

**PLANT-BASED NATURAL DYES: A COMPREHENSIVE
EXPLORATION OF SOURCES, CHEMISTRY, AND
SUSTAINABLE APPLICATIONS**

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APPLICATIONS**

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ABSTRACT

PLANT-BASED NATURAL DYES: A COMPREHENSIVE EXPLORATION OF SOURCES, CHEMISTRY, AND SUSTAINABLE APPLICATIONS

Plant-based natural dyes hold a deep historical and cultural significance, having been utilized for centuries across diverse global cultures. Derived from plants, insects, and minerals, these dyes offer a spectrum of colors to textiles, aligning with modern sustainability efforts. They provide an eco-friendly, biodegradable, and non-toxic alternative to synthetic dyes. The chemistry of natural dyes is complex, with compounds like tannins and anthocyanins contributing to their hues. Extraction methods include maceration, soxhlet, and ultrasound-assisted techniques, showcasing the diversity in harnessing these dyes. Natural dyes are versatile, and suitable for fabrics like cotton, silk, and wool. Amidst rising demand for sustainable products, plant-based dyes have seen a resurgence in the fashion industry, offering a sustainable substitute to synthetic counterparts. This resurgence embodies a harmonious relationship with nature, respect for tradition, and conscientiousness towards the ecosystem.