

PC 69. Valorisation of Purple Onion Peel as a Sustainable Biodye for Cotton and Wool

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Abstract

The textile industry is a major contributor to environmental pollution, largely due to high water consumption and the use of non-biodegradable synthetic dyes, which contaminate ecosystems and pose risks to human health [1]. Among its processes, dyeing stands out for high environmental impact. In response, more sustainable alternatives have been explored, including natural-origin dyes. However, natural dyes still face key limitations, particularly low colour fastness, as they tend to fade after washing or prolonged exposure to sunlight [2]. This study investigates the potential of purple onion peel (*Allium cepa* L.), a by-product of the food industry, as a sustainable biodye for cotton and wool fabrics. The aim is to evaluate the effectiveness of this bio-dye as an eco-friendly alternative to synthetic dyes [3]. To evaluate dye fixation improvement, samples dyed without and with the mordant carbonyldiimidazole (CDI) used directly in the dyeing solution were compared, testing different concentrations. The dye was extracted using a simple solid-liquid process with water, and dyeing was performed under controlled conditions (50 °C, 320 rpm, 100 min). Subsequently, fastness tests to washing (cold and hot water) and natural light exposition were conducted, with the colour change evaluated using the CIELAB colour space. Results show that CDI improved dye fixation, especially in wool, where minimal colour difference was observed between exposed and protected areas from light. In cotton, colour fastness improved but remained unsatisfactory. These findings show the potential of using agricultural waste in the textile industry for sustainable practices within the circular economy. However, the lightfastness limitation underscores the need for further research on eco-friendly solutions to improve colour durability.

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