Rapid Evaluation of Aflatoxin in Peanuts using FTIR

Virginia Tech
Invent the Future

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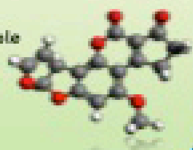
WHY FTIR?

- Non-destructive, rapid, easy, convenient method
- Allows conclusions for the sample as a whole
- Can be automated and reduce the need for solvents and toxic reagents
- The instrument is portable, making it suitable for field measurements

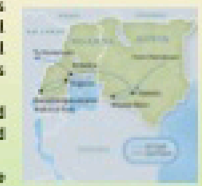
Background: Aflatoxin

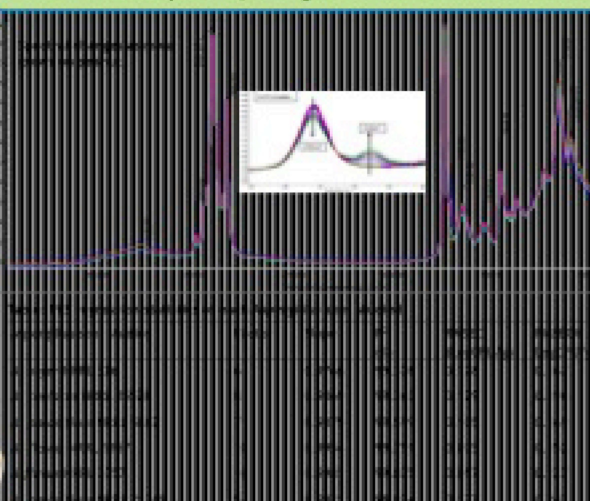
- Aflatoxins are secondary metabolites of *Aspergillus flavus* and *Aspergillus parasiticus*.
- Aflatoxin B_1 is the most potent natural carcinogen known and is usually the major aflatoxin produced by toxigenic mold strains.
- Peanuts are major source of protein in East African Countries and are susceptible for Aflatoxin contamination
- Prevalence of Aflatoxin in East Africa warrants removal of contaminated peanuts. Any rapid method for sorting would economically benefit the region.



Background: East Africa (Uganda & Kenya)

- One in three people in Africa is undernourished. This forces the rural poor to consume any food material even if molds have changed its organoleptic quality
- Hot and humid climate prevails and agricultural practices favor mold growth
- There are many studies showing the significantly high levels of aflatoxin in peanuts as well as other foods in the market of Uganda and Kenya.





PLS Regression:

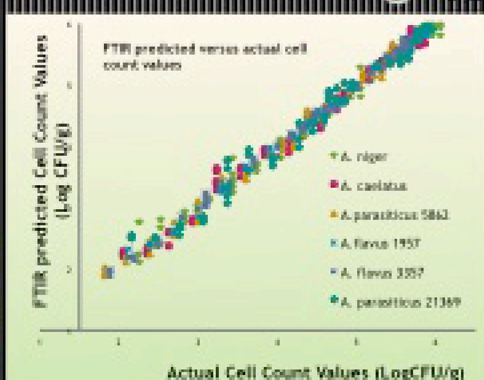
- Six different *Aspergillus* spp. were analyzed.
- Aflatoxin detection in peanut complex structure can be achieved when suitable multivariate analysis methodology is employed.
- As fungal growth proceeds, hydrolysis of lipid content of peanut was observed. Relying on chemical modifications, the limiting detection level set to 20 ppb produced acceptable results.

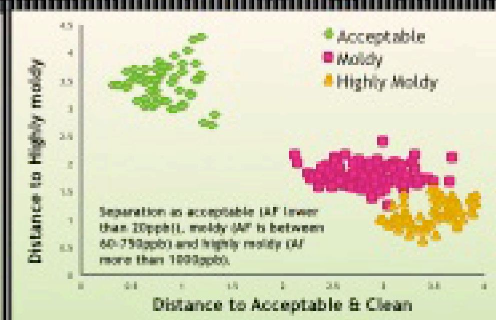
Rapid evaluation of peanuts just in seconds!

Discriminant Analysis:

- All of the samples having lower than 20 ppb aflatoxin were classified correctly as "Acceptable" stream, and in total 98.5% correct identification was found.
- In the range of aflatoxin of 60-750 ppb, 91% of the analyzed samples correctly classified as "Moldy" and "Toxic". This means after separating clean peanuts that can be used for human consumption, rest can be used as animal feed.

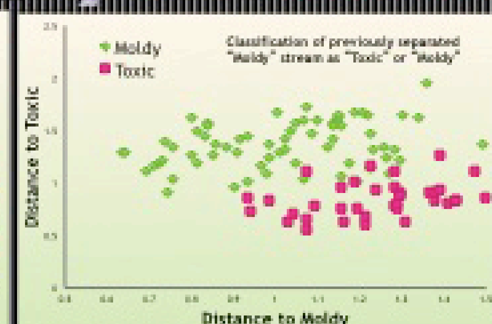
Less loss of food source! Safer peanuts!





4/231 Standards misclassified
10 Principle components used
99.7 variability described

Acceptable: 0/56 stds. are misclassified
Moldy: 0/102 stds. are misclassified
Highly Moldy: 4/73 stds. are misclassified



9/102 standards misclassified
10 Principle components used
99.85 of variability described

Moldy: 7/64 stds. are misclassified
Toxic: 2/38 stds. are misclassified