Biochrome-Dyed Human Hair

A Sustainable Fashion Material

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About Dr. E-B

Welcome to my final project proposal! I am excited to present my journey towards creating non-toxic biochrome dyes and how they could correlate to fashion design.

FACTS ABOUT ME

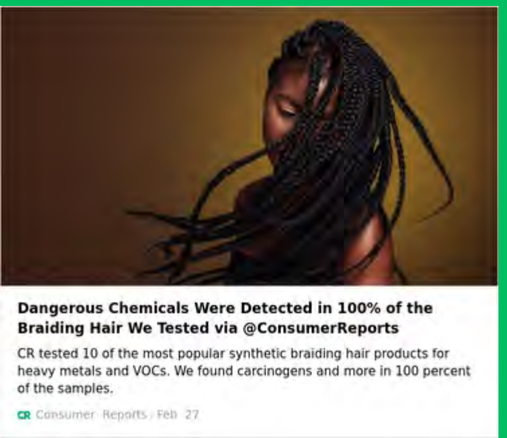
- Associate Dean and Full Professor in Fashion, Apparel, and Textile Design Studies
- 20th year working at North Carolina Central University
- Won the highest award at the University for Excellence in Teaching and also Student Advocacy
- Background is in Textile Chemistry

NCCU
College of Arts, Social Sciences and Humanities

Background

Chemicals found in Synthetic Hair

Consumer Reports tested 10 popular synthetic braiding-hair products and reported that every sample contained at least one chemical linked to cancer, including methylene chloride in all products. They also found lead in 9 of 10 products and noted the presence of volatile organic compounds (VOCs) that can be released during common braiding practices involving heat.



Dangerous Chemicals Were Detected in 100% of the Braiding Hair We Tested via @ConsumerReports

CR tested 10 of the most popular synthetic braiding hair products for heavy metals and VOCs. We found carcinogens and more in 100 percent of the samples.

CR Consumer Reports / Feb 27

Problems for people suffering from Alopecia

This article examines the role of wigs and hair prostheses in supporting the psychological well-being and quality of life of individuals with alopecia areata. It highlights how wigs function not only as cosmetic solutions but also as important tools for restoring self-esteem, social confidence, and emotional stability. The authors emphasize the need for greater attention to comfort, material quality, and patient-centered design in wig development, particularly for long-term and sensitive scalp use.

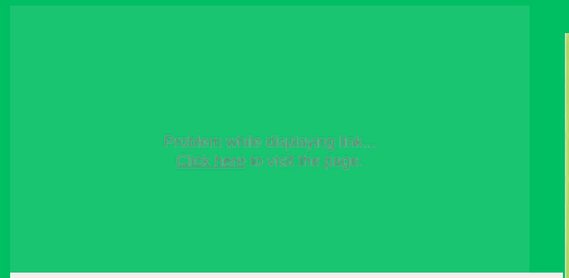
Wigs and Alopecia Areata: Psychosocial Impact and Economic Considerations

Alopecia areata (AA) presents a challenging and unpredictable condition associated with substantial psychosocial and financial burdens. A chronic, relapsing form of non-scarring hair loss, it affects approximately 0.1–0.2...

MDPI / Apr 3, 2024

Life Cycle of False Hair Products and Opportunities for Remanufacture

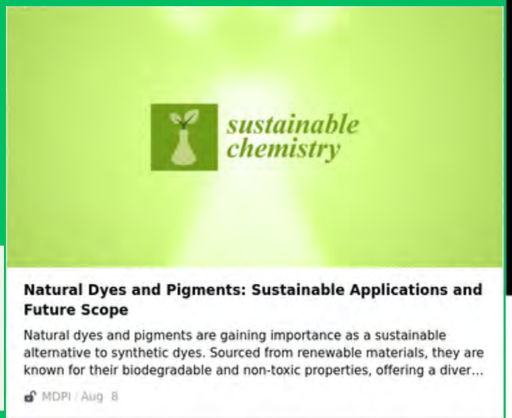
This study maps the full life cycle of false hair products (including wigs and extensions) and identifies significant environmental impacts associated with current manufacturing, use, and disposal practices. It highlights how synthetic materials contribute to waste and resource depletion while underscoring the limited existing research on the material life cycle of hair products. The authors argue for sustainable strategies such as recycling, reconditioning, and remanufacture to extend product life, reduce reliance on virgin materials, and lessen environmental harm from the false hair industry.



Capturing the life cycle of false hair products to identify opportunities for remanufacture

Natural Dyes as Sustainable Alternatives

This article reviews natural dyes and pigments as biodegradable, non-toxic alternatives to synthetic colorants used in textiles, cosmetics, and related industries. It highlights plant- and microbe-derived pigments for their environmental benefits while noting challenges such as color stability and processing limitations. Overall, the authors emphasize that continued research is advancing natural dyes as viable, sustainable solutions for future material and design applications.



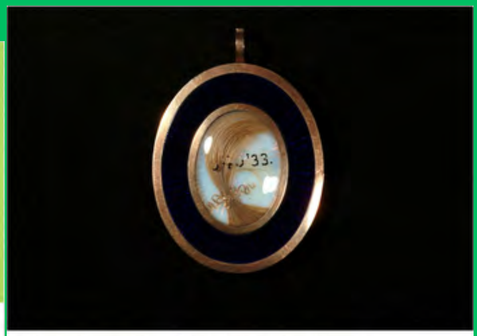
Natural Dyes and Pigments: Sustainable Applications and Future Scope

Natural dyes and pigments are gaining importance as a sustainable alternative to synthetic dyes. Sourced from renewable materials, they are known for their biodegradable and non-toxic properties, offering a diver...

MDPI / Aug 8

Performativity and Meaning in Victorian Mourning Jewelry

This article examines Victorian mourning jewelry as a performative material practice, focusing on how human hair was transformed into wearable objects of memory and grief. It argues that hairwork functioned not only as adornment but as an active expression of mourning, identity, and social ritual. By analyzing woven, braided, and crafted hair objects, the study situates hair jewelry within broader discussions of material culture, embodiment, and emotional labor in the Victorian era.



The Performativity of Hair in Victorian Mourning Jewellery

Mourning rings were popular items of remembrance in the Victorian era which commonly incorporated the hair of a departed loved one. The role of hair within this type of jewellery is discussed in relation to...

Coalition of Masters Scholars on Material Culture / Jun 9, 2021

Photo: nss Magazine

Alexander McQueen

This image presents a striking fashion look that transforms hair into a sculptural garment, blurring the boundary between body, adornment, and clothing. The exaggerated volume and crown-like headpiece evoke themes of power, ritual, and Afro-futurist elegance, positioning hair as both material and symbolic armor.

Photo: Laetitia Ky
Medusa gaze

Laetitia Ky

This image presents natural hair styled into branching, snake-like extensions that radiate outward, evoking roots, movement, and living forms. The sculptural hairstyle transforms hair into a symbolic material, suggesting themes of power, ancestry, and the connection between the body, nature, and imagination.

Photo: Hlonipha, Cassilhaus

Zanele Muholi

This striking black-and-white portrait presents the body and adornment as a unified sculptural form, where layered, looped materials echo the texture and rhythm of natural hair. The image evokes themes of strength, ritual, and ancestry, positioning hair-inspired structures as both armor and adornment within a fashion and cultural context.

Photo: Hayward Gallery

Nick Cave/Soundsuit

This image captures a dynamic performance moment in which a brightly colored, fur-covered sculptural costume moves with explosive energy, blurring the boundary between fashion, dance, and performance art. The exaggerated texture and motion echo themes of transformation, ritual, and embodied identity, emphasizing how clothing can become an active, expressive force rather than a static object.

Photos: Zsofia Kollar

Zsofia Kollar

Has founded the Human Material Loop which makes clothes out of human hair. The Human Material Loop aims to create a globally applicable system where the hair waste would be turned into sustainable products, lowering the demand for cotton and synthetic fibers.

Research Inspirations for the Project

1. **Toxic dyes harm people, ecosystems, and supply chains.**
2. **The hair industry generates massive chemical waste.**
3. **Dyed hair could be used for people suffering hair loss as a safe alternative**
4. **The fashion sector seeks low-impact materials but lacks viable color alternatives.**

THE PROBLEM

Addressing Toxic Dye Challenges

Environmental Impact

Synthetic dyes cause serious pollution issues

Hair Waste

Untapped potential from large hair waste volume

Safe Alternatives

Non-toxic dyes needed for hair products

Social Relevance

Safe options for individuals with hair loss

Beauty Industry:
$100+Billion

Hair Extensions:
$7+Billion

Sustainable Fashion:
Fastest-growing consumer segment

Biomaterials:
Emerging Venture Capital (VC)-backed field

WHY

INTRODUCING

Hair could be sourced from:

Beauty Supply Stores
Amazon
Family Member (Dye Only)

HAIR

Hair has a strength-to-weight ratio comparable to steel.

Can be stretched up to one and a half times its original length before breaking (the faster hair is stretched, the stronger it is).

Zero toxic runoff

Strong aesthetic value

Cultural resonance

Versatile material

New IP opportunities in fashion + beauty industries

INTRODUCING

- Pigments produced by fruits and/or living organisms
- Requires minimal water + energy
- Safe, biodegradable, non-toxic
- Bonds naturally to keratin fibers (found in hair, skin, nails)

BIOCHROMES

Microbe Growth

Grow and create microbes using fruit and other substances.

Pigment Extraction

Harvest pigments from the microbes to create a dye

Hair Preparation

Preparing hair for dye application

Dye Application

Apply biochrome dye (room temp or low heat)

Hair Samples

Dry + set color to showcase the range of colors

Felting Techniques

Transform fibers into garment structures (braids, weaving, and felting)

HOW

Transforming hair into fashionable art

- **Woven textiles**
- **Sculptural couture**
- **Fringe + trims**
- **Braid-based structures**
- **Felting-like assemblies**
- **Soft armor shapes**

Fashion Designers & Brands

Sustainable fashion designers seeking non-toxic alternatives to synthetic dyes
Avant-garde and couture designers interested in biomaterials and experimental color
Hair-based fashion innovators using hair as textile, embellishment, or structure
Luxury brands aiming to meet ESG and sustainability commitments

Why they care:

Biochromes offer unique aesthetics, storytelling value, and compliance with sustainability goals.

Beauty, Hair, & Wig Industry

Wig and hair-prosthetic manufacturers (especially medical wigs)
Natural hair brands focused on clean beauty
Consumers with hair loss (alopecia, chemotherapy, autoimmune conditions)
Stylists and salons seeking safer, non-toxic materials

Why they care:

Biochromes reduce scalp irritation, chemical exposure, and long-term health risks.

Healthcare & Psychosocial Stakeholders

Dermatologists and oncologists
Hospitals and cancer support programs
Alopecia advocacy organizations
Mental health professionals

Why they care:

Non-toxic, biocompatible hair dyes improve quality of life for people experiencing hair loss.

Consumers

Eco-conscious consumers (Gen Z & Millennials)
People with sensitive skin or chemical sensitivities
Black and Brown communities are disproportionately exposed to toxic hair products
Culturally engaged consumers who value heritage-based materials

Why they care:

Biochromes align with clean beauty, cultural integrity, and environmental justice.

WHO

WHEN

TIMELINE

Jan

Create a prototype using 1-2 biochromes

Feb

Add biochromes to different lengths of hair

Mar

From hair to create three fashion looks (i.e., felting, braids and weaving

Project Value

Highlighting the significance of biochrome dyes for sustainable fashion innovation

While existing scholarship documents hair as symbolic material, cultural artifact, or decorative element, there are little to no studies that have systematically examined biochrome-dyed human hair as a sustainable textile structure for fashion garment construction. Thus, this proposal can add to the body of literature intersecting the hair and fashion industry.