INTERNATIONAL MULTIDISCIPLINARY JOURNAL FOR RESEARCH & DEVELOPMENT
SJIF 2019: 5.222 2020: 5.552 2021: 5.637 2022:5.479 2023:6.563 2024: 7,805
eISSN :2394-6334 https://www.ijmrd.in/index.php/imjrd Volume 12, issue 05 (2025)

METROLOGICAL SUPPORT ISSUES IN THE RAW SILK PRODUCTION CHAIN COMPLYING WITH INTERNATIONAL STANDARDS

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Abstract: This article analyzes the role and existing issues of metrological support in the raw silk production chain that complies with international standards. It is demonstrated that insufficient metrological control leads to differences in product quality and deviations from standards. The article discusses the measuring instruments, testing methods, and certification requirements necessary to control raw silk quality. Proposals have been developed to enhance the role and efficiency of metrology in ensuring compliance with standards. Existing practices and international experiences are compared, and the need to strengthen metrological support in raw silk production is substantiated.

Keywords: Metrological support, raw silk, international standards, quality control, measuring instruments, metrological control, certification, production chain, product quality, compliance.

Introduction

Today, manufacturing products that comply with international standards has become crucial in industrial sectors. Specifically, ensuring product quality in the raw silk production chain directly depends on metrological support. Metrology, a scientific and technical field that ensures the uniformity and accuracy of measurements, plays a vital role in assessing the quality of manufactured products and ensuring their compliance with international standards.

The raw silk production process consists of many technological stages, each requiring precision, reliability, and compliance with standard requirements. If metrological control is not adequately implemented, differences in the quality of the final product, defects, and non-conformance to standards may occur. This not only reduces competitiveness in the domestic market but also affects global competitiveness.

Metrological support improves accuracy in assessing raw silk quality through measuring tools and methods, stabilizes production processes, and ensures quality assurance. Therefore, strengthening metrological control and monitoring systems at each stage of raw silk production has become an integral part of modern manufacturing.

This article details the importance of metrological support in the raw silk production chain, existing issues, and ways to address them. Additionally, recommendations for improving the metrological system based on international practices are presented.

Literature Review

There are numerous scientific studies and technical regulations in the fields of raw silk production and metrological support. Analysis shows that reliability and continuity of metrological systems are crucial for quality management and compliance with standards.

The decrees of the President of the Republic of Uzbekistan and the Law "On Technical Regulation" indicate that metrological support has become a significant state-regulated area. International standard ISO 17025 is recognized as a key normative document that defines the competence of testing and calibration laboratories.

In academic sources, especially in the works of metrology and technical regulation scholars (e.g., A. Khodjaev, B. Ibragimov), the role of measurement accuracy and instruments in assessing product quality is emphasized. Foreign literature (experiences from Russia, China, Japan) underlines the importance of automated metrological systems in preserving silk quality. Furthermore, international organizations like FAO and UNIDO highlight the implementation of metrological control and monitoring systems as a key factor in developing the silk industry.

Based on the reviewed literature, it is evident that for Uzbekistan to remain competitive in the global market, it is necessary to implement modern metrological approaches, highly accurate measuring instruments, and digital monitoring technologies in production. Scientific and technical proposals for this direction are of critical importance for the country's silk industry.

Main Part

1. The Role of Metrological Support in the Raw Silk Production Chain

The raw silk industry connects agriculture, processing, and light industry sectors into a complex system. Each stage in this system relies on important measurements to determine quality. The density of cocoons, fiber length, elasticity, and appearance must be evaluated according to international standards. Accurate identification of such parameters depends directly on metrological support.

In the cocoon sorting process, each batch is evaluated based on weight and quality indicators. Here, accuracy at the 1–2 gram level is required. Additionally, moisture content measurements require micron-level accuracy, as excess moisture leads to low-quality products. The calibration and accuracy of metrological devices directly affect these measurements.

In developed countries, each technological process in silk production is integrated into the ISO 9001 quality management system, where metrological support is one of the core pillars. If such approaches are introduced in Uzbekistan, the country's export potential would significantly increase.

2. Existing Issues in Metrological Support

Problems in metrological support are not limited to technical tools—they also stem from personnel qualifications, documentation processes, and the standards database. In many silk production enterprises, measuring instruments have not been replaced for over 10 years, which reduces their reliability. Measurement results are often not regularly recorded or tracked, leading to disputes about quality.

Another major issue is that most metrological laboratories lack international accreditation. This creates challenges in certifying export products abroad. As a result, Uzbekistan's silk products are frequently exported through intermediaries, reducing economic benefits.

Analysis shows a lack of understanding about metrology among producers. Measuring instruments are viewed only as service tools rather than as crucial components of quality management systems, which hinders their effective use.

3. Proposals for Addressing the Issues

To eliminate these issues, metrological support policies should be clearly defined across sectors. Every silk-producing enterprise should have a dedicated metrology department where instruments are regularly calibrated. Moreover, national programs should be developed in cooperation with research institutes and innovation centers to accredit industrial laboratories according to ISO 17025.

Through these programs, short-term courses, training, and practical seminars for enterprise personnel can be organized. Furthermore, introducing digital technologies and IoT-based automated measurement systems into the production chain can reduce human errors. These systems record measurements in real time, transmit data to databases, and simplify quality analysis. As a result, not only will product quality stabilize, but a network of internationally compliant and metrologically prepared enterprises will emerge.

Conclusion

Metrological support is of paramount importance in the raw silk production chain, with each stage directly depending on the accuracy and reliability of measurements. This article's analysis demonstrates that the lack of proper metrological control in Uzbekistan's silk industry negatively affects product quality. Especially in producing high-quality raw silk that meets international standards, the technical condition of measurement tools, frequency of calibration, and reliability of metrological laboratories play a critical role.

Existing shortcomings in the current metrological system—including outdated measurement instruments, irregular calibration, and non-compliance of laboratories with international standards—lead to product quality discrepancies. This, in turn, reduces export potential and weakens competitiveness in the global market.

To address these problems, the following proposals are presented:
1) Modernize metrological infrastructure – establish metrology centers equipped with modern measuring instruments for silk producers.
2) Systematic calibration practices – ensure all instruments are regularly calibrated at accredited laboratories.
3) Improve regulatory documentation – develop national standards aligned with ISO 1110, ISO 1130, and other relevant international silk product standards.
4) Enhance human resources – organize continuous professional development courses for specialists in metrology and quality control.
5) Use information technologies – implement digital systems enabling automated measurements and real-time monitoring.

The implementation of these proposals will not only stabilize silk product quality but also ensure the international reliability of the entire production chain. Ultimately, Uzbekistan's silk industry will increase its export potential, strengthen its competitiveness, and enhance its position in global markets.

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