

Examination of a sample is likely to be a cotton plant found above an Egyptian mummy

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Introduction

Although many researchers assume that ancient Egypt didn't know the cotton plants, but some old sources mentioned some evidence of the existence of cotton since the fourth century BC., and it was used in cloths since the Ptolemaic period onwards, but we had little evidence to confirm this assumption.

The aim of the current investigation is to indicate that the sample is typical to cotton plant by various approaches, then trying to test its possible fiber physical properties to check if it could fit for producing fabric or not.

Results and discussion

The microscopic examination and IR analysis of the fiber proved that the sample is cotton fiber.

Dating by C 14 radiocarbon indicating that cotton fibers date laid between c. 1822 ± 36 B p. Those dates are falling in the end Ptolemaic Period and start to Roman period.

Fiber physical properties:

The reading of fiber physical properties showed that, the fiber is coarse. That was clear from micronaire value, fiber fineness and fiber diameter readings. The maturity ratio reflected moderate mature fiber. The fiber is very short. The bundle mechanical characters could not be measured. This may be due to that the fiber is very dry and deteriorated this make them easy to rupture.

Single fiber properties:

the percent of single fiber elongation of the cotton sample was low, while it recorded moderate tenacity (g/tex). The single fiber fineness was a little bit coarse.

The difference between the single fiber fineness and the bundle fineness may be because of that, the difficulty faced the operator to measure the single fiber properties due to the deterioration found in most the fibers. They struggled to find valid numbers for doing the test, adding to that, the bundle test need fluffy sample.

In fact, messing up the tested sample was too hard because, it was compacted, ruptured and the seed was embedded firmly and folded with the convoluted fibers. In general, the current readings of the single fiber and bundle quality properties of the tested sample are moderate except, the fiber length and single fiber elongation %, indicating that, it may not be fitted for producing yarn, especially in that period. **Nevertheless**, we should emphasis on that the sample is ancient, exposed to excess dryness, extreme environmental conditions. That caused deterioration to the fiber as inferred before so, may be the fiber length and the single fiber elongation% values were greater than the current tested readings.

Fig 1 The seed-cotton between the bandage and the body of an Egyptian mummy



Fig 2 The cotton sample with its captions



Fig 3 Longitudinal view of the whole fiber

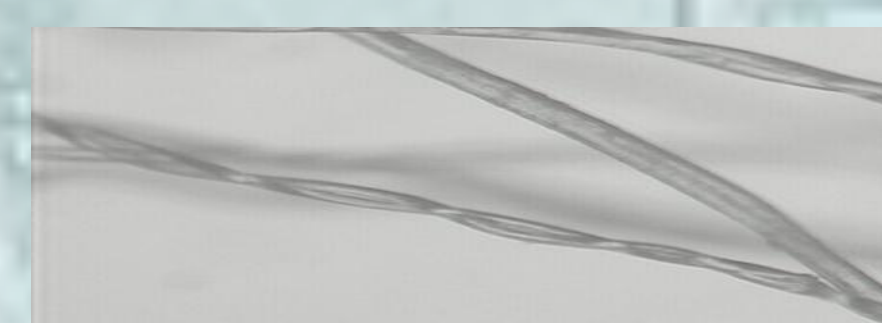


Fig 4 Cross sectional view of the fiber



Fig 5 Cotton fiber reversals

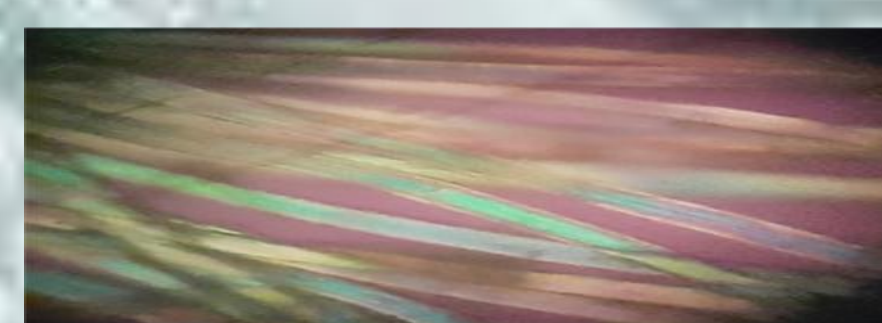


Fig 6 SEM longitudinal view

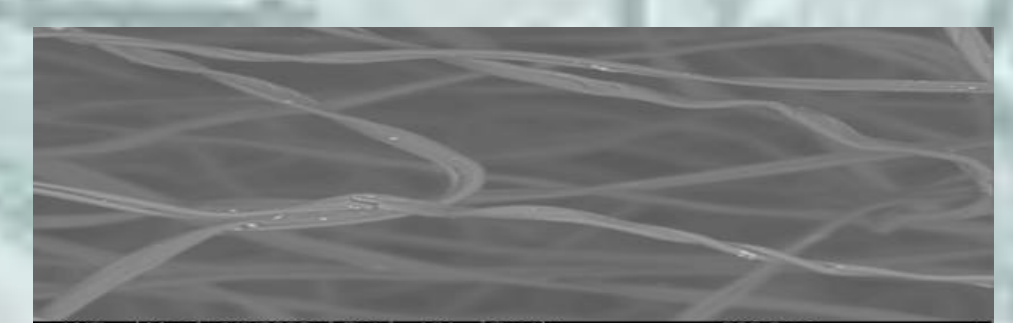


Fig 7 The white spots on the fiber

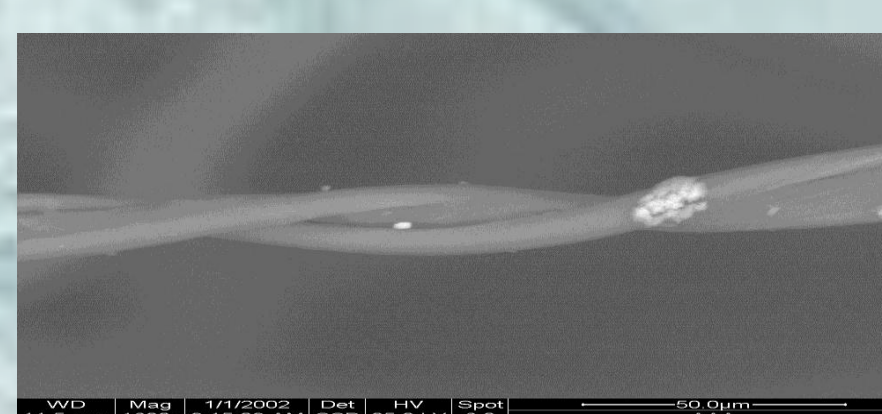


Fig 8 EDAX analysis for natron powder

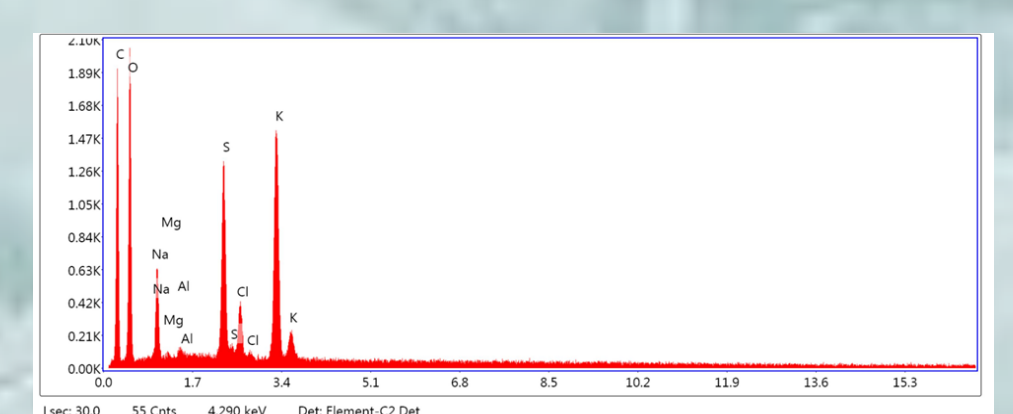


Table 1, Analysis of natron powder

| eZAF Smart Quant Results | | | | | | | | | |
|--------------------------|----------|----------|----------|---------|--------|--------|--------|--------|--------|
| Element | Weight % | Atomic % | Net Int. | Error % | Kratio | Z | R | A | F |
| C K | 35.26 | 46.87 | 283.58 | 9.30 | 0.1036 | 1.0510 | 0.9707 | 0.2795 | 1.0000 |
| O K | 41.17 | 41.08 | 360.17 | 10.23 | 0.0619 | 1.0097 | 0.9913 | 0.1489 | 1.0000 |
| Na K | 6.45 | 4.48 | 124.50 | 10.41 | 0.0176 | 0.9211 | 1.0163 | 0.2954 | 1.0028 |
| Mg K | 0.02 | 0.01 | 0.60 | 83.49 | 0.0001 | 0.9379 | 1.0235 | 0.3996 | 1.0050 |
| Al K | 0.05 | 0.03 | 2.42 | 68.73 | 0.0003 | 0.9041 | 1.0303 | 0.5574 | 1.0090 |
| S K | 5.41 | 2.69 | 345.77 | 3.61 | 0.0454 | 0.9074 | 1.0487 | 0.9031 | 1.0236 |
| Cl K | 1.69 | 0.76 | 96.30 | 7.06 | 0.0135 | 0.8639 | 1.0542 | 0.9008 | 1.0317 |
| K K | 9.95 | 4.06 | 503.52 | 2.39 | 0.0842 | 0.8612 | 1.0644 | 0.9678 | 1.0154 |

Table 2, The fiber physical properties of the cotton sample.

| Fiber character | Micronaire value | Fineness (millitex) | Maturity ratio | Diameter (μ) | Fiber length (mm) |
|-----------------|------------------|---------------------|----------------|--------------|-------------------|
| Reading mean | 4.87 | 187.14 | 88.3 2 | 20.86 | 17.29 |
| Min. | 4.55 | 175.32 | 84.78 | 18.11 | 14.23 |
| Max. | 4.90 | 200.07 | 90.25 | 24.42 | 18.34 |
| C.V% | 7.00 % | 14.31% | 11.33% | 15.00 % | 17.16 % |

Table 3, Single fiber properties of the cotton sample.

| Fiber character | Elongation(%) | Tenacity(g/tex) | Linear density (mtex) | Time to rupture (sec) |
|-----------------|---------------|-----------------|-----------------------|-----------------------|
| Reading mean | 3.65 | 31.24 | 167 | 2.79 |
| Min. | 2.29 | 11.13 | - | 1.86 |
| Max. | 5.18 | 56.06 | - | 4.29 |
| C.V% | 18.18 | 39.22 | - | 20.19 |

Fig 9 IR analysis for the current sample marked with red and the standard cotton sample.

