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Textiles — Determination of stable nitrogen isotope ratio in cotton fibres

Textiles — Détermination du rapport isotopique stable de l'azote dans les fibres de coton

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Foreword

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This document was prepared by Technical Committee ISO/TC 38, *Textiles*.

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Introduction

Nitrogen (N) is the most essential element for cotton fibre production, since cotton crops require large amounts of N to sustain their growth and productivity. For this purpose, considerable amounts of nitrogen are applied to the soil as chemical fertilizers (e.g. urea) or organic fertilizers (e.g. composted manure).

The nitrogen applied in the form of a chemical fertilizer or a composted manure is absorbed from the soil to cotton crops through their root systems during cultivation, leaving a fertilizer-specific nitrogen isotopic signature in cotton tissues (particularly in cotton fibres). The inerasable nitrogen isotopic fingerprint engraved in cotton fibres remains unchanged during manufacturing of yarns, textiles and fabrics.

This document employs the principle of nitrogen isotope discrimination that fractionates against ^{15}N (heavier nitrogen isotope), resulting in ^{15}N-enriched reactants and ^{15}N-depleted products. In general, composted manure has a much higher $\delta^{15}N$ (natural ^{15}N abundance, defined hereinafter) than chemical fertilizer due to faster NH_3 (ammonia) volatilization of the lighter nitrogen isotope (^{14}N) than ^{15}N during the composting process. In contrast, chemical fertilizers (e.g. urea) are produced from the atmospheric N_2 via the Haber-Bosch process, resulting in low $\delta^{15}N$ values close to atmospheric N_2, which means that similar isotopic nitrogen compositions of chemical fertilizers to the atmospheric N_2.

Organic farming strictly bans the use of genetically modified crops (GMO), synthetic pesticides, and chemical fertilizers. Therefore, the use of chemical fertilizer during organic cotton production can be detected by determining $\delta^{15}N$ of cotton fibres, since the difference in $\delta^{15}N$ values between the two isotopically different nitrogen inputs (chemical vs. organic fertilizers) leaves a fertilizer-specific isotopic fingerprint in cotton fibres that can thereafter provide a forensic evidence for organic cotton fibre production.