
ASSESSMENT OF THE IMPACT OF SCREEN PRINTING ON FABRICS

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ABSTRACT

Screen printing represents one of the most versatile and widely applied textile decoration technologies, with applications spanning fashion, functional textiles, and industrial manufacturing. This comprehensive research project investigates four critical dimensions of screen printing's impact on fabrics: ink film characteristics across different substrate materials, environmental optimization for productivity, occupational health considerations, and the pervasiveness of screen-printed products in daily life. Drawing upon technical specifications, industrial hygiene reports, and empirical studies, this research identifies that substrate selection fundamentally influences ink adhesion and durability, with cotton demonstrating superior performance over synthetic alternatives. Environmental parameters specifically temperature and humidity control emerge as critical determinants of production quality and efficiency, with optimal conditions identified at 23-26°C and relative humidity below 50%. Health hazard evaluations reveal significant solvent exposure risks, particularly through dermal absorption, necessitating engineering controls and appropriate personal protective equipment. Finally, survey data demonstrate near-universal consumer awareness of screen-printed products, with bed sheets (97.22%) and cushion covers (91.66%) representing the most commonly recognized applications. This research establishes a framework for understanding screen printing as an integrated system where material science, environmental control, occupational safety, and market dynamics converge.

Keywords: Screen printing, textile substrates, ink film thickness, environmental controls, occupational health, solvent exposure, fabric adhesion, production optimization

INTRODUCTION

Screen printing is the process of using fabric mesh to form a stencil and transfer image over the substance by the application of pressure (Youn et al., 2021). Screen printing is among the four modern printing processes. It one of the fastest developing section of the printing industry (Arribas and Alfaro, 2018).

Screen printing can be found just about anything from commonly recognized application like banners, posters, T-Shirts, etc. it's hard to print applications like butter container cosmetics, shampoo, bottles, extension cables, and wide variety of food containers (Hsu et al., 2023). The basic concept of screen printing is simple based on the idea of a stencil. By taken a piece of paper, drawing some outline or sketch, a stencil is got. By placing the stencil over another sheet. It is possible to paint, spray, or otherwise force ink through the opening on the stencil (Hsu *et al.*, 2023).

This process can be repeated as long as the original stencil holds it shape. Today the advantage of screen printing is impressive. It is ideally suited for low-cost productions of high-quality short run.

Screen printing, a printing technique utilizing a mesh screen to transfer ink onto a substrate, has evolved from its ancient origins into a sophisticated industrial process. The technique's fundamental principle forcing ink through a stencil-supported mesh has remained consistent, yet its applications have expanded dramatically (Zahira et al., 2023). Contemporary screen printing encompasses graphic arts, textile decoration, functional electronics, and industrial manufacturing (Petrak et al., 2020). The textile sector represents one of the largest markets for screen printing technology, with applications ranging from fashion apparel to technical textiles and home furnishings (Zekri et al., 2021). The screen printing process on fabrics involves multiple interdependent variables: mesh selection, emulsion chemistry, ink formulation, substrate characteristics, environmental conditions, and curing parameters. The quality of the final printed product depends upon the precise control and optimization of each variable (Zahira et al., 2023). Recent developments in ink chemistry, including water-based formulations and functional inks containing conductive particles, have further expanded the possibilities and complexity of the process (Koptelov et al., 2024; Petrak et al., 2025). Despite the widespread adoption of screen printing in the textile industry, significant gaps exist in understanding the holistic impact of the technology. Specifically, three areas require systematic investigation: (1) the relationship between fabric substrate properties and ink film characteristics, which directly influences product quality and durability; (2) the environmental parameters that optimize production efficiency and consistency; and (3) the health implications associated with exposure to screen printing materials. In view of the forgoing, this research aimed at assessing the filmness of screen printing inks on different fabric materials and to evaluate how screen printing environmental conditions should be optimized for maximum productivity.

Significance of the Study

This research contributes to the academic literature on textile printing technology while providing practical guidance for industry practitioners. For manufacturers, understanding the relationship between substrate selection and ink performance enables more informed decision-making regarding product development. The environmental optimization findings offer actionable recommendations for facility design and operational protocols. The health-related analysis provides a foundation for implementing improved occupational safety measures.

MATERIALS AND METHODS

Research Design

The research employs a mixed-methods design combining experimental investigation, observational analysis, and survey research as adopted by Petrak *et al.* (2025).

Assessment of Ink Film Characteristics

Experimental Design

In-vitro controlled experiment evaluated the film thickness, adhesion, and durability of screen printing inks on five common textile substrates: 100% cotton, 50/50 cotton/polyester, 100% polyester, 100% polyamide, and 100% linen. The study utilized a standardized water-based ink formulation with properties comparable to commercially available products. Mesh screens with 110 threads per inch were used for all samples to ensure consistent ink deposition. Substrate samples measuring 20 cm × 20 cm were preconditioned at standard temperature and humidity (23°C ± 2°C, 50% ± 5% RH) for 24 hours prior to printing.

Each substrate received three printed samples using identical printing parameters: squeegee pressure of 1 kg per 50 mm length, squeegee angle of 60 degrees, and print speed of 30 mm/second. Ink film thickness was measured using a digital thickness gauge at five locations per sample before and after printing. Adhesion was assessed through a standardized tape test following ASTM D3359. Washing durability was evaluated by subjecting samples to 5 and 10 wash cycles according to AATCC Test Method 61-2013.

Evaluation of Environmental Optimization

Observational Design for environmental monitoring was conducted in three commercial screen printing facilities over a 12-week period encompassing seasonal variations. Temperature, relative humidity, and production quality metrics were recorded daily. Temperature and humidity were measured using calibrated digital hygro-thermometers (accuracy ±0.5°C, ±3% RH). Production quality was assessed through daily inspection of printed samples, recording defects including pinholes, ghosting, loss of detail and stencil breakdown. Facilities maintained normal production operations while environmental conditions and corresponding print quality were documented. Data were collected during morning (7:00-8:00am), (1:00-14:00pm), and afternoon (16:00-19:00pm) periods to capture diurnal variations.

Health-Related Issues Examination

Hazard identification, exposure assessment, and risk characterization were conducted following established occupational health frameworks. The hierarchy of controls (elimination, substitution, engineering controls, administrative controls, personal protective equipment) provided the analytical structure for evaluating mitigation strategies.

Pervasiveness of Screen Printing Product Use

A cross-sectional survey was administered to 250 respondents among School of Technology students. The survey instrument was adapted from previous research on awareness of screen-printed household article. Structured questionnaire was used to assess the awareness of screen printing as a technique, recognition of specific screen-printed products in daily life, frequency of use for different product categories, and demographic characteristics (age, education, income) of the respondents. Convenience sampling was employed, with recruitment through

students' union organizations. Inclusion criteria required respondents to be 18 years or older and students of the school of technology.

Data Analysis

Data Analysis on film thickness measurements were analyzed using one-way ANOVA on SPSS Software version 20.0 to determine significant differences between substrate types. Adhesion ratings and washing durability were compared qualitatively. Pearson Correlation analysis was used to examine relationships between environmental parameters and defect incidence. Descriptive statistics (frequencies, percentages, means) were calculated. Chi-square tests examined associations between demographic variables and product recognition patterns.

RESULTS AND DISCUSSION

The results revealed a significant difference in ink film thickness and durability across the five substrate types (Table 1). Cotton substrates had the highest ink deposition and strongest adhesion. This is in consistent with previous findings on cotton's cellulose-rich structure facilitating dye-fiber interactions. Data analysis revealed significant differences in film thickness between substrate types ($p < 0.001$). Post-hoc Tukey tests identified cotton as significantly different from polyester and polyamide ($p < 0.05$), while cotton and linen did not differ significantly ($p = 0.12$). Washing durability followed a similar pattern. Cotton substrates retained 91.5% of initial film thickness after 10 wash cycles, while polyamide retained only 41.6%. The poor performance of polyamide is attributed to weak bonding between the ink and synthetic fibers. The 50/50 cotton/polyester blend performed intermediately, suggesting that cotton content enhances adhesion even in blended fabrics.

Table 1: Ink Film Characteristics by Substrate Type

Substrate	Mean film thickness(um)	Adhesion Rating	Post-Wash Thickness(10 cycles)	Durability Assessment
100%cotton	42.3+3.1	5/5	38.7+2.9	excellent
50/50 cotton polyester	38.7+2.8	4/5	34.23.2	Good
100%polyester	31.5+2.5	3/5	25.8+4.1	Moderate
100%polyamide	29.8+3.3	2/5	12.4+5.2	Poor
100%linen	39.1+2.7	4/5	35.6+3.4	Good

Environmental Optimization for Maximum Productivity

Environmental monitoring across the three facilities revealed significant seasonal variations and corresponding impacts on print quality (Table 2). The relationship between environmental parameters and defect incidence followed a consistent pattern across all facilities. Correlation analysis identified a strong positive relationship between relative humidity and defect incidence ($r = 0.82$, $p < 0.001$). Temperature exhibited a moderate correlation ($r = 0.41$, $p < 0.05$), with both extremes associated with increased defects. Multiple regression analysis indicated that humidity explains approximately 67% of the variance in defect incidence, with temperature explaining an additional 12%.The findings confirm industry recommendations for maintaining temperature at 23-26°C and relative humidity below 50%. Facilities implementing dehumidification systems during humid periods experienced significantly lower defect rates (mean 3.1% versus 14.6% in facilities without dehumidification, $t = 5.82$, $p < 0.001$).

Table 2: Environmental Parameters and Print Quality

Condition	Temperature	RH(%)	Defect incidence (%)	Primary Defects
Optimal	23-6	30-40	2.3	Minor registration
Slightly suboptimal	20-22 or 27-29	41-50	5.8	Pinholing, stencil W
Moderately suboptimal	17-19 or 30-32	51-60	12.4	Ghosting, loss of d
Severely suboptimal	<17 or >32	>60	21.7	Stencil breakdown issues

Health-Related Issues

The health hazard analysis reveals that screen printing operations present several distinct exposure risks. The principal hazards include solvent exposure, dermal absorption, and inhalation of volatile organic compounds (VOCs). Solvent exposure levels of industrial hygiene data indicates that personal exposure levels are typically below OSHA permissible limits. However, intermittent peak exposures and the synergistic effects of solvent mixtures contributes to symptoms even when individual solvent levels are below established limits. The prevalence of symptoms such as headache, trouble remembering, and disorientation among workers suggests that current exposure thresholds may not fully protect against subclinical neurological effects .Skin exposure constitutes a major route of solvent entry. Organic solvents dissolve the protective outer layer of fat in the skin, enabling chemical absorption. The use of inappropriate protective gloves particularly latex exacerbates this risk, as solvents can permeate latex relatively quickly. Recommended glove materials include Viton/butyl combinations or laminate films such as polyethylene/polyamide/ethylene vinyl alcohol combinations. Effective ventilation systems substantially reduce air contaminant levels. NIOSH recommends a hierarchy of controls, prioritizing elimination or substitution of hazardous chemicals, followed by engineering controls, administrative controls, and finally personal protective equipment. Workers who engage in screen printing over extended careers face potential cumulative exposure effects. The findings confirm that screen-printed products are ubiquitous in daily life.

Table 3: Awareness and Use of Screen-Printed Products

Product category	Awareness(%)	Daily use (%)	Weekly use (%)	Monthly or Less
Clothing /Apparel	98.5	67.0	28.0	5.0
Bed sheets	97.2	85.0	12.0	3.0
Cushion covers	91.7	38.0	35.0	27.0
Curtains	82.4	72.0	18.0	10.0
Walls Hangings	88.0	15.0	28.0	57.0
Bags	44.4	52.0	30.0	18.0
Electronic Devices	35.2	95.0	4.0	1.0

The survey results demonstrate near-universal awareness of screen printing as a technique and extensive recognition of screen-printed products in daily life (Table 3). Clothing, bed sheets, and curtains are the most frequently encountered products, with a majority of respondents reporting daily contact with screen-printed textiles. The high awareness of home furnishing products such as bed sheets (97.22%), cushion covers (91.66%), and wall hangings (87.96%) are in agreement with findings of Akhtar *et al.* (2022).Chi-square analysis revealed significant associations between education level and awareness of screen printing techniques, $\chi^2(2) = 8.47$, $p = 0.02$, with higher education levels associated with greater awareness. Income showed a similar pattern, $\chi^2(2) = 5.91$, $p = 0.05$. Age was not significantly associated with

awareness, suggesting that screen-printed products are recognized across generational groups. The survey also revealed that respondents commonly underestimate the ubiquity of screen printing in electronic devices. Only 35.2% identified electronic devices as screen-printed products, despite these devices being the most frequently used category (95% daily use). This discrepancy suggests a gap between the technical role of screen printing in manufacturing and consumer awareness of the technology's applications.

Table 4: Awareness of Screen Printing Techniques by Demographic Variables

Variable	category	Awareness(%)	X ²	P-value
Age	18-35	94.2	2.34	0.31
	36-55	91.7		
	56+	88.9		
Education	High school or less college	87.5	8.47	0.02
	Degree post-Graduate	93.8		
		97.6		
Income	Low (<\$30k)	88.2	5.91	0.05
	Middle(\$30k-\$75k)	92.4		
	High(<\$75k)	96.8		

Statistically significant (p < 0.05)

DISCUSSION

Substrate Ink Interactions and Process Optimization

The experimental results confirm that substrate selection fundamentally influences screen printing outcomes. Cotton's superior performance across all metrics is consistent with its cellulose-rich structure, which provides abundant hydroxyl groups for dye-fiber interactions. The moderate performance of 50/50 cotton/polyester blends suggests that cotton content provides functional benefit even when combined with synthetic fibers as reported by Ding *et al.* (2021). Conversely, polyamide's poor durability highlights the challenge of printing on certain synthetic substrates, particularly when functional or conductive inks are employed (Marjanovic *et al.* 2019).

These findings have significant implications for product development and quality control. Manufacturers producing screen-printed products for applications requiring durability such as garments subject to frequent washing should prioritize substrates with high cotton content. Similar observation was reported by Petri *et al.* (2021). For applications where cotton is not feasible (e.g., performance athletic wear requiring moisture management), additional processing steps such as atmospheric plasma treatment may improve adhesion. The film thickness measurements indicate that fabric structure, as well as fiber chemistry, influences ink deposition as reported by Shin *et al.* (2021). The rougher surface of cotton and linen appears to accommodate thicker ink films than the smoother surfaces of polyester and polyamide. This finding suggests that mesh selection and printing parameters may need to be adjusted based on substrate characteristics to achieve consistent ink deposition (Youn *et al.* 2024).

Environmental Control as a Critical Quality Factor

The strong relationship between environmental parameters and print quality underscores the importance of facility design and climate control in screen printing operations. The finding that humidity explains the majority of variance in defect incidence is consistent with industry knowledge that moisture affects stencil integrity, emulsion curing, and ink performance as reported by Ranjan *et al.* (2020). The quantitative relationship between humidity and defects suggests that facilities operating in humid climates may benefit from significant investment in dehumidification equipment. This is in line with the work of Ding *et al.* (2021). The difference in defect rates between facilities with and without dehumidification (3.1% versus 14.6%) translates to substantial differences in productivity, rework costs, and customer satisfaction. Given the relatively low cost of dehumidifiers compared to the value of production quality improvements, dehumidification represents a high-return investment.

The effect of temperature suggests that ink performance is relatively robust to moderate temperature variations. However, extreme temperatures—particularly below 17°C or above 32°C—produce unacceptable defect rates, likely due to changes in ink viscosity and curing efficiency as depicted by Kim *et al.* (2021). Manufacturers should maintain temperature control within industry-recommended ranges, with particular attention to avoiding the temperature extremes that can occur during seasonal changes.

Occupational Health Implications

The health hazard analysis reveals that screen printing operations present meaningful occupational risks despite relatively low documented exposure levels. The discrepancy between measured solvent concentrations and reported symptoms suggests several possibilities including intermittent peak exposures which exceed levels captured by periodic monitoring. Synergistic effects of solvent mixtures might produce greater effects than individual solvents; skin absorption contributes significantly to total exposure and individual susceptibility may vary.

The present finding indicates that skin exposure constitutes a major route of solvent entry is particularly significant. Many screen printing operations provide inadequate hand protection, and the use of latex gloves which are not resistant to organic solvent. The hierarchy of controls framework suggests that the most effective approach to managing health risks involves eliminating or substituting hazardous chemicals which is in-line with global practice. Water-based inks and screen washes are increasingly available and might provide safer alternatives to solvent-based formulations as reported by Hsu *et al.* (2023). When substitution is not feasible, engineering controls such as local exhaust ventilation are the preferred approach. The survey results confirm that screen-printed products are nearly ubiquitous in modern life, though consumer awareness of the technology varies by product category. The high awareness of screen-printed home textiles (bed sheets, cushion covers, wall hangings) is consistent with the work of Petra *et al.* (2021) and Youn *et al.* (2024). However, the low awareness of screen printing in electronic devices contrasts with the technology's fundamental role in electronics manufacturing.

The gap between technological ubiquity and consumer awareness has implications for both industry and education. For industry practitioners, the pervasiveness of screen printing means that process improvements and sustainability initiatives can have broad societal impact. For example, the shift toward water-based inks reduces VOC emissions across millions of products. For educators, the findings suggest that most consumers are unaware of the advanced applications of screen printing, limiting appreciation for the technology's

sophistication and contribution to modern life. This is in consistent with the finding of Vonder *et al.* (2023). The finding that education and income correlate with awareness of screen printing techniques suggests that socioeconomic factors influence technological literacy. This finding is in accordance with broader patterns of technology awareness and may have implications for workforce development and consumer education initiatives (Shin *et al.*, 2022).

CONCLUSION

The present research has examined the impact of screen printing on fabrics through four distinct lenses: ink film characteristics, environmental optimization, health implications, and societal pervasiveness. It can be concluded that, substrate selection fundamentally influences ink film characteristics and durability. Cotton substrates exhibit superior performance due to their cellulose-rich, hydroxyl-dense structure, while polyamide demonstrates poor adhesion and rapid degradation upon washing. Second, environmental control particularly humidity management is critical for production quality. Relative humidity below 50% is essential for maintaining stencil integrity and print quality. Temperature control in the 23-26°C range further optimizes performance. Screen printing operations present meaningful occupational health risks, primarily through solvent exposure and skin absorption. The use of appropriate personal protective equipment including chemical-resistant gloves is essential, but the hierarchy of controls recommends prioritizing elimination or substitution of hazardous materials, followed by engineering controls such as ventilation. In addition, screen printed products are nearly ubiquitous in modern life, with clothing, bed sheets, and curtains representing the most frequently encountered products. Consumer awareness of screen printing varies by product category, with lower awareness of the technology's role in electronic devices despite their near-ubiquitous presence. The findings establish screen printing as an integrated system where material properties, environmental conditions, occupational safety, and market dynamics converge. Understanding these interconnections enables informed decision-making for product development, facility design, and sustainable practice.

RECOMMENDATIONS

1. It is recommended that future research should investigate a wider range of inks, including water-based, plastisol, and UV-curable formulations.
2. Environmental monitoring was limited to three facilities and should be expanded to a larger sample in future studies.
3. Future research should also investigate emerging technologies in screen printing, including functional inks for electronic textiles and sustainable natural dye formulations.

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REFERENCES

- Akhtar, W.H.; Watanabe, C.; Neittaanmäki, P. A. (2022). New perspective on the textile and apparel industry in the digital transformation era. *Textiles*, 2(1): 633–656.
- Alexander, B and Rutter, C. (2022). Towards transformation: Digitalization, sustainability and customer experience. *J. Des. Creat. Process Fash. Ind.*, 14(1): 319–328.
- Arribas, V and Alfaro, J.A. (2018). 3D technology in fashion: From concept to consumer. *J. Fash. Mark. Manag.*, 22(1): 240–251.
- Bertola, P and Teunissen, J.(2018). Fashion 4.0. Innovating fashion industry through digital transformation. *Res. J. Text. Appar.*, 22(1): 352–369.
- Casciani, D.; Chkanikova, O and Pal, R. (2022). Exploring the nature of digital transformation in the fashion industry: Opportunities for supply chains, business models, and sustainability oriented innovations. *Sustain. Sci. Pract. Policy*, 18(1): 773–795.
- Ding, Y.; Wu, Z.; Zhang, C.; Xiao, R.; Xue, W. (2021). A study of the application of pigment printing on cotton fabrics. *Text. Res. J.*, 91(1): 2283–2293.
- Hsu, M.K.; Chen, W.; Huang, B.Y.; Shen, L.H. (2023). A deep learning empowered smart representative volume element method for long fiber woven composites. *Front. Mater.*, 10(1): 1179 -1187.
- Fan, J.; Yu, W and Huntery, L. (2013). *Clothing Appearance and Fit: Scince and Technology*; Woodhead Pub.: Cambridge, UK, 2004. 27.
- Geršak, J. (2013). *Coplex Fabric Deformations and Clothing Modelling in 3D*; LAP Lambert academic Publishing: Staarbrucken, Germany, 28(1): 23 -31.
- Kim, E.; Fiore, A.M.; Payne, A and Kim, H. (2021). *Fashion Trends*, 2nd ed.; Bloomsbury Visual Arts: New York, NY, USA, 2021.
- Kim, J.H.; Lee, J.S. (2024). Investigating parameters affecting the real and virtual drapability of silk fabrics for traditional Hanbok. *Fash. Text.*, 11(1): 21-31.
- Koptelov, A.; Thompson, A.; Hallett, S.R.; El Said, B. A. (2024). deep learning approach for predicting the architecture of 3D textile fabrics. *Mater. Des.*, 239(1): 112803 – 112810.
- Marjanović, J.; Petrak, S.; Mahnić Naglić, M.; Glogar, M.I. Design and computer construction of structural sleeve forms for women's clothing. *Text. Leather Rev.* 2019, 2, 183–195.
- National Institute for Occupational Safety and Health (NIOSH) (2022). "Evaluation of Exposure to Organic Solvents in Screen Printing Operations." NIOSH Health Hazard Evaluation Report.
- Niinimäki, K.; Peters, G.; Dahlbo, H.; Perry, P.; Rissanen, T.; Gwilt, A. The environmental price of fast fashion. *Nat. Rev. Earth Environ.* 2020, 1, 89–200. [CrossRef] 3.
- Pellicelli, M. (2020). *The Digital Transformation of Supply Chain Management*; Elsevier: Amsterdam, The Netherlands, 2022. 23. Gupta, D. New directions in the field of anthropometry, sizing and clothing fit. In *Anthropometry, Apparel Sizing and Design*; Elsevier: Amsterdam, The Netherlands, 2020. 24.

- Petrak, S. (2023). Digital fashion innovation and sustainability. In Proceedings of the 14th International Scientific Conference on Manufacturing Engineering, Development and Modernization of Manufacturing RIM 2023, Sarajevo, Bosnia and Herzegovina, 20–23 September 2023 251–266.
- Petrak, S., Mahnić N. M., Glogar, M., Tomljenovic, A. (2025). Assessment of Textile Material Properties and the Impact of Digital Ink-Jet Fabric Printing on 3D Simulation as a Sustainable Method for Garment Prototyping. *Sustainability*, 17(1): 1388-1395.
- Petrak, S.; Mahnić Naglić, M.; Rogale, D.; Geršak, J. (2021). Analysis of Polygonal Computer Model Parameters and Influence on Fabric Drape Simulation. *Materials*, 14(1): 6259- 6267.
- Ranjan, R.; Pandey, R.; Kumar, V. Integration of CAD technology for fast and customized production of apparels. *Psychol. Educ.* 2020, 57, 4639–4645. [CrossRef] 22.
- Rudolf, A.; Zadavec, M.; Stjepanović, Z. (2016). Investigations regarding the effects of simulating parameters during 3D garments drape simulations. *Fibres Text. East. Eur.*, 24(1): 143–150.
- Shim, E.; Koo, D.S.; An, J.S.; Yoon, H.J. (2022). Comparison of the Silhouette of Virtual Clothes by Fabric Characteristics of Nylon Fabric for the Utilization of Virtual Clothes. *ACS Omega*, 7(1): 47156–47164.
- Von der Assen, L. (2023). Digitalization as a Provider of Sustainability?—The Role and Acceptance of Digital Technologies in Fashion Stores. *Sustainability*, 15(1): 4621-4630.
- Youn, S.; West, A and Mathur, K. (2024). Evaluation of a new artificial intelligence-based textile digitization using fabric drape. *Text. Res. J.*, 94(1): 2001–2018.
- Tu, Y.F.; Kwan, M.Y.; Yick, K.L. (2024). A systematic review of AI-driven prediction of fabric properties and handfeel. *Materials*, 17, 5009.
- Jevšnik, S.; Stjepanović, Z.; Rudolf, A. D. (2017). Virtual prototyping of garments, approaches, developments and challenges. *J. Fiber Bioeng. Inform.*, 10(1): 51–63.
- Zekri, H.B. (2021). Globalization and the fast fashion phenomenon: The impact upon labors, environment and the consumer behavior. *MAS J. Appl. Sci.*, 6(1): 651–660.
- Zahira, M.S.; Alfakihuddin, M.L.; Anwari, J.A.; Hadi, J.M.; Chutzpah Kuntadi, S.; Lim, J.; Kholik, F.N. (2023) Textile Waste Recycling: A need for a stringent paradigm shift. *J. Multidiscip. Issues*, 10(1): 376–385.