

CB BIOINDIGO



01 DISTINCTIVE FEATURES SUSTAINABILITY

1-A. BIO-BASED PRODUCTION

- Four routes are available for indigo synthesis.
- BioIndigo is produced by natural fermentation **without chemical synthesis**.

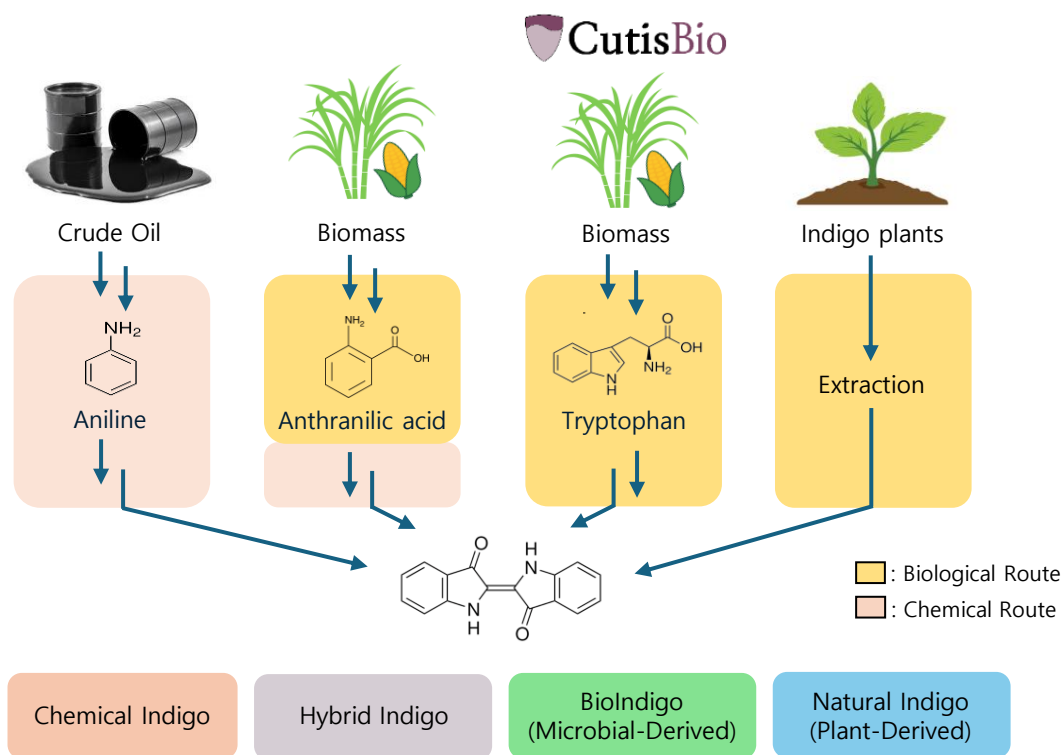


Figure 1-1. Four routes for indigo synthesis. BioIndigo is a microbial-derived natural indigo.

1-B. CO₂ EMISSIONS: CHEMICAL vs. BIO INDIGO

- While the chemical route follows a **linear economy**, the biological route follows a **circular economy**.
- The biological route offers a **sustainable** pathway to **reduce CO₂ emissions**.

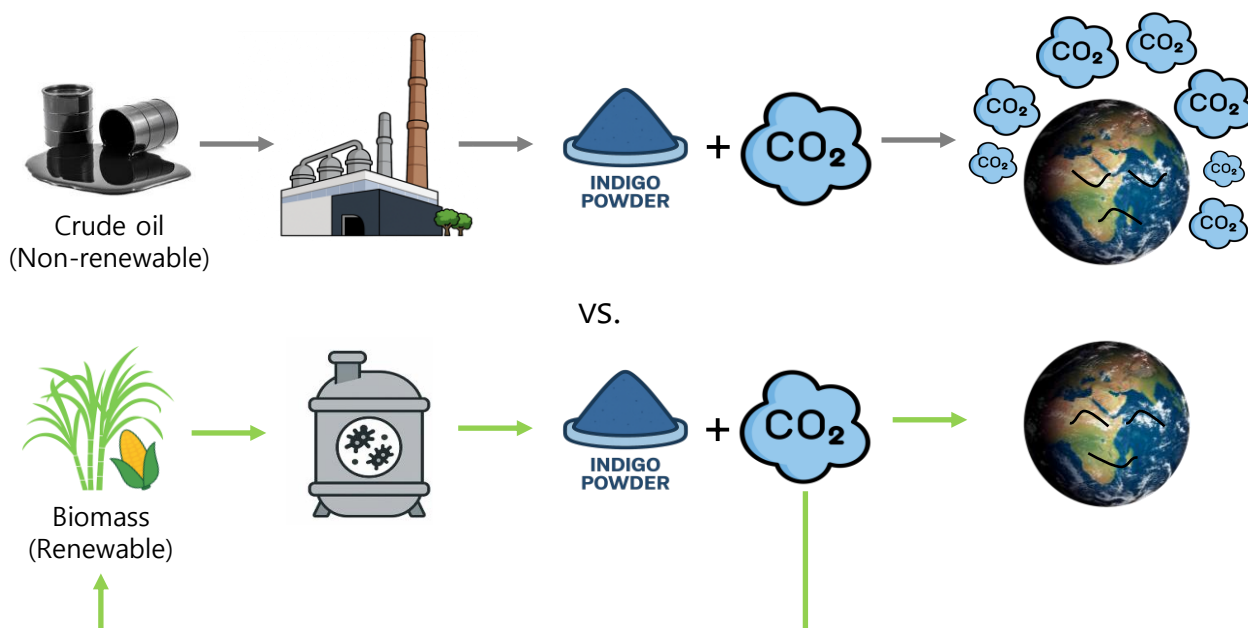


Figure 1-2. Carbon cycle comparison: Chemical (Top) vs. Bio Indigo (Bottom).

SUSTAINABILITY

1-C. CERTIFIED BIO INDIGO

- Determined the proportion of bio-based (renewable) carbon in commercially available indigo dyes.
- BioIndigo is a tested and proven indigo.
- Some plant-derived indigo dyes on the market appear to be blended with chemical indigo.

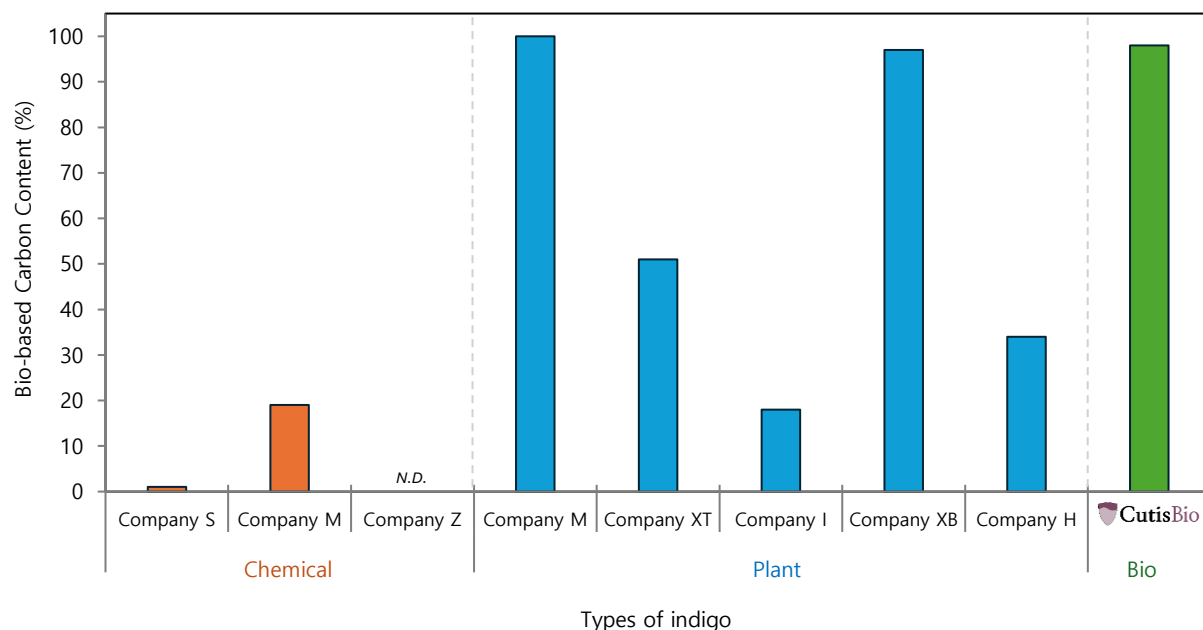


Figure 1-3. Results of the C14 bio-based test for commercially available indigo dyes.

Table 1-1. Summary of the C14 bio-based test for commercially available indigo dyes.

TEST	Types of indigo								
	Chemical			Plant					Bio
	Company S	Company M	Company Z	Company M	Company XT	Company I	Company XB	Company H	CutisBio
Appearance									
percent Modern Carbon (pMC)	1.07	19.20	0.30	100.39	51.15	18.34	96.82	33.66	97.73
Biobased Carbon Content (%)	1	19	0	100	51	18	97	34	98
Test Lab	KATRI (KOREA APPAREL TESTING AND RESEARCH INSTITUTE)								
Test Report n°	SBED25-00000153-1	SBED25-00000211	SBED25-00000211	SBED25-00000211	SBED25-00000211	SBED25-00000211	SBED25-00000211	SBED25-00000153-1	SBED25-00000153-1
Report Date	May 22, 2025	July 11, 2025	July 11, 2025	July 11, 2025	July 11, 2025	July 11, 2025	July 11, 2025	July 11, 2025	May 22, 2025
Test Method	ASTM D6866-24a Method B (AMS)								

2-A. ENSURING A SAFE AND HEALTHY WORKSPACE

- BiolIndigo ensures a hazardous chemical-free workspace that **priorities operator safety**.

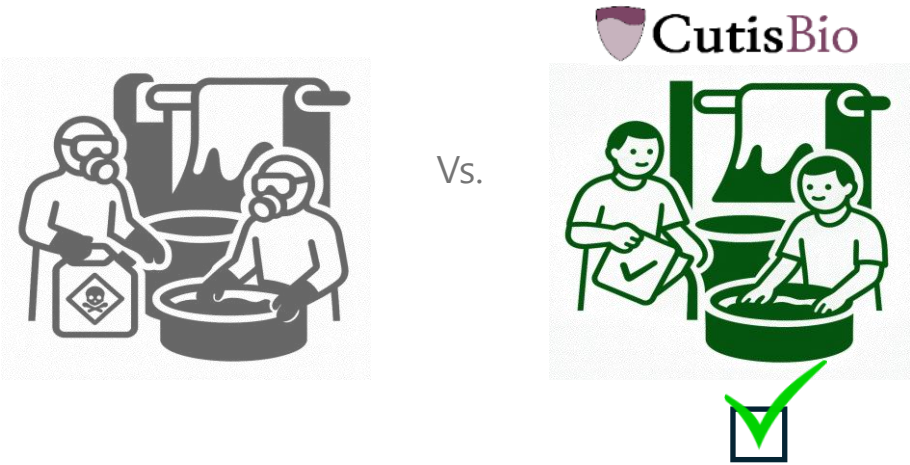


Figure 2-1. Hazardous (**Left**) vs. Non-hazardous (**Right**) chemicals handling.

2-B. HAZARDOUS CHEMICALS IN CHEMICAL INDIGO

- **Aniline** and **N-methylaniline** are often used as starting materials or intermediates in the chemical route to indigo.
- Trace levels of aniline and N-methylaniline may remain as **impurities** or **unreacted residues** in the final indigo powder.
- Due to the its **toxic** and **potentially carcinogenic nature**, many **certification standards** (e.g., ZDHC, OEKO-TEX, GOTS) **set strict limits** on their allowable concentrations in textile dyes and final products.

Table 2-1. Global regulatory standards for aniline and methylaniline.

Region/Country	Regulatory Body	Substance	Product Type	Maximum Allowable Concentration
European Union	REACH	Aniline	Textiles and leather products	30 mg/kg
European Union	Toy Safety Directive	Aniline	Toys (textiles and leather)	30 mg/kg (after extraction)
European Union	Toy Safety Directive	Aniline	Finger paints	10 mg/kg (free aniline), 30 mg/kg (after extraction)
United States	EPA	Aniline	Textile products	30 ppm
Germany	MAK	Aniline	Workplace air	7.7 mg/m ³
United States	NIOSH	Methylaniline	Workplace air	0.5 ppm (2 mg/m ³)

Table 2-2. Aniline and methylaniline allowable limits by certifications/standards.

Certification / Standard	Applicable Product Category	Aniline Allowable Limit
ZDHC MRSL v3.0	Textile and leather products	≤100 ppm (Level 1 requirement)
OEKO-TEX Standard 100	Textiles, leather, and finished goods	≤100 ppm (Class I: more stringent)
GOTS	Organic textile products	Recommended: Non-detectable level (≤ 20 ppm suggested)

2-C. (N-METHYL)ANILINE ANALYSIS FOR COMMERCIALLY AVAILABLE INDIGO DYES

- BioIndigo is an **aniline and N-methylaniline free**-indigo.
- Some plant-derived indigo dyes on the market appear to be blended with chemical indigo.

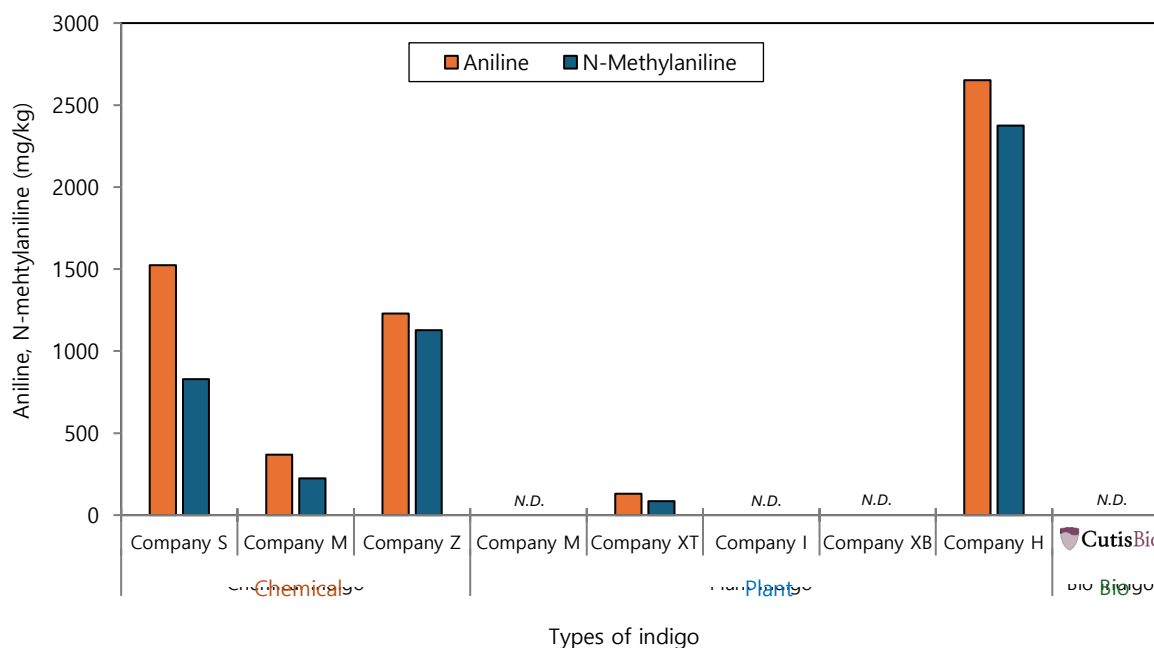


Figure 2-2. Results of the (N-methyl)aniline analysis for commercially available indigo dyes.

Table 2-3. Summary of the (N-methyl)aniline analysis for commercially available indigo dyes.

TEST	Types of indigo								
	Chemical			Plant					Bio
	Company S	Company M	Company Z	Company M	Company XT	Company I	Company XB	Company H	CutisBio
Aniline (mg/kg)	1,524	369	1,229	N.D.	131	N.D.	N.D.	2,652	N.D.
N-Methylaniline (mg/kg)	828	225	1,127	N.D.	85	N.D.	N.D.	2,375	N.D.
Test Lab	KOTERI (KOREA HIGH TECH TEXTILE RESEARCH INSTITUTE)								
Test Report n°	2025-0604-1132-C03	2025-0624-1268	2025-0624-1268	2025-0624-1268	2025-0624-1268	2025-0624-1268	2025-0624-1268	2025-0604-1132-C03	2025-0604-1132-C03
Report Date	June 10, 2025	July 3, 2025	July 3, 2025	July 3, 2025	July 3, 2025	July 3, 2025	July 3, 2025	June 10, 2025	June 10, 2025
Test Method	KS K 0734 2019								
Method Detection Limit (mg/kg)	5								

3-A. DYEABILITY

- BioIndigo **matches the performance of plant-based and chemical indigo**, delivering durable and reliable results across various fabrics, including cotton, silk, and cashmere.



Figure 3-1. Results of the fabric dyeing using different types of indigo dyes.

3-B. COLORFASTNESS

- BioIndigo also matches the performance of plant-based and chemical indigo, with comparable colorfastness to laundering, light, rubbing, and perspiration-ensuring seamless substitution without compromising quality.

Table 3-1. Results of the colorfastness to laundering.

(Method: KS K ISO 105-C06:2010, A2S)

	#1	#2	#3	#4	#5	#6	#7	#8	#9
Staining	Color Change	4-5	3-4	4-5	4-5	4	4-5	4-5	4-5
	Acetate	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4
	Cotton	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	Nylon	4-5	4-5	4	4-5	4-5	4	4	3-4
	Polyester	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	Acrylic	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5
	Wool	4-5	4-5	4-5	4-5	4-5	4-5	4-5	4-5

Table 3-2. Results of the colorfastness to light.

(Method: KS K ISO 105-B02:2014, Exposure Cycle A1, Method 5)

	#1	#2	#3	#4	#5	#6	#7	#8	#9
Color Change	4	4-5	4-5	4	4	4-5	4	4-5	4-5

Table 3-3. Results of the colorfastness to rubbing.

(Method: (KS K ISO 105-X12:2016))

		#1		#2		#3		#4		#5		#6		#7		#8		#9	
		Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft	Warp	Weft
Staining	Dry	4-5	4-5	4-5	4-5	3-4	3-4	4-5	4-5	4-5	4-5	1	2	4-5	4-5	4-5	4-5	2	2-3
	Wet	4-5	4-5	4-5	4-5	3-4	3-4	4	4-5	4	4-5	3	3	4	4	4	3-4	3	3-4

Table 3-4. Results of the colorfastness to perspiration.

(Method: (KS K ISO 105-E04:2013))

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4-A. CUSTOMIZABLE SHADE OUTCOMES

- By adjusting the concentration of indigo dye, various depths and intensities of color can be achieved.
- The color became deeper as the number of dyeing cycles increased.

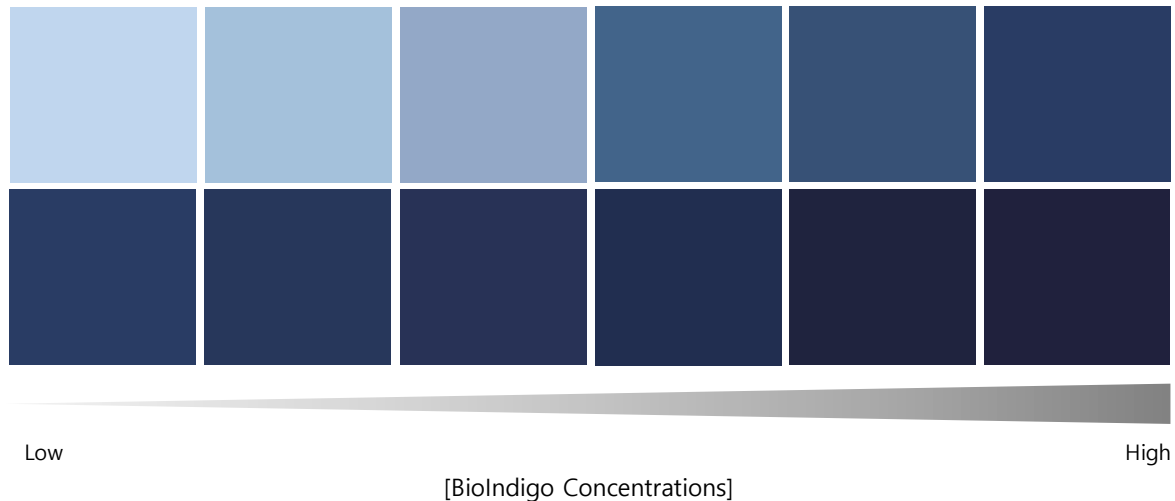


Figure 4-1. Results of fabric dyeing by concentration of indigo.

4-B. MAKE YOUR BLUE UNIQUE

- Indirubin is a red isomer of indigo.
- Indirubin is one of the active ingredients in the Traditional Chinese Medicine and modern pharmacology.
- By modulating the composition of indigo and indirubin produced through microbial fermentation, a brand can create its own unique shade of blue.

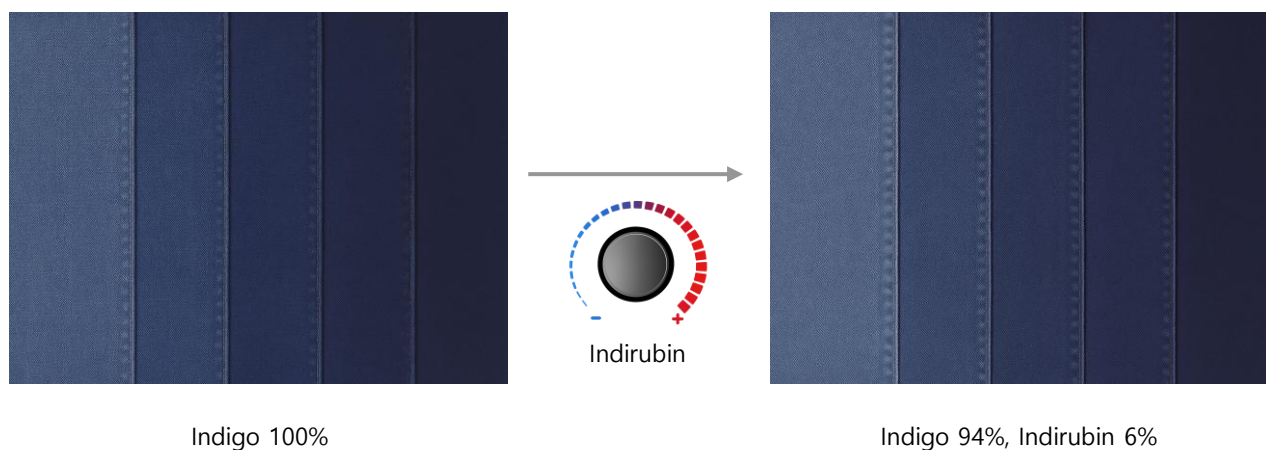


Figure 4-2. Effect of Indirubin on indigo dyeing color.

5-A. POWDER

- 100% Bio-based.
- Toxic chemical free.
- Comparable performance to chemical indigo.

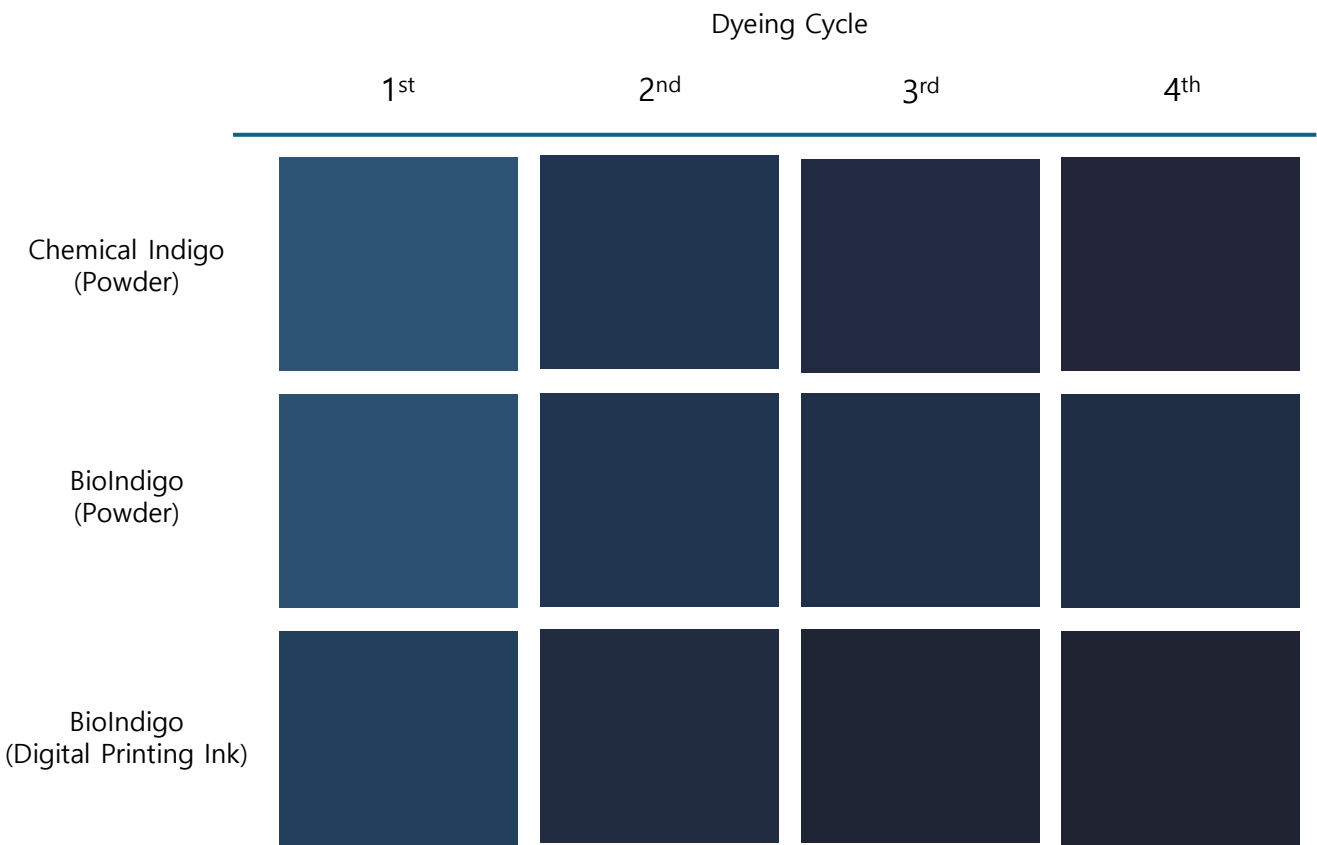


5-B. DIGITAL PRINTING INK

- "Ready-to-Dye", "Ready-to-Print".
- Higher performance than that of chemical or known-natural indigo.



5-C. Dyeing Test (Powder vs. Digital Printing Ink)



Color Intensity: Digital Printing Ink > Chemical Indigo ≈ Powder BioIndigo

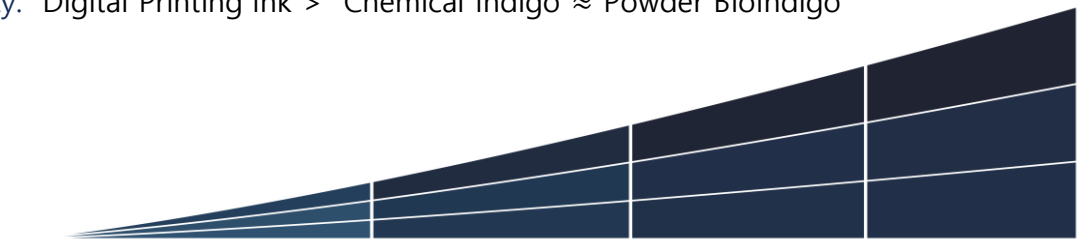


Figure 5-1. Results of cotton dyeing using two types of BioIndigo (Powder and Liquid).

6-A. ADVANTAGES OF DIGITAL PRINTING IN TEXTILE DYEING

- Enables high-resolution, detailed patterns and unlimited color combinations that are difficult to achieve with traditional dyeing method.
- Reduces **water consumption** and **textile waste** compared to conventional dyeing (often 80~90% savings) by applying color directly where needed.
- Ensures cost-effectiveness for small runs.

6-B. BIOINDIGO INK: A SUSTAINABLE BLUE INK FOR DIGITAL PRINTING

- Eco-friendly, Free from toxic by-products.
- **Lower carbon footprint across the life cycle** (feedstock → production → end use).
- Enables consistent reproduction of complex designs.
- Aligns with growing demand for **sustainable fashion** and eco-printing solutions.
- Strengths brand image with traceable, green chemistry claims.



Figure 6-1. Production process for digital printing ink using BioIndigo.



Figure 6-2. Examples of digital printing results with BioIndigo ink.

7-A. ZDHC (Zero Discharge of Hazardous Chemicals)

- A global initiative focused on eliminating hazardous chemicals from the textile and apparel supply chain.
- ZDHC MRSL LEVEL 1 (H682-25-00154)

fiit
TESTING & RESEARCH INSTITUTE

Certificate Number :H682-25-00154

ZDHC MRSL LEVEL 1 Version 3.1
CERTIFICATE

Chemical Formulation Supplier	: CurtisBio Co., Ltd. 8F Appulseong B/D, 842 Nonhyeon-ro, Gangnam-gu, Seoul, South Korea
Scope of Certification	: ZDHC MRSL Level 1 Version 3.1
Name of Chemical Formulation (Local / Alien Name)	: CB Bio Indigo Dye Powder
Usage/Application in Manufacturing	: Natural dyes(1.7.27)
Color Name / Code	: -
Country of Origin	: -
Test Standards	: ZDHC MRSL Smart Testing Code 1.7.27 For Chapter 1 - Textile Processing

FITI Testing & Research Institute declares that the sample of chemical formulation described on this certificate has been tested by us and found to be compliant in accordance with ZDHC MRSL Conformance Level 1 Version 3.1. It is only valid in connection with the test report number (Previous Report No.: H682-25-00153).

Date of Issue : Jun. 10, 2025
Valid from : Jun. 10, 2025
Valid to : Jun. 09, 2027

Authorized by President
YUN JU KEYNG

※ Certificate Verification No.: LGTM-RMYV-RPNB ※
(It is available to refer see the authenticity of this certificate through the above "Certificate Verification No." at FITI homepage)

This certificate of conformity is based on an evaluation of the sample(s) provided by supplier. It is not necessarily indicative or representative of the assessment of the whole batch and relevant.

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FITI Testing & Research Institute

Ø **ZDHC**
Zero Discharge of
Hazardous Chemicals

7-B. OEKO-TEX® ECO PASSPORT

- An independent certification that verifies chemicals, colorants, and auxiliaries used in textile production are free from harmful substances and meet strict environmental and safety standards.
- OEKO-TEX® Eco Passport (E2AGHSST4)

CurtisBio Co., Ltd.
8F Appulseong B/D, 842 Nonhyeon-ro, Gangnam-gu, Seoul, South Korea

OEKO TEX®

Certificate
OEKO-TEX® ECO PASSPORT

CurtisBio Co., Ltd.
is granted the OEKO-TEX® ECO PASSPORT certification
and the right to use the trademark.

TYPE
ECO PASSPORT with Self-Assessment

PRODUCT
See attached enclosure

PRODUCT CATEGORY
2.9 Natural dyes

ECO PASSPORT

This certificate E2AGHSST4 is valid until 31.10.2026.

SUPPORTING DOCUMENTS
✓ Test Report Number: 25-04855-01
✓ Declaration of conformity in accordance with EN ISO 17050-1 as required by OEKO-TEX®

The above captioned products can be used for the production of human-ecological optimized textiles & leather.
The combined results of the reports mentioned above reveal that there is no harmful effect on the human and also environmental health of the textiles & leather's treated/finished with the certified products.

ZDHC MRSL 3.1 Conformance Level 1 is achieved for certified products unless indicated otherwise.
Further compliance information (REACH, SVHC, POP etc.) can be found on our website: www.oeko-tex.com.
The certificate is based on the test methods and requirements of the OEKO-TEX® ECO PASSPORT test were in force at the time of evaluation.

Signature
Certification Officer

Zugzwang, 2025-10-23

OEKO-TEX Service GmbH, Gerstenhause 25, CH-8002 Zurich

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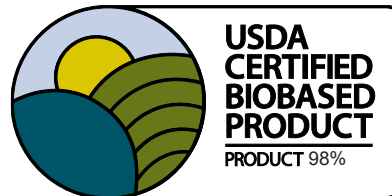
**ECO
PASSPORT**



E2AGHSST4
Centexbel

7-C. USDA BIOPREFERRED

- A certification program by the U.S. Department of Agriculture that verifies products contain a certain percentage of biobased content derived from renewable biological resources.
- USDA BioPreferred (4295FD7FF6695D3B1D293DB7DDEE34A5)



*Precision on the RESULT is cited as $\pm 3\%$ (absolute).

7-D. OK BIOBASED

- A certification issued by TÜV Austria that verifies the percentage of biobased carbon content in a product derived from renewable biological sources.
- OK Biobased Class5 (TA8072609668)



The range of the logo refers to the Biobased Carbon Content (BCC) class obtained:

- 20 – 39 %: $20 \% \leq BCC < 40 \%$
- 40 – 59 %: $40 \% \leq BCC < 60 \%$
- 60 – 79 %: $60 \% \leq BCC < 80 \%$
- 80 – 96 %: $80 \% \leq BCC < 97 \%$
- 97 – 100 %: $97 \% \leq BCC \leq 100 \%$



PRODUCT SUMMARY

- Name: Bio Indigo Dye Powder (Microbial Fermentation)
- CAS Number: 482-89-3
- Samples are available upon request.



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