

Spectrophotometric Analysis Report

Advanced Colorimetric & Exhaustion Evaluation

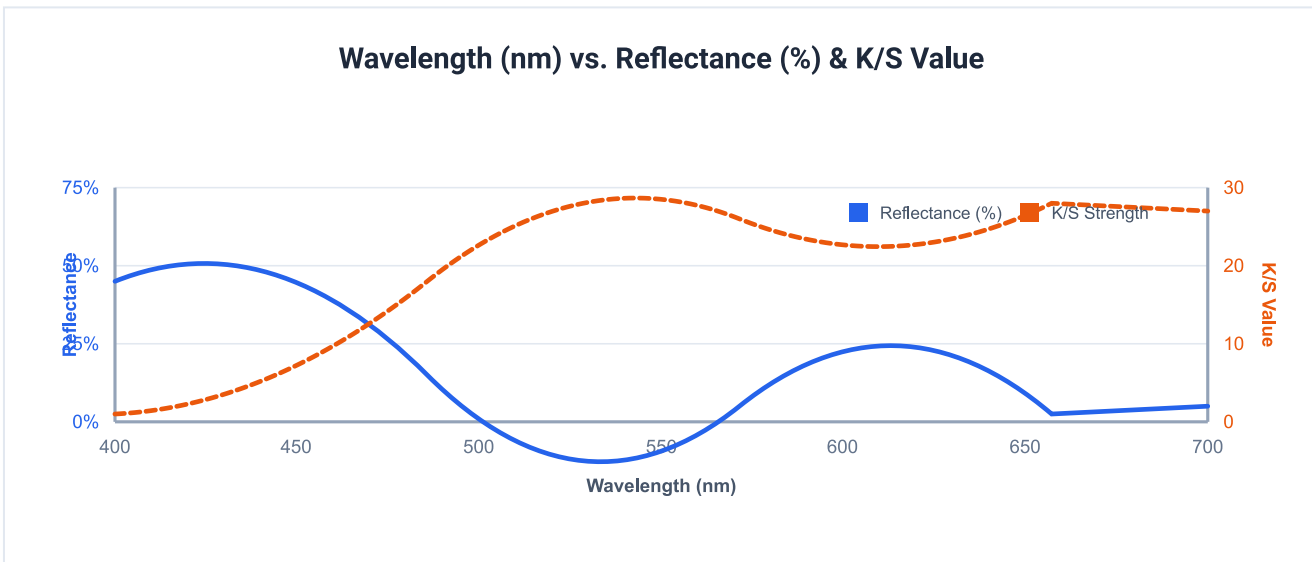
Report ID: QA-2026-992A
Date: Sept 18, 2026
Substrate: 100% Cotton Knits
Dye Class: Reactive (Hot)

Maximum Strength & Best Matching Outcome Verified

Optimal dye yield achieved. Shade matches digital standard with Delta E (CMC) within strict <0.8 tolerance limits.

APPROVED

REFLECTANCE & K/S CURVE ANALYSIS



Analysis: The K/S curve demonstrates peak dye absorption at 620nm, corresponding to maximum color strength for the target navy shade. High exhaustion rates ensure brilliant chromatic yield.

COLOR DIFFERENCE (ΔE) DATA

SAMPLE ID	ILLUMINANT	L* (LIGHTNESS)	A* (RED/GREEN)	B* (YELLOW/BLUE)	ΔL	ΔC	ΔH
Standard (Target)	D65 - 10°	22.45	-2.10	-18.65	--	--	--
Batch A (Optimized)	D65 - 10°	22.51	-2.04	-18.55	+0.06	-0.12	+0.06
Batch B (Standard)	D65 - 10°	22.80	-1.85	-18.10	+0.35	-0.55	+0.10

METAMERISM CONTROL

Metamerism control evaluates shade consistency across varying light sources. A Metamerism Index (MI) below 0.5 indicates visually imperceptible shade shifting under different lighting environments, ensuring uniform commercial presentation.

PRIMARY METAMERISM INDEX (D65 VS TL84)

0.18 MI

Rating: Excellent (Non-metameric)

SECONDARY METAMERISM INDEX (D65 VS A)

0.25 MI

Rating: Excellent (Non-metameric)

ILLUMINANT STANDARD	DESCRIPTION	ΔE SHIFT (RELATIVE TO D65)	VISUAL ASSESSMENT	STATUS
D65 (Primary)	Standard Artificial Daylight	0.00	On-shade Navy Blue	BASE
TL84 (F11)	Store Fluorescent Lighting	0.18	Negligible shift, trace red flare	PASS
Illuminant A	Tungsten / Incandescent Home Light	0.25	Trace dark/flat shift	PASS

COST & STRENGTH EVALUATION

The formulation was optimized using the CCMS integration. By substituting a high-strength chromophore, the total required dye concentration was reduced by 14% while maintaining identical K/S depth, resulting in a significant unit cost reduction.

OPTIMIZED DYE RECIPE	CONCENTRATION (%)	DYE STRENGTH RATING	UNIT COST (\$/KG)	CONTRIBUTION COST
Novacron Navy S-G	2.150 %	150% (High Conc)	\$ 12.50	\$ 0.268
Reactive Red 195	0.420 %	100% (Standard)	\$ 8.20	\$ 0.034
Reactive Yellow 84	0.115 %	100% (Standard)	\$ 9.40	\$ 0.010
Total Formulation Cost (per Kg of Fabric):				\$ 0.312

Formulation Optimization Summary

Cost reduced by 18% compared to previous standard formulation. Dye exhaustion increased to 86%, minimizing effluent waste.

MAX
OPTIMIZED