

Program Profile		
Program	Program name	A Multifactorial Analysis of the Effect of Washing Temperature Variations on Denim Fabric Performance: Examining Changes in Denim Fabric's Structural, Mechanical, and Aesthetic Properties.
	Category	B3

Summary of Program	
Program Name	A Multifactorial Analysis of the Effect of Washing Temperature Variations on Denim Fabric Performance: Examining Changes in Denim Fabric's Structural, Mechanical, and Aesthetic Properties.
Category	B3
Abstract of Program	Denim fabric, renowned for its durability and cultural significance in fashion, experiences substantial physical and visual transformations when subjected to repeat laundering. Among the various laundering parameters, washing temperature has emerged as a critical factor influencing the long-term performance and aesthetic retention of denim textiles. This study presents a multifactorial analysis aimed at evaluating the impact of washing temperature variations on the structural, mechanical, and aesthetic properties of denim fabric. Standardized laboratory tests were conducted to assess key performance indicators, including dimensional stability (shrinkage), tensile strength, abrasion resistance, pilling resistance, and colorfastness. Denim specimens were exposed to controlled laundering cycles at varying temperatures, followed by evaluations adhering to ISO and AATCC testing protocols. Findings indicate a significant correlation between elevated washing temperatures and detrimental changes in fabric properties, including increased shrinkage, pronounced fading, diminished tensile strength, and surface degradation. In contrast, lower temperature settings were found to preserve dimensional and color stability more effectively, albeit with potential compromises in cleaning efficiency. This research underscores the critical role of temperature management in laundering practices to sustain both the functional integrity and visual appeal of denim garments. The outcomes offer practical implications for textile producer

Details of Program		
Planning		
Objectives	Long-term Goals	To contribute to sustainable garment care practices by identifying washing conditions that extend denim longevity while minimizing environmental impact.
	Short-term Targets	- To investigate the influence of varying washing temperatures on the structural properties of denim fabric, including dimensional stability and tensile strength. - To evaluate changes in mechanical performance attributes such as abrasion resistance and pilling resistance across different washing temperature conditions. - To assess the aesthetic impact of washing temperature variations on denim fabric, particularly focusing on colorfastness and visual surface appearance. - To establish correlations between washing temperature and overall fabric performance, identify thresholds beyond which degradation becomes significant. - To provide practical recommendations for laundering denim garments that optimize both fabric preservation and washing efficiency.
	Rationale	The reason for conducting this study is to evaluate the impact of washing temperature variations on denim's durability, performance, and appearance, thereby providing practical guidelines for sustainable garment care that enhance fabric longevity while reducing energy use and environmental impact.
Subject (Leader)	Initiator(s)	Dip Das
	Champion(s)	Dip Das
	Major team member(s)	Md. Mostafizur Rahman, Mohammad Bellal Hoque
Environment	Nature/Society	
	Industry/Market	Product Quality and Consumer Satisfaction.
	Citizen/Government	
Resources	Human resources	3 students were involved in the program work.
	Financial resources	75,000 BDT

	Technological resources	Industrial Access & WUB textile labs (yarn, fabric, wet processing, garment labs), ISO/AATCC standard testing.
Mechanism	Strategy (Weight/Sequence)	Subject (High Priority, 40%) – Research focus on denim washing temperature as a core technological innovation. Environment (Medium Priority, 35%) – Industry relevance, sustainability goals, and societal benefits (energy saving, fabric longevity). Resources (Moderate Priority, 25%) – Student involvement, laboratory facilities, industrial access, and financial support.
	Organization	The program is housed within the Department of Textile Engineering, WUB. The organizational structure — with faculty guidance, student involvement, and administrative backing — aligns effectively with the program’s strategies and supports collaborative research with industry.
	Culture	WUB promotes a culture of utilitarian education and industry collaboration. This culture strongly supports innovation, practical training, and sustainability-focused projects, ensuring the smooth execution of this program
Doing		
Launch date		July 2025
Responsible organization		World University of Bangladesh (Department of Textile Engineering)
Program content and process		This program investigates the comprehensive effects of washing temperature variations on denim performance. The research content is structured into three domains: structural (GSM, thickness, shrinkage), mechanical (tensile/tearing strength, abrasion, pilling resistance), and aesthetic (colorfastness, surface finish). Denim samples are washed under controlled temperatures (30°C, 40°C, 60°C, 90°C) following ISO and AATCC standards. The process begins with sample preparation and standardized washing treatments. Next, testing and data collection are carried out in WUB’s textile labs (wet processing, fabric manufacturing, quality control). Results are analyzed using quantitative methods (charts, graphs, statistical correlations). Finally, industrial validation is performed through collaboration with denim manufacturers.

	The implementation ensures: • Student training in advanced textile testing and sustainability research. • Integration of academic knowledge with industrial applications. • Practical guidelines for industry and consumers on optimized denim care. By focusing on both scientific analysis and real-world application, this program balances academic rigor, innovation, and social impact.
Key highlights of the content/process	• Multifactorial study covering structural, mechanical, and aesthetic domains. • Use of ISO/AATCC standards ensuring scientific validity. • Sustainability focus: linking temperature control with energy savings and garment longevity. • Controlled lab experiments with real-world denim samples. • Data-driven analysis using charts and quantitative testing. • Collaboration with denim industries for validation and future scaling.
Differences from traditional approaches	Traditional denim research focuses on chemical washing (enzymes, bleaching, stone wash) targeting aesthetics only. This program isolates temperature as a variable and examines its broader impact across multiple properties, combining eco-friendly innovation and performance optimization.
Progress as of today	• Facilities and testing equipment secured. • Initial denim samples prepared. • Faculty and student research team finalized.
Problems in implementation	• Lack of uniform washing temperature control across factories. • Resistance from industry to adopt new parameters. • Balancing energy efficiency with desired garment softness and look.
Approaches to solve the problems	• Develop flexible, factory-specific washing guidelines. • Pilot testing in select denim mills to demonstrate feasibility. • Industry training workshops on benefits of temperature optimization. • Encourage adoption of modern washing machines with temperature regulation.

Completion date, if completed	October 2025
Seeing	
Impacts on students	Students report strong satisfaction through hands-on learning, research exposure, and career-relevant skills in sustainability and testing.
Impacts on professors	Professors gain new research opportunities, potential publications, and stronger links with industry — enhancing academic satisfaction
Impacts on university administration	The project aligns with WUB's utilitarian vision, boosting reputation in sustainable textile innovation. Administrators view it as enhancing WUB's global academic profile.
Responses from industry/market	Denim manufacturers see value in cost reduction (less fabric damage, longer garment life) and sustainability alignment with global buyers.
Responses from citizen/government	Government and society benefit indirectly through reduced energy consumption, export competitiveness, and environmental responsibility.
Measurable output (revenues)	Projected industry savings through optimized washing: 5–10% reduction in fabric loss per batch, translating to significant cost benefits.
Measurable input (expenses)	Program budget: 75,000 BDT (research materials, lab testing, industrial trials).
Cost-benefit analysis for effectiveness	With fabric waste and energy savings, industries adopting optimized washing could recover 5–7 times the program's cost annually, proving high effectiveness
Future Planning	
Where does the project go from here?	The project will expand to include different denim varieties, wider industrial washing trials, and integration of energy consumption analysis. Future outputs include industry guidelines, training modules, and publications to promote global best practices in sustainable denim care.
Addendum	

Exhibits, pictures, diagrams, etc.



Visual Effect of Different Washing Temperatures on Denim Fabric.

Reports, mimeos, monographs, books, etc.

Others which may help explain the program (including website links)