.010	0.005	0.012	0.018	0.023	0.008	0.009	0.027	0.018	0.011	0.006	0.010	0.011	0.010
L/P2_2	0.012	0.009	0.005	0.012	0.018	0.022	0.008	0.009	0.026	0.018	0.010	0.005	0.010	0.011	0.011
L/P2_3	0.012	0.010	0.005	0.012	0.018	0.022	0.008	0.009	0.026	0.019	0.011	0.005	0.010	0.011	0.011
L/P2_4	0.012	0.010	0.005	0.012	0.019	0.022	0.008	0.009	0.026	0.019	0.011	0.005	0.010	0.011	0.010
L/P2_5	0.013	0.010	0.005	0.012	0.019	0.023	0.008	0.009	0.027	0.019	0.011	0.006	0.011	0.012	0.011
L/P2_6	0.012	0.010	0.005	0.012	0.019	0.022	0.008	0.009	0.026	0.018	0.011	0.005	0.010	0.011	0.011
L/P3_0	0.008	-0.007	0.006	0.013	-0.025	-0.016	-0.005	0.002	-0.044	0.040	0.005	-0.003	-0.023	-0.001	0.145
L/P3_1	0.015	0.009	0.003	0.015	-0.017	0.020	-0.012	0.013	-0.008	0.023	0.008	0.008	0.015	-0.013	0.115
L/P3_2	0.025	0.002	0.007	0.024	-0.061	0.010	-0.002	-0.003	-0.009	0.045	-0.008	0.001	-0.014	0.001	0.126
L/P3_3	0.013	-0.004	0.014	0.019	-0.044	-0.032	-0.010	0.003	-0.012	0.067	0.003	0.008	-0.001	-0.013	0.152
L/P3_4	0.018	-0.003	-0.006	0.022	-0.033	-0.036	-0.008	0.005	-0.031	0.062	-0.017	0.016	0.013	0.009	0.179
L/P3_5	0.008	0.001	0.003	0.026	-0.003	-0.041	0.007	0.004	-0.013	0.038	0.010	0.014	0.020	-0.000	0.123
L/P3_6	0.020	-0.012	-0.002	0.017	0.011	-0.038	-0.006	0.007	-0.050	0.041	-0.017	0.007	0.018	0.007	0.150
L/P4_0	2.206	2.203	2.203	2.212	2.195	2.161	2.204	2.196	2.194	2.212	2.236	2.196	2.197	2.217	2.310
L/P4_1	2.217	2.210	2.216	2.227	2.206	2.163	2.210	2.194	2.196	2.226	2.248	2.209	2.208	2.260	2.324
L/P4_2	2.222	2.206	2.209	2.220	2.208	2.212	2.201	2.200	2.246	2.219	2.245	2.207	2.205	2.249	2.307
L/P4_3	2.231	2.202	2.202	2.226	2.211	2.220	2.201	2.198	2.233	2.241	2.252	2.204	2.208	2.256	2.335
L/P4_4	2.222	2.208	2.201	2.217	2.199	2.169	2.21	2.195	2.196	2.223	2.263	2.210	2.202	2.241	2.348
L/P4_5	2.215	2.222	2.208	2.222	2.220	2.184	2.203	2.198	2.205	2.226	2.271	2.212	2.222	2.260	2.325
L/P4_6	2.225	2.212	2.217	2.235	2.207	2.174	2.214	2.212	2.204	2.224	2.268	2.212	2.209	2.280	2.334

**Table S3.** Central moments of the Mueller matrix elements for silk sample washed by toilet soap.

Detergent/Parameter	m12	m13	m14	m21	m22	m23	m24	m31	m32	m33	m34	m41	m42	m43	m44
T/P1_0	0.033	0.001	-0.001	0.018	0.560	0.001	-0.011	0.000	-0.006	0.039	0.001	-0.001	0.003	0.000	0.030
T/P1_1	0.039	0.002	-0.001	0.031	0.492	0.006	-0.011	0.001	-0.001	0.047	0.001	-0.001	0.003	-0.001	0.036
T/P1_2	0.039	-0.001	-0.002	0.030	0.453	-0.016	-0.009	-0.001	-0.023	0.052	0.002	-0.001	0.004	-0.001	0.041
T/P1_3	0.037	0.001	-0.000	0.030	0.418	-0.004	-0.009	-0.001	-0.006	0.061	0.001	-0.000	0.004	-0.001	0.043
T/P1_4	0.033	0.000	0.001	0.024	0.379	0.003	-0.006	-0.001	-0.002	0.057	0.003	-0.001	0.001	-0.002	0.045
T/P1_5	0.031	0.001	-0.001	0.025	0.367	0.004	-0.006	0.001	-0.003	0.061	0.001	-0.001	0.003	-0.001	0.048
T/P1_6	0.026	-0.002	-0.001	0.021	0.307	-0.016	-0.004	-0.001	-0.021	0.061	0.001	-0.001	0.003	-0.000	0.048
T/P2_0	0.013	0.011	0.005	0.012	0.024	0.020	0.009	0.010	0.023	0.019	0.011	0.006	0.011	0.011	0.010
T/P2_1	0.013	0.011	0.006	0.013	0.025	0.021	0.009	0.010	0.023	0.019	0.011	0.006	0.010	0.011	0.010
T/P2_2	0.013	0.011	0.006	0.012	0.029	0.019	0.009	0.010	0.021	0.019	0.010	0.006	0.010	0.011	0.010
T/P2_3	0.013	0.011	0.006	0.012	0.028	0.020	0.009	0.010	0.021	0.019	0.010	0.006	0.010	0.011	0.010
T/P2_4	0.012	0.011	0.006	0.012	0.031	0.019	0.009	0.010	0.020	0.019	0.010	0.006	0.010	0.011	0.010
T/P2_5	0.012	0.011	0.006	0.012	0.027	0.019	0.009	0.010	0.020	0.019	0.010	0.006	0.010	0.011	0.010
T/P2_6	0.011	0.010	0.005	0.011	0.027	0.018	0.008	0.010	0.018	0.018	0.009	0.006	0.009	0.010	0.009
T/P3_0	0.022	0.007	-0.007	0.023	-0.100	0.003	0.016	0.004	0.048	0.010	-0.018	-0.004	0.008	0.009	0.114
T/P3_1	0.017	-0.004	-0.070	0.032	-0.043	0.027	0.021	0.001	0.088	0.000	-0.003	0.007	0.016	-0.001	0.073
T/P3_2	0.027	0.000	-0.003	0.035	-0.157	-0.004	0.005	0.001	0.002	0.016	0.002	0.003	0.021	-0.011	0.104
T/P3_3	0.035	0.005	0.002	0.042	-0.084	0.018	0.011	-0.007	0.055	0.028	-0.018	0.000	0.025	0.021	0.134
T/P3_4	0.036	-0.003	-0.007	0.039	-0.047	0.003	0.012	-0.001	0.006	0.005	0.011	0.001	0.013	-0.016	0.069
T/P3_5	0.023	0.003	-0.014	0.027	-0.017	-0.005	0.006	0.008	0.013	0.016	0.001	0.007	0.005	-0.018	0.101
T/P3_6	0.033	-0.015	-0.012	0.034	-0.009	0.007	-0.003	-0.004	0.008	0.003	0.001	-0.002	0.026	-0.011	0.105
T/P4_0	2.205	2.197	2.201	2.206	2.231	2.202	2.192	2.203	2.209	2.213	2.224	2.203	2.184	2.250	2.280
T/P4_1	2.210	2.196	2.198	2.209	2.156	2.209	2.191	2.185	2.219	2.219	2.225	2.205	2.194	2.221	2.279
T/P4_2	2.211	2.193	2.194	2.217	2.226	2.199	2.197	2.197	2.213	2.219	2.218	2.199	2.202	2.220	2.301
T/P4_3	2.203	2.191	2.205	2.204	2.179	2.198	2.199	2.203	2.207	2.209	2.228	2.206	2.201	2.223	2.292
T/P4_4	2.213	2.208	2.207	2.203	2.116	2.203	2.202	2.193	2.217	2.206	2.211	2.200	2.203	2.223	2.255
T/P4_5	2.200	2.199	2.209	2.212	2.157	2.202	2.207	2.209	2.202	2.205	2.213	2.195	2.209	2.218	2.281
T/P4_6	2.199	2.203	2.199	2.205	2.148	2.206	2.192	2.194	2.194	2.207	2.204	2.195	2.204	2.207	2.257

**Table S4.** Central moments of the Mueller matrix elements for silk sample washed by color stain net.

Detergent/Parameter	m12	m13	m14	m21	m22	m23	m24	m31	m32	m33	m34	m41	m42	m43	m44
C/P1_0	0.034	0.000	-0.003	0.021	0.555	0.009	-0.011	0.001	0.002	0.034	0.001	-0.001	0.004	0.000	0.028
C/P1_1	0.036	0.008	-0.002	0.023	0.582	0.134	-0.015	0.006	0.131	0.060	0.000	-0.001	0.004	-0.003	0.019
C/P1_2	0.039	0.005	-0.003	0.025	0.636	0.073	-0.012	0.004	0.067	0.042	0.002	-0.001	0.002	-0.003	0.016
C/P1_3	0.032	0.003	-0.002	0.018	0.607	0.074	-0.011	0.003	0.067	0.047	0.002	-0.001	0.003	-0.003	0.013
C/P1_4	0.030	0.001	-0.002	0.017	0.585	0.017	-0.014	0.002	0.006	0.061	0.001	-0.001	0.007	-0.03	0.025
C/P1_5	0.025	-0.007	-0.002	0.013	0.560	-0.010	-0.014	-0.003	-0.019	0.113	-0.001	-0.001	0.007	0.000	0.029
C/P1_6	0.010	-0.009	-0.002	0.003	0.441	0.003	-0.012	-0.000	-0.009	0.182	-0.003	-0.000	0.008	0.003	0.031
C/P2_0	0.013	0.011	0.005	0.012	0.024	0.020	0.009	0.010	0.022	0.018	0.011	0.006	0.011	0.011	0.009
C/P2_1	0.014	0.011	0.006	0.014	0.024	0.021	0.009	0.010	0.025	0.022	0.015	0.006	0.013	0.015	0.014
C/P2_2	0.017	0.013	0.007	0.016	0.029	0.027	0.012	0.012	0.029	0.027	0.018	0.007	0.015	0.018	0.017
C/P2_3	0.018	0.014	0.007	0.017	0.032	0.029	0.014	0.013	0.030	0.030	0.019	0.008	0.017	0.020	0.020
C/P2_4	0.019	0.014	0.007	0.018	0.040	0.031	0.014	0.013	0.034	0.036	0.020	0.008	0.018	0.021	0.025
C/P2_5	0.029	0.021	0.010	0.027	0.073	0.061	0.021	0.020	0.066	0.079	0.027	0.011	0.026	0.028	0.033
C/P2_6	0.032	0.026	0.011	0.029	0.107	0.073	0.025	0.025	0.078	0.119	0.027	0.011	0.028	0.029	0.033
C/P3_0	0.013	0.002	-0.003	0.024	-0.048	0.025	-0.030	0.000	0.001	0.009	0.007	0.005	-0.056	-0.012	0.104
C/P3_1	0.139	0.041	-0.002	0.128	-0.216	-0.002	-0.037	0.016	-0.013	0.143	-0.000	0.012	0.015	-0.004	0.256
C/P3_2	0.081	0.020	-0.008	0.075	-0.028	0.031	0.008	0.013	0.030	0.094	-0.013	0.008	-0.035	-0.001	0.116
C/P3_3	0.079	0.015	-0.001	0.078	-0.145	-0.030	0.072	0.018	-0.032	0.112	-0.035	0.025	-0.010	0.030	-0.007
C/P3_4	-0.002	0.005	0.006	-0.014	-0.224	0.064	-0.052	0.012	0.081	0.288	-0.098	0.008	-0.017	0.089	0.306
C/P3_5	-0.530	-0.259	0.014	-0.433	-0.028	0.622	-0.072	-0.119	0.518	1.152	-0.194	0.107	-0.324	0.065	0.524
C/P3_6	-0.423	-0.099	0.143	-0.383	-0.305	-0.001	0.085	0.073	-0.025	0.794	-0.156	0.033	-0.182	0.149	0.345
C/P4_0	2.224	2.210	2.208	2.217	2.194	2.194	2.194	2.215	2.196	2.196	2.242	2.214	2.205	2.235	2.308
C/P4_1	2.337	2.226	2.249	2.327	2.337	2.243	2.263	2.222	2.227	2.323	2.517	2.247	2.270	2.490	2.576
C/P4_2	2.252	2.223	2.235	2.231	2.219	2.195	2.251	2.224	2.208	2.299	2.385	2.230	2.249	2.379	2.520
C/P4_3	2.279	2.220	2.234	2.281	2.319	2.252	2.279	2.222	2.245	2.350	2.472	2.246	2.267	2.465	2.585
C/P4_4	2.288	2.234	2.233	2.268	2.317	2.268	2.322	2.230	2.281	2.436	2.505	2.233	2.292	2.486	2.762
C/P4_5	3.150	2.766	2.545	3.023	2.590	3.428	2.700	2.732	3.149	3.912	2.880	2.646	2.849	2.827	2.970
C/P4_6	2.602	2.539	2.489	2.574	2.309	2.490	2.656	2.670	2.386	2.740	2.610	2.487	2.538	2.635	2.751

F, L, T and C represent fabric softener, laundry powder, toilet soap and color stain net respectively. F/P1\_0 represents the parameter P1 of silk sample before washing under the condition of fabric softener, and by analogy, C/P4\_6 represents the parameter P4 of silk sample after the sixth washing by color stain net.