PROGRESS REPORT ON UNDERSTANDING AFIS SEED COAT NEP LEVELS IN PRE-OPENED SLIVERS ON THE ADVANCED FIBER INFORMATION SYSTEM (AFIS)

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Abstract

The Advanced Fiber Information System (AFIS) is utilized in this segment of the research project to study how seed coat neps are measured. A patent search was conducted, and studied to assist with the understanding of the AFIS measurement of this impurity in raw cotton. The older AFIS 2 is primarily used, with important findings confirmed with the AFIS PRO unit. A smaller sliver size was utilized to study the AFIS response to a variety of single seed coat fragments placed into the smaller slivers. A significant weight loss of the fragments due to processing in the AFIS was found and the individual impurity counts ranged from lower (0%) to higher (300%) than expected values.

Introduction

Seed coat fragments (SCF) are small pieces of seed coat tissue with or without attached fibers and seed coat neps (SCN) are a subset of SCF sized 0.5 – 3 mm, with attached fibers, which remain with the lint during opening in the AFIS. The AFIS counts SCN rather than SCF. The source of SCNs can be motes, immature as well as mature cotton seed.

The instrument measures properties of textile fibers such as cotton, polyester, and rayon both raw and processed. AFIS uses a two stage process to measure the entities presented to it via the recommended 0.5 g, 30 cm long hand-prepared sliver. Stage 1 separates neps, fibers, and trash while the airflow splits the entities into two streams and stage 2 sends each stream to different sensors. One detector is the fiber/nep sensor, the other the trash/dust sensor. While stage 1 individualization is occurring, the AFIS may generate and remove entities.

In the second stage, the fibers and neps enter the same sensor, a waveform signal is generated for each entity and the classification algorithm discriminates SCN from other neps (Shofner et al., 1995). If the waveform is not that of a single fiber, large clump of fibers, few entities at one time passing through the sensor, fiber or plastic fragment, it is then classified as a nep or a SCN. Neps are entanglements of fibers only, or else fiber entanglements with any type of trash. The SCN waveform coincides with SCF that meet the AFIS defined size of 0.5 to 3 mm. A SCN that meets the AFIS definition is not counted if it enters the trash/dust sensor.

Materials and Methods

Two AFIS models were run: AFIS 2, an older version of AFIS with two separate waste bins and the AFIS PRO a newer version with one combined waste bin. Confirmation of significant findings on the AFIS 2 were conducted with the AFIS PRO.

Typically, an AFIS sliver weight is 0.5g and 30 cm long. For ease of locating SCF in fiber and waste bins of the AFIS 2, a 0.1g, 6 cm long pre-opened and pre-cleaned sliver was used. AFIS reports SCN count output in terms of counts per gram, thus, the actual count reported is two times the amount found in a 0.5g sample. For the 0.1 g sample, the counts per gram reported are actually the counts found in 0.2 g, since the output data are multiplied by two.

Seed coat fragments were added to the pre-treated slivers and embedded in the sliver to present the entity to the AFIS in a process termed spiking. Two SCF sources were used to generate fragments in the size range as detectable by AFIS, 0.5 to 3mm. One source was seed coat fragments cut from midsection of seed and the other seed coat fragments pulled from raw cotton.

Before spiking, the SCF fuzz fibers were tagged with a dye to enhance recovery from either waste bin (fiber/neps bin and trash/dust bin) of the AFIS 2. All SCF (0.5 – 3 mm) were conditioned to standard textile testing conditions and weighed before AFIS analysis. The carrier fibers used were AFIS pre-opened/pre-cleaned sliver to minimized

friction, both fiber-to-fiber and fiber-machine, and false positive SCN counts. All carrier fibers were conditioned to standard textile testing conditions. The smaller 0.1g, 6 cm long sliver was spiked with one conditioned SCF. Next, the sliver was analyzed in the AFIS 2, and all materials were removed from both waste bins. The SCF in the waste was extracted, conditioned, and reweighed so that a % weight loss could be computed due to abrasion in the AFIS. For each carrier fiber, five sliver replicates were analyzed.

Results and Discussion

The recovery of SCF from the AFIS 2 produced some interesting results. The AFIS determined SCN were found in both the trash and fiber bins, and some were broken into pieces. The % weight loss of the recovered SCN ranged from 18% to 82%. SCN recoveries ranged from 0% to 300%. SCN recoveries of 100%, meaning the AFIS output was 2 x SCN actual count, SCN actual count = 1, and only the 2 x SCN/2 = 1 tally was found in the bins. Some SCN recoveries were 200%, meaning the AFIS output was 2 x SCN actual count, SCN actual count = 2, and only the 2 x SCN/2 = 2 tally was found in the bins. The counts of SCN detected demonstrated the AFIS 2 produced true positives, true negatives, false positives and false negatives.

Figure 1 highlights the % weight loss found with seed coat fragments cut from the seed as well as those pulled from raw fiber. The SCF pulled from the raw fiber did have the longer attached fibers. These fibers had been removed during AFIS analysis. This fiber loss did contribute to the higher weight losses observed with the SCF pulled from the raw cottons when compared to those cut from the seed which contained only fuzz fibers.

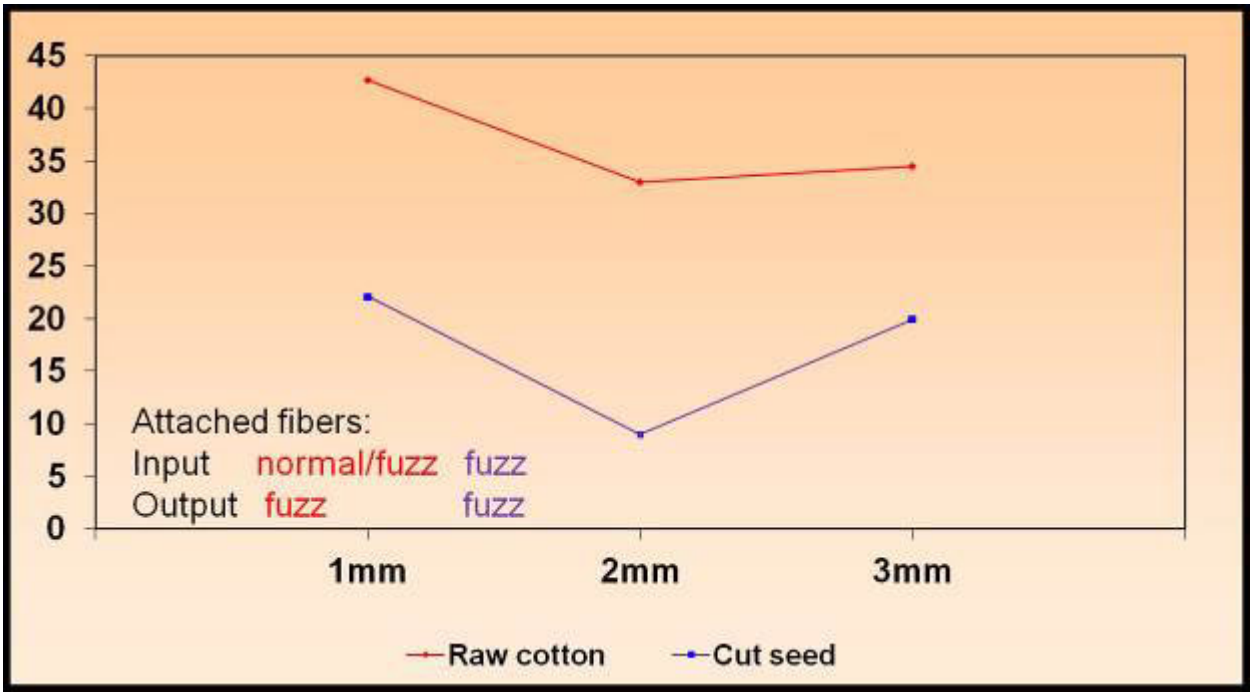

Figure 1. SCF weight loss (%) after AFIS analysis versus spiked SCF size

Conclusions

This progress report on AFIS SCN analysis produced unexpected findings. The counts of SCN as detected by AFIS 2 for the smaller sliver spiked with one single seed coat fragment produced true positives, true negatives, false positives and false negatives. The % weight losses for same samples were dramatic, which may have been due to the longer fibers loss during AFIS processing, and perhaps from the SCF being broken up into very small pieces that were not recovered as SCF from the fibers or trash bins. In summary, the pretreated sliver and one added SCF do provide a less complex glimpse into the AFIS processes that influence SCN levels and accuracy.

Disclaimer

Mention of a product or specific equipment does not constitute a guarantee or warranty by the U.S. Department of Agriculture and does not imply its approval to the exclusion of other products that may also be suitable.

References

Shofner, F., J. Baldwin, M. Gaylon, anf Y-T Chu. Apparatus and methods for measurement and classification of generalized neplike entities in fiber samples. U.S. Patent No. 5,430, 301, 1995.