HYBRIDA STUDIO

2026

BIOCHROMES RECIPES

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CARLOTTA PREMAZZI

BIOCHROMES

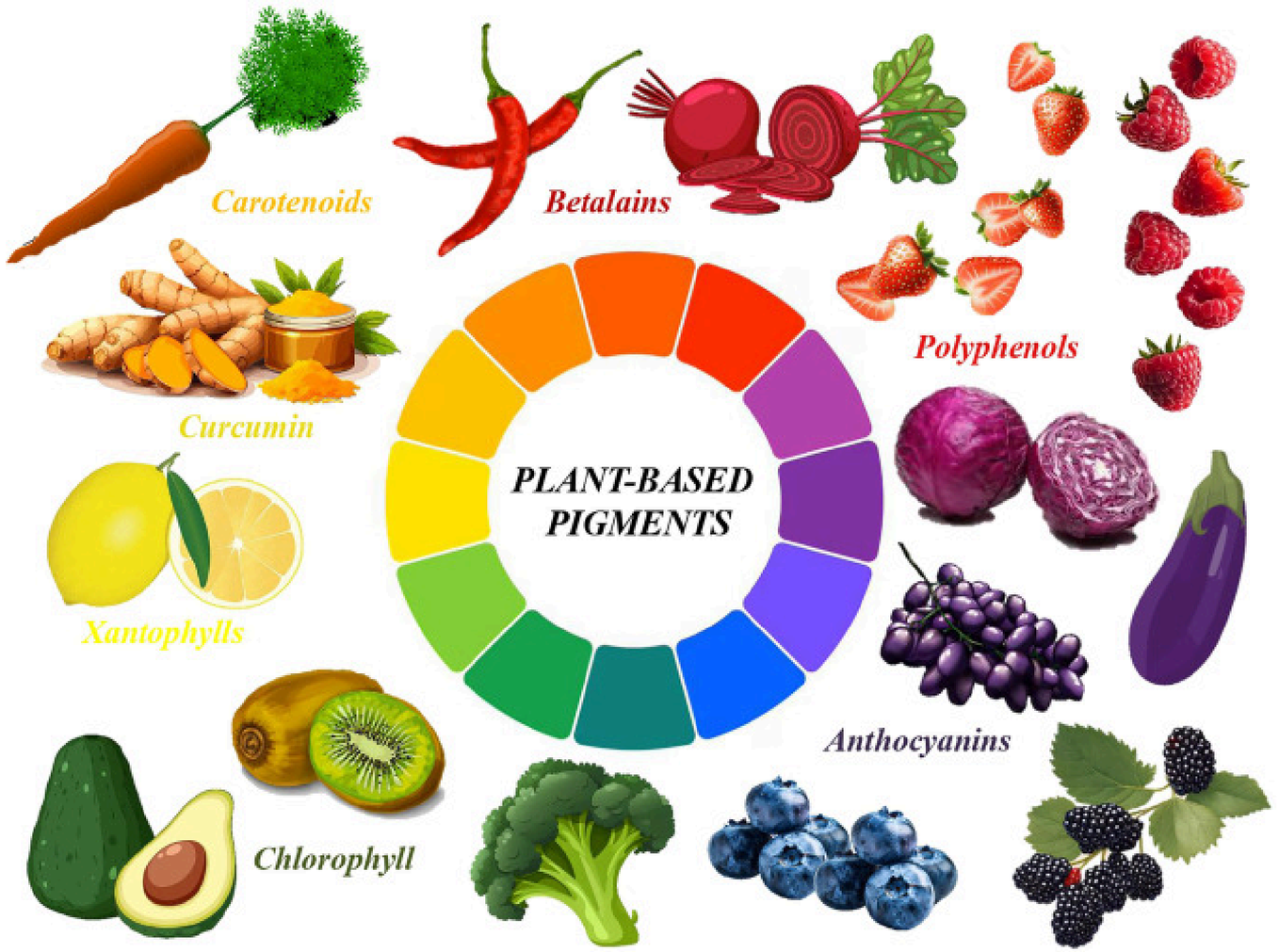
BIOCHROMES = "BIOLOGICAL PIGMENTS," [LIVING COLORS]
MEANING MICROSCOPIC CHEMICAL PIGMENTS PRODUCED BY LIVING ORGANISMS
(SUCH AS PLANTS, ANIMALS, FUNGI, AND BACTERIA)
THAT ABSORB CERTAIN WAVELENGTHS OF LIGHT AND REFLECT OTHERS TO CREATE COLOR.
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THEY ARE OPPOSED TO SYNTHETIC PIGMENTS (DERIVED FROM PETROLEUM) BECAUSE:

- 0 WASTE
- BIOBASED AND BIODEGRADABLE, OFTEN NON-TOXIC,
- LOCALLY POSITIVE: THEY CAN BE GROWN OR EXTRACTED IN THE LABORATORY OR KITCHEN.

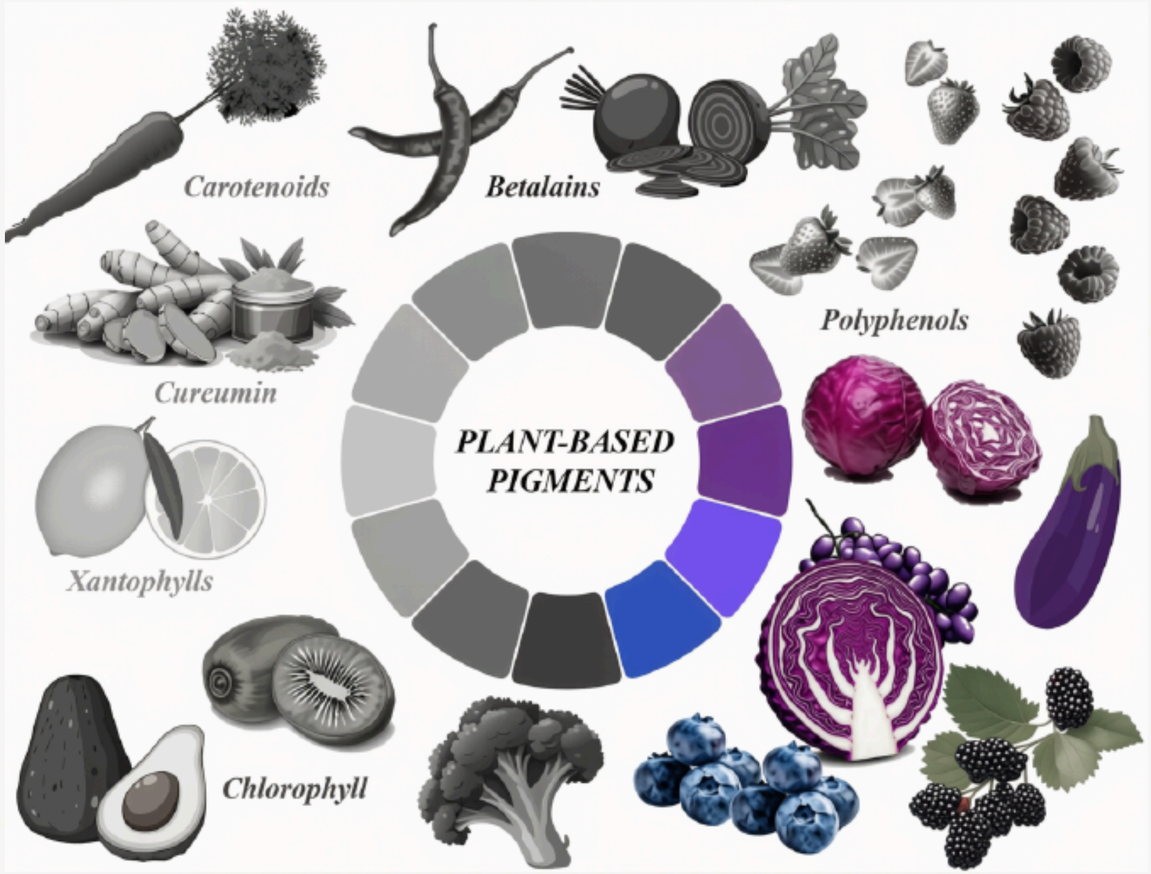


Ref: https://class.textile-academy.org/tutorials/#natural-dyeing
https://class.textile-academy.org/2026/svetlana-khachatryan/assignments/week04/
https://class.textile-academy.org/2020/loes.bogers/assignments/week04/
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Graphical abstract, Main sources and colors of plant-based natural pigments.
P. Todorovic, N. Kicovic, M. Sentic, I. Gadjanski, T. Karbowiak, P. Ristivojevic, J. Vidic. Sustainable use of bioactive natural pigments in the food industry, Applied Food Research,Volume 6, Issue 1,2026,102039, ISSN 2772-5022, https://doi.org/10.1016/j.afres.2026.102039.

Pigment	Color	Sources (Fruit, Veg & Plants)	Main Properties & Benefits	Dyeing / Coloring Particularities (Dye)	Best Mordant / Fixative	Color Modifiers & Shifts
CHLOROPHYLL	🟢 Green	Spinach, broccoli, asparagus, kiwi, zucchini, basil, parsley	Antioxidant, rich in folic acid, aids iron absorption, supports heart health.	Unstable to light and heat. Quickly turns to a dull brownish-green (pheophytin) when heated or exposed to sunlight.	Alum + Tannin pre-treatment (for plant fibers).	Soda Ash: Prevents turning brown in low doses; excess turns it yellow. Iron (Copper sulfate alternative): Darkens the green into a stable olive/military green and increases lightfastness.
BETA-CAROTENE	🟠 Orange / Yellow	Carrots, pumpkin, apricots, melons, mangoes, sweet potatoes	Vitamin A precursor, essential for eye health, skin cell regeneration, and immunity.	Fat-soluble. Requires an oil/lipid base to be extracted for food coloring. Gives pale yellow to orange tones on fabrics.	Alum (Works best on animal fibers like wool).	Used for cotton pre-wash to maximize absorption; no color shift. None needed: Naturally stable on protein fibers, but requires tannins on cotton to prevent solar fading.
LYCOPENE	🔴 Red	Tomatoes (especially cooked), watermelon, pink grapefruit	Powerful antioxidant, cardioprotective, linked to prostate health support.	Highly hydrophobic (water-insoluble). Permanently stains plastics when hot, but difficult to apply evenly as a textile dye.	Soy milk pre-mordant or Tannins.	Vegetable Oil: Crucial during the extraction phase to bind the pigment before attempting to coat fibers.
ANTHOCYANINS	🔵/🟣 Blue, Purple, Dark Red	Blueberries, blackberries, red cabbage, eggplants, dark grapes	Improve blood circulation, reduce capillary fragility, combat cellular aging.	Highly pH-sensitive (Chameleon Effect). Colors shift easily depending on the laundry detergent used on the fabric.	Alum (Mandatory to keep the color from washing out completely).	Soda Ash (Strong Base): Shifts to vibrant blue, teal, or emerald green. Vinegar/Lemon (Acid): Shifts to bright pink/red. Baking Soda (Base): Shifts to blue/green. Iron: Shifts to dark grey.
LUTEIN & ZEAXANTHIN	🟡 Deep Yellow	Corn, yellow peppers, marigold, saffron, dark leafy greens	Protect the macula of the eye from blue light damage and macular degeneration.	Excellent stability. Highly resistant to solar fading compared to other natural dyes. Saffron/Marigold are premium historical dyes.	Alum or Cream of Tartar.	Soda Ash: Brightens and enhances yellow extraction. Iron: Converts the brilliant sunny yellow into a warm mustard yellow or deep olive tone.
BETALAINS	🔴/🟤 Magenta, Deep Red	Beetroot, prickly pear (cactus pear), rhubarb	Strong anti-inflammatory, detoxifying properties, supports liver health.	Heat-sensitive. Ideal for cold food coloring (yogurt, ice cream). Boiling past 60°C turns the vibrant magenta into a dull brown.	White Vinegar (Added directly into the dye bath to maintain acidity).	Soda Ash: Destroys fuchsia matrix, shifting it to an undesirable yellow/brown. Avoid high heat and heavy metallic mordants, which degrade the brilliant fuchsia color matrix.
HIBISCUS	🌺 Ruby Red, Pink, Plum	Hibiscus calyces (Hibiscus sabdariffa / Karkadeh)	Packed with Vitamin C and organic acids. Lowers blood pressure and adds natural shine to hair.	Extreme pH reactivity. Highly popular for cool-toned hair rinsing, but fades quickly on textiles without proper mordants.	Alum + Cream of Tartar (Wool/Silk); Tannin + Alum (Cotton).	Soda Ash (Strong Base): Shifts to deep purple, teal-blue, or dark forest green. Vinegar: Shifts to cool bright pink. Baking Soda: Shifts to violaceous, blue, or dark green. Iron: Shifts to a moody slate grey.



ANTHOCYANINS

1. **Extreme pH Sensitivity (Chameleon Effect):** Anthocyanins change their molecular structure depending on the acidity or alkalinity of the liquid they are dissolved in, causing dramatic color shifts:
- ***Acidic Environment (pH < 3):*** *The pigment stabilizes into the flavylium cation form, turning into bright red, pink, or fuchsia (achieved by adding vinegar, lemon juice, or citric acid).*
- ***Neutral Environment (pH 6-7):*** *It stabilizes into a purple or violet hue.*
- ***Alkaline/Basic Environment (pH > 8):*** *The molecule converts into an anionic quinonoidal form, shifting directly to vibrant blue, teal, or emerald green (achieved by adding soda ash or baking soda).*
2. **Low Lightfastness:** UV rays break down the chemical bonds quickly, causing the dye to fade fast in direct sunlight.
3. **Wash Sensitivity:** Commercial laundry detergents (alkaline) will alter or shift the fabric's color during washing; requires pH-neutral soap.
4. **Mandatory Mordanting:** Being highly water-soluble, they require a mordant like alum to chemically bond to fibers, otherwise the color washes out completely.
5. **Iron Interaction (Saddening):** Reacts with iron sulfate to instantly shift purples and reds into moody slate grey, charcoal, or violet-black.



Swatches created during W5 BioChromes Workshop at Biolab Lisboa, Carlotta Premazzi 9-10-2026. Scan by Asli Aydin Aksan

RED CABBAGE pH MATRIX

Sample ID	Modifier Added	Real pH	Expected Color	Color Result Description
A (Strong Acid)	+ 1g Citric Acid	pH 2	Vibrant Pink / Fuchsia	Bright, intense neon pink.
B (Weak Acid)	+ 0.5g Alum	pH 3.5 - 4	Purplish Pink / Rose	Soft, warm pink with a hint of violet.
C (Iron Shift)	+ 0.5g Alum + Iron	pH 4 - 5	Slate Grey / Charcoal	Iron saddens the anthocyanins into a metallic grey.
D(Neutral)	None (Pure Cabbage)	pH 6	Violet / Purple	The natural hue of the plant extract.
E (Weak Base)	+ 0.5g Baking Soda	pH 7.5 - 8	Blue	True sky blue / cornflower blue.
F (Strong Base)	+ 0.2g Soda Ash	pH 9 - 10	Teal / Turquoise	A deep, rich blue-green.
G (Extreme Base)	+ 1g Soda Ash	pH 11 - 12	Bright Emerald Green	High alkalinity shifts the matrix to pure green.

PROTOCOL: RED CABBAGE DYE (200% WOF)

1. **Extraction:** Boil 200g of cabbage in 1L of water at 100°C for 1 hour (reduces to ~1/3). Strain.
2. **pH Modifiers (Cold):** Divide your extracted cabbage liquid into separate dye baths and add the modifiers.
3. **Dyeing:** Cold Method: Submerge fabrics for 24 hours (cold dye to protect anthocyanins).// Hot Method: Cook at 80°C for 40 minutes. Turn off the heat and leave the fabrics inside for 12 hours.

Red Cabbage pH Modification Matrix_Biolab Lisboa workshop 9-10-2026

Sample ID	Dye Volume	Modifier Added	Measured	Expected Color
A (Acidic)	100 ml	+ 0.5g Alum	pH 2	Pink
A (Acidic)	100 ml	+1.5g Add Citic	pH 5	Blue
B (Neutral)	100 ml	None	pH 6	Blue-Purple
C (Akaline)	100 ml	+ 0.03g Soda Ash	pH 7	Blue
D (Akaline)	100 ml	+ 0.2g Soda Ash	pH 9	Green
			1xpH 7+1xpH 6	Turquese
			2xpH 5+1xpH 2	Violet
			2xpH 2+1xpH 7	Fuxia







Lake pigment created during W5 BioChromes Workshop at Biolab Lisboa, Carlotta Premazzi 9-10-2026.

LAKE PIGMENT

100 ml concentrated dye bath (filtered) | 100%
3 g Alum (Potassium aluminum sulfate) 3% w/v (metallic fixative to bind the color).
1.5 g Soda Ash (Sodium carbonate) 1.5% w/v (alkaline precipitant to cause effervescence).
Hot water (just enough to dissolve the powders)

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1. **Dissolve:** Mix the alum into half a cup of hot water until dissolved. Do the same with the soda ash in a separate cup.
   Alum to Soda Ash Ratio: 2:1.
   1% w/v means 1 gram of powder in 100 ml of liquid.
1. **Mix:** Pour the dissolved alum into your dye bath and stir well.
2. **Precipitate:** Slowly pour the dissolved soda ash into the dye bath. It will fizz up.
3. **Filter:** Let the mixture sit for a few hours until the powder settles at the bottom. Pour off the clear water from the top, then dump the remaining colorful sludge into a coffee filter.
4. **Dry & Grind:** Leave the paste to dry completely. Once it forms a hard crust, grind it into a fine powder (always wear a face mask!).

LAKE PIGMENT



Lake pigment process during W5 BioChromes week. Carlotta Premazzi 2025, Biolab Lisboa.

⚠️ IMPORTANT TECHNICAL NOTES ON PH SHIFTS

1. **Expected Result with ANTHOCYANINS (Hibiscus/Red Cabbage):** The high alkalinity of the 1.5% Soda Ash will cause an immediate pH shift, turning the final dried pigment powder into a ***vibrant blue, teal, or deep emerald green*** rather than its original red.
2. **To Preserve the Original RED/PINK Color**: If your goal is a Red Lake (from Hibiscus) or a Pink Lake (from Red Cabbage), you must replace the Soda Ash with Calcium Carbonate (\(CaCO_{3}\)). Calcium Carbonate maintains a weaker alkaline environment, allowing the anthocyanins to precipitate while holding onto their acidic red and fuchsia tones.

Step	🌸 PINK LAKE (From Red Cabbage)	🔴 RED LAKE (From Hibiscus)
1. Base Juice	**100 ml** Pure red cabbage extract (filtered).	**100 ml** Pure hibiscus extract (filtered).
2. pH Shift	Add **5–10 ml White Vinegar**. *(Turns the purple juice into bright fuchsia/pink).*	**None needed.** *(Hibiscus juice is already naturally acidic and deep ruby red).*
3. Fixative	Add **3 g Alum** (3% w/v) dissolved in hot water.	Add **3 g Alum** (3% w/v) dissolved in hot water.
4. Precipitant	Add **3 g to 4 g Calcium Carbonate ($CaCO_3$)**. *(Triggers gentle fizzing and drops pink sediment).*	Add **3 g to 4 g Calcium Carbonate ($CaCO_3$)**. *(Triggers gentle fizzing and drops red sediment).*
5. Core Reason	**Vinegar forces the cabbage into pink.** $CaCO_3$ keeps it there.	**Hibiscus is already red.** $CaCO_3$ does not alter it.

🧪 ALUM VS. pH IN LAKE PIGMENTS

1. In Fabric Dyeing (Alum alters color): On wool or cotton, Alum acts as a chemical mordant, shifting plant shades.
2. In Lake Pigments (Alum doesn't define the tone): In the beaker, Alum binds with anthocyanins (hibiscus/cabbage) to form a metallic complex. This might slightly darken or saturate the liquid, but pH remains the ultimate color switch.

Why does pH win over Alum?

Anthocyanins are so highly sensitive to pH that the color-shifting effect of Alum is overridden by the other ingredients:

- Alum + Acidic environment (Hibiscus/Vinegar): The pigment binds permanently as Pink/Red.
- Alum + Alkaline environment (Soda Ash): The pigment is forced to turn Blue/Green, ignoring the Alum.

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BIOLAB Lisboa

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