Citation: Wael Mahmoud et al. (2023), The Environmental Concept of the House in Hassan Fathy Architecture, International Design Journal, Vol. 13 No. 1, (January 2023) pp 45-54

Development of Dyeing Reactive Dyes on Blended Banana Fabrics Treated with Plasma Technology

Mohamed M. Mosaad Kamel
Textiles printing, dyeing and finishing, Faculty of Applied Arts, Benha Uni. Egypt
Correspondence: e-mail (Mohamed.Kamel@fapa.bu.edu.eg);

Abstract:

Banana pseudo-stem fibres have been used as a greener substitute for synthetic fibres that are harmful to the environment in the textile industry. Banana applications are expanding since different components of the banana are employed in various industries like fruits as food sources, leaves as food wrap, and stems for paper pulp and fibre. this due of rising environmental consciousness and the growing relevance of eco-friendly fabrics. The 4th state of matter is called plasma, Plasma treatment has demonstrated that it can be used as an environmentally friendly method to improve dyeing uptake of textiles with dyes.

The goal of this research is to create a reactive dyeing process suitable for banana fabrics and compare between dyeing behaviours of banana blended fabrics with cotton fabrics. Testing was performed to evaluate the colors properties between pre-treated, dyed banana fabrics, untreated dyed banana fabrics, and cotton fabrics.

In this study, the blended banana/cotton fabrics was pre-treated with Plasma DBD with different gases, and then dyed with synthetic reactive dyes. Finally, the dyed samples were evaluated according to standard testing methods. The findings demonstrated that plasma-pretreated blended banana textiles outperformed untreated fabrics. According to other findings, cotton and bananas also exhibit comparable dyeing behaviors. As a result, fabrics made from bananas may use the cotton dyeing method. Finally, it was possible to dye banana-based fabrics with a reactive dye that had superior washing fastness properties when compared to cotton-based fabrics.

Keywords:

Banana blended fabric, dyeing, Reactive dyes, plasma DBD treatment, Fastness, Colour properties

References:

1- Mosaad M. and Abo El Amiam Y., "Eco-friendly process for dyeing banana fabrics with curcuma natural dyes.", journal of architecture arts and humanistic sciences, 2021. Doi:10.21608/mjaf.2021.61566.2200
2- Manilal VB and Sony J. "Banana pseudostem characterization and its fiber property evaluation on physical and bio extraction." J Nat Fibers 2011; 8(3): 149–160.
3- Gupta G and Bhatnagar RA., "Review on composition and properties of bagasse fibers.", Int J Sci Eng Res 2015; 6(5): 143–148
4- Ray DP, Nayak LK, Ammayappan L, et al. Energy conservation drives for efficient extraction and utilization of banana fiber. Int J Emerg Technol Adv Eng 2013; 3(8): 296–310., [S. Balakrishnan et al., "Study on dyeing behavior of banana fiber with reactive dyes", Journal of Engineered Fibers and Fabrics, 2019, Vol 14: Pp. 1–12.
5- Balakrishnan S. et al., "Study on dyeing behavior of banana fiber with reactive dyes", Journal of Engineered Fibers and Fabrics, 2019, Vol 14: Pp. 1–12.
6- Subagyo A. and Chafidz, A. "Banana Pseudo-Stem Fiber: Preparation, Characteristics, and Applications", 2018,
7- DOI: http://dx.doi.org/10.5772/intechopen.82204
8- Al Mamun M. et al. "Eco-Friendly Treatment of Green Banana Fibre in Compared to Chemical Treatment", J. Mater. Environ. Sci., 2021, Vol 12, Issue 6, Pp 823-826.
9- Preethi P., M. G. Balakrishna, Physical and Chemical Properties of Banana Fibre Extracted from Commercial Banana Cultivars Grown In Tamilnadu, Agrotechnology, 11 (2013) 1-3. https://doi.org/10.4172/2168-9881.s11-008.
10- Islam, T. et al, "Dyeing Properties of Banana Fibre Dyed with Different Dyes", IJEAT, Volume-9 Issue-1, 2019. DOI: 10.35940/ijeat. A1285.109119
11- Chinta SK and Vijaykumar S. Technical facts & figures of reactive dyes used in textiles. Int J Eng Manag Sci 2013; 4(3): 308–312.
12- Mukhopadhyay S., Fangueiro R., "Physical modification of natural fibers and thermoplastic films for composites- a review", J. Thermoplast. Compos. Mater. 22 (2) (2009) 135–162)- (U. Gupta, et. Al, "Surface modification of banana fiber: A review", Materials Today: Proceedings 43 (2021) 904-915. https://doi.org/10.1016/j.matpr.2020.07.217
13- Vajpayee M," Investigation of Antimicrobial Activity of DBD Air Plasma-Treated Banana Fabric Coated

with Natural Leaf Extracts.", ACS Omega 2020, 5, 19034−19049 https://dx.doi.org/10.1021/acsomega.0c02380?ref=pdf

14- Dave H, Ledwani L, Nema SK. Nonthermal plasma: a promising green technology to improve environmental performance of textile industries. In: Shahidul- Islam, Butola BS, editors. The impact and prospects of green chemistry for textile technology. Amsterdam: Elsevier; 2019. P. 199–249
15- Naebe M. et. al, "Plasma-assisted antimicrobial finishing of textiles: A review", https://doi.org/10.1016/j.eng.2021.01.011
16- Ratnapandian S, Wang L, Fergusson SM, Naebe M. Effect of atmospheric plasma treatment on pad-dyeing of natural dyes on wool. J Fiber Bioeng Inf 2011;4(3):267-76.
17- Haji A, Naebe M.," Cleaner dyeing of textiles using plasma treatment and natural dyes: a review.", J Cleaner Prod, 2020; Pp 265:121866.
18- Herbert T. Atmospheric-pressure cold plasma processing technology. In: Shishoo R, editor. Plasma technologies for textiles. Cambridge: Woodhead Publishing; 2007. p. 79–128.
19- K. Vinisha Rani, et Al., "Plasma treatment on cotton fabrics to enhance the adhesion of Reduced Graphene Oxide for electro-conductive properties", Diamond & Related Materials 84 (2018) 77–85. https://doi.org/10.1016/j.diamond.2018.03.009
20- J. Neves, "Technologia Textile", LLS Edn., Porto, Portugal; Vol. l; (1982).
21- The Society of dyer and colorists; "Standard methods for the Assessment of color fastness of textiles", Third Report of the fastness tests coordinating committee, Yorkshire, England, (1955), 71, p.24
22- AATCC Test Method 8-1996; International Organization for Standardization (ISO) 105X12.
23- AATCC test method 36-1972; International Organization for Standardization (ISO) 105-C06 A2S: 1994 standards.
24- AATCC 15: 2009; International Organization for Standardization ISO 105 E04 :2013.
25- Pransilp P, Pruettiphap M, Bhanthumnavin W, Paosawatyanyong B, Kiatkamjornwong S. Surface modification of cotton fabrics by gas plasmas for color strength and adhesion by inkjet ink printing. Appl Surf Sci 2016;364:208–20.

Paper History:

Paper received 6th September 2022, Accepted 24th November 2022, Published 1st of January 2023

