

Using tobacco chemistry to help explain toxicity data for mainstream smoke from cigarillos and filtered cigars

John H. Lauterbach, Ph.D., DABT
Lauterbach & Associates, LLC, Macon, GA 31210-4708 USA
Deborah A. Grimm, Ph.D.
Coordinated Instrumentation Facility
Tulane University, New Orleans, LA 70118-5698 USA

Introduction

- In 2011, Rickert *et al.* reported *in vitro* cytotoxicity data for mainstream smoke (MSS) TPM from cigarillos and filtered cigars
 - Smoking was Health Canada Intensive (“HCI”)
 - Filtered cigars were size of KS cigarettes
- Results were opposite those reported by Bombick et al., (1998) for MSS from all flue-cured and all burley KS cigarettes
- What were causes of differences?

Possible causes of differences

- **Smoking regimen**
 - Rickert work used HCl smoking
 - Bombick research used FTC smoking
- **Blend**
 - Little information about blends in products used in Rickert study
 - Bombick report did not specify grades of flue-cured and burley tobaccos used
- **Wrapper — paper versus tobacco**

Other confounding factors

- **Recent product changes due to regulations**
 - Most products weigh >3 pounds/1000 cigars
 - Most now dimensionally like 100s cigarettes
- **Flavors**
 - Many newer products are flavored
 - Compositions and use levels not known
- **Wrappers**
 - Paper-type reconstituted tobaccos
 - Different colors available
 - Composition and burn properties not known

Research approach

- Obtain samples of representative products
 - Many brand-styles difficult to find at retail
 - Trade shows best place to get samples
- Two-pronged analytical approach
 - GC-MS scan techniques
 - DS Scan (humectants, sugars, organic acids, etc.)
 - HFP (MeOH) Scan (nonpolar, semi-polar compounds)
 - Good for distinguishing among blend types
 - Routine chemical analyses
 - Alkaloids, sugars, chloride, nitrate, oven moisture
 - Requires at least 2 g of sample

Examples of filtered cigars

Cigars

Double-wrapped



100s filter cigarettes

Examples of cigar tobacco blends



Cigars — routine chemistry

Brand	Flavor	Wrapper	Filter	Nicotine	Total Sugar	Reducing Sugar	Nitrate	Chloride	Moisture
A	Cherry	Single	Y	1.46	2.48	2.43	1.51	1.63	10.40
B	Sweet	Single	Y	2.02	2.29	2.20	1.17	0.95	10.07
C	Peach	Single	Y	1.35	2.99	2.78	2.17	1.91	9.74
D	Lights	Single	Y	1.29	3.19	2.78	1.59	1.69	10.90
E	Vanilla	Single	Y	1.47	3.79	3.54	0.64	1.22	10.12
F	Regular	Single	Y	1.35	3.06	3.01	1.95	1.52	9.44
F	Cherry	Single	Y	1.57	2.21	2.31	1.68	2.07	10.69
G	Coconut	Single	Y	1.23	2.79	2.53	1.82	1.59	10.37
H	Sweet	Double	Y	1.80	6.85	6.42	0.87	0.79	10.38
I	N/A	Double	N	1.38	1.63	1.58	1.61	1.48	NM
B3VF	N/A	N/A	N/A	4.35	3.27	2.93	1.56	0.70	10.12
B4K	N/A	N/A	N/A	5.16	2.82	2.71	1.55	0.61	10.38
C4M	N/A	N/A	N/A	4.75	2.55	2.44	2.03	1.10	9.71
B-wrapper	Sweet	Wrapper	N/A	0.37	0.85	1.10	1.60	1.10	NM
F-wrapper	Cherry	Wrapper	N/A	0.17	0.91	1.10	2.35	1.33	10.69

Notes:

N/A Not applicable

NM Not measured

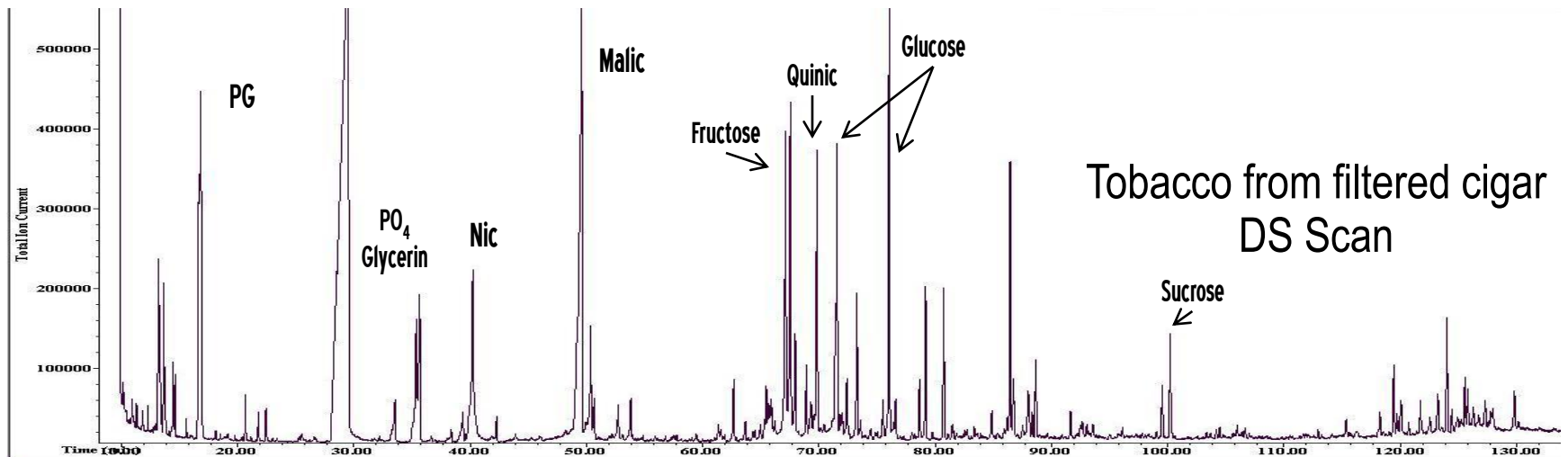
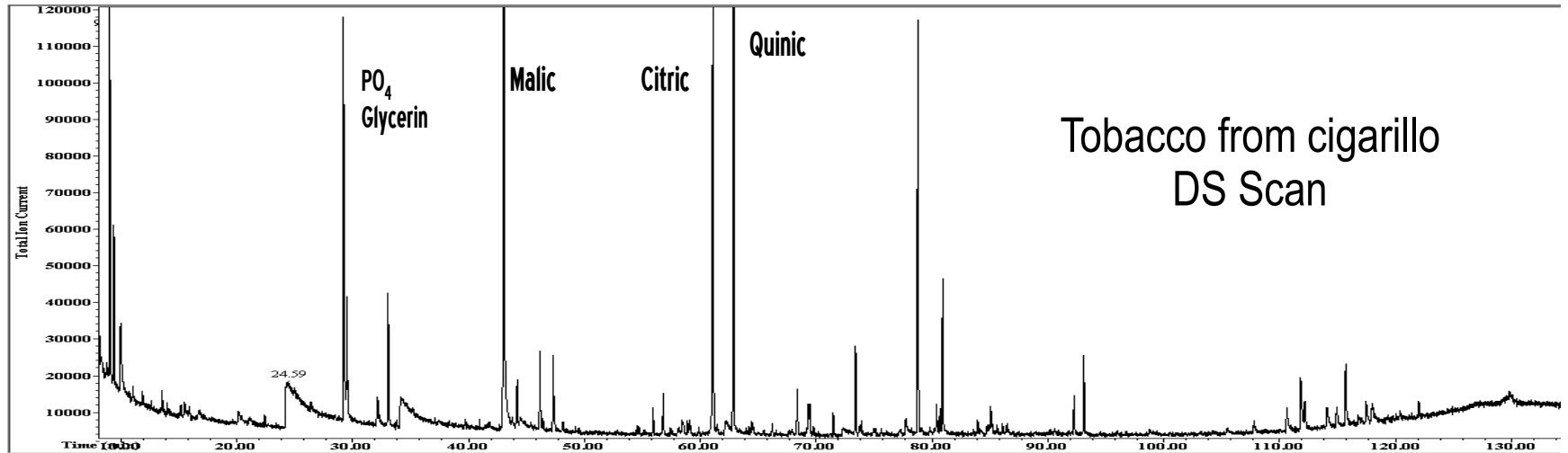
Brand E has black-colored wrapper

Brand I is traditional European cigarillo

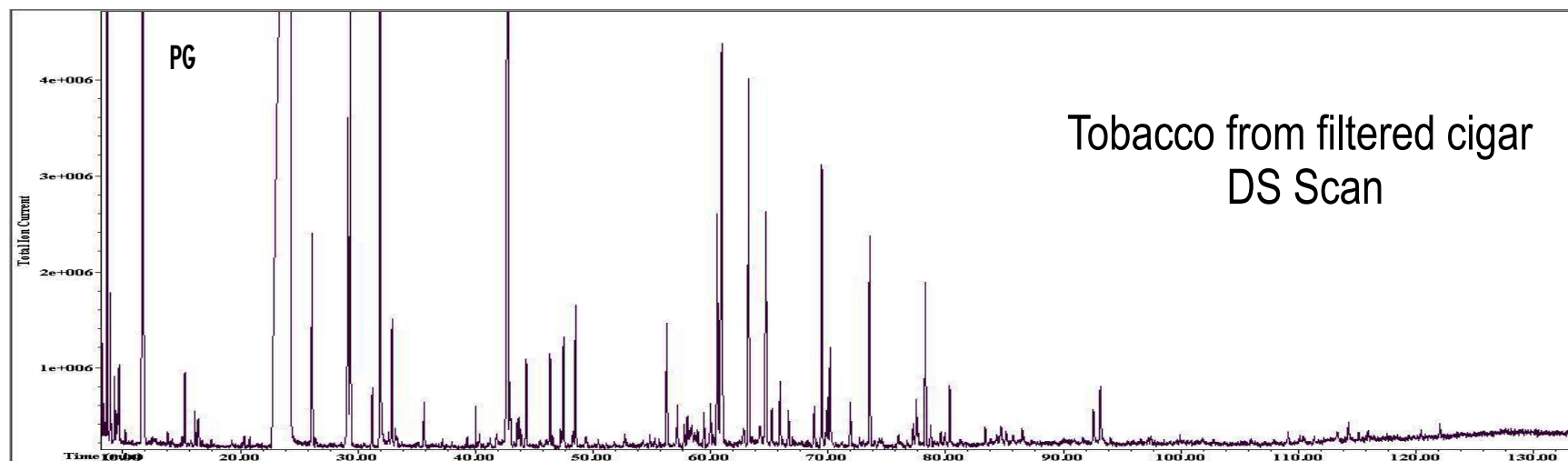
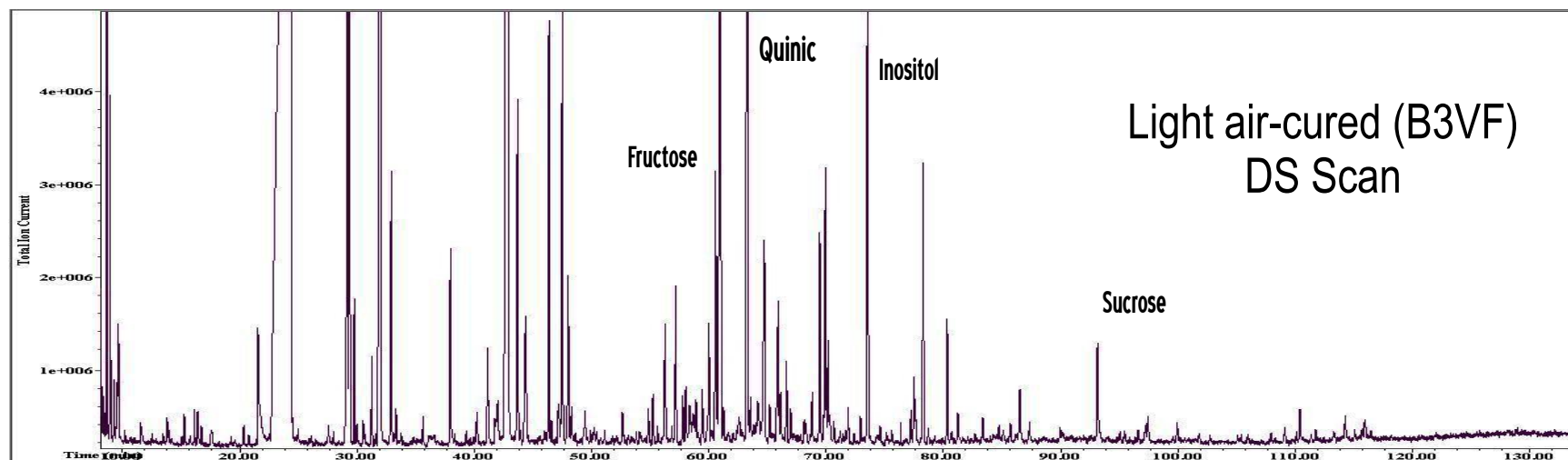
Drought-stressed burley

- Our initial work on filtered cigars showed
 - Different smoke sensory than cigarillos
 - Much lower impact
 - Little cigar taste
 - Most blends were light-colored; GC-MS showed
 - Low levels of sugars and nicotine
 - Small amounts (~0.15%) of glycerin (endogenous)
 - Occasionally trace amounts of flue-cured markers
- Experts suggested drought-stressed burley
 - Not usually used in cigarettes (low cost)
 - Would explain light-colored tobaccos

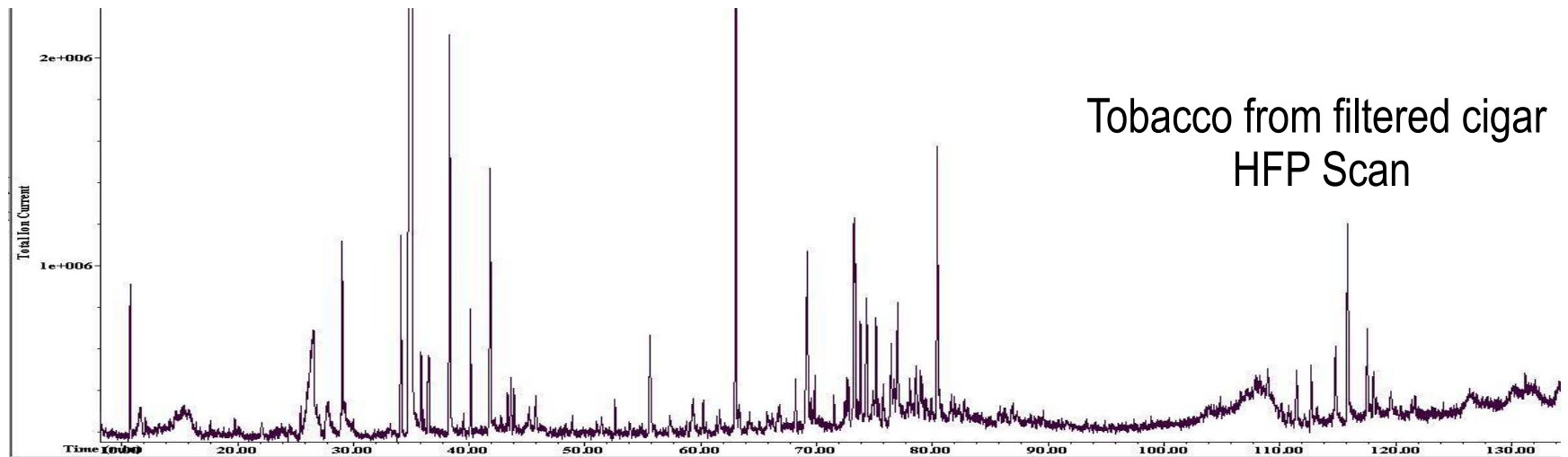
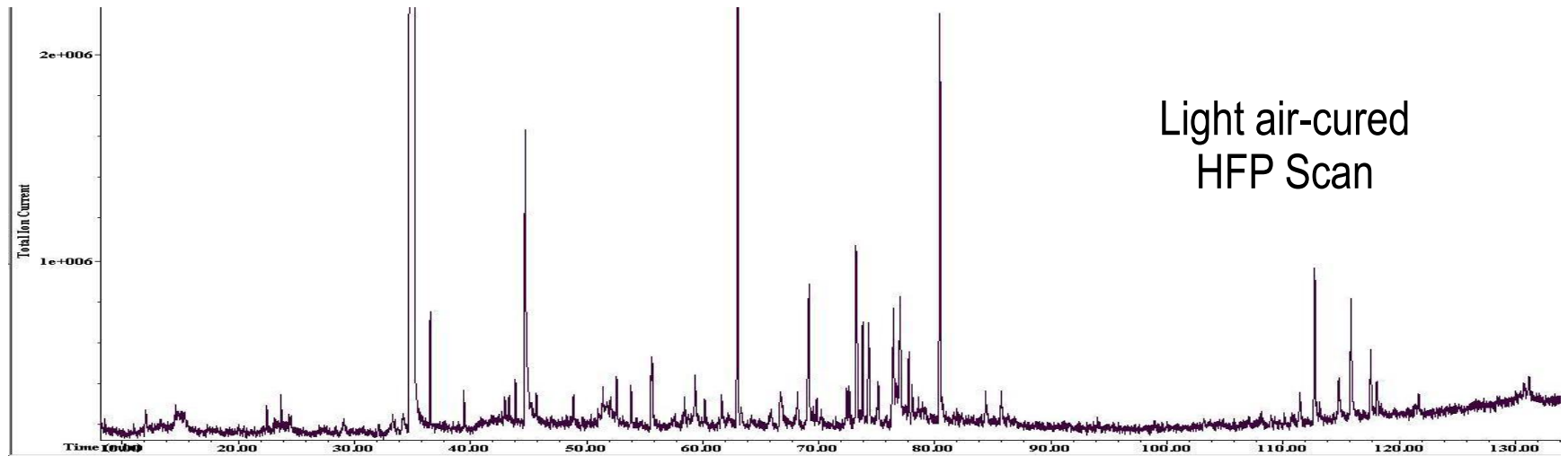
Comparison with cigarillos



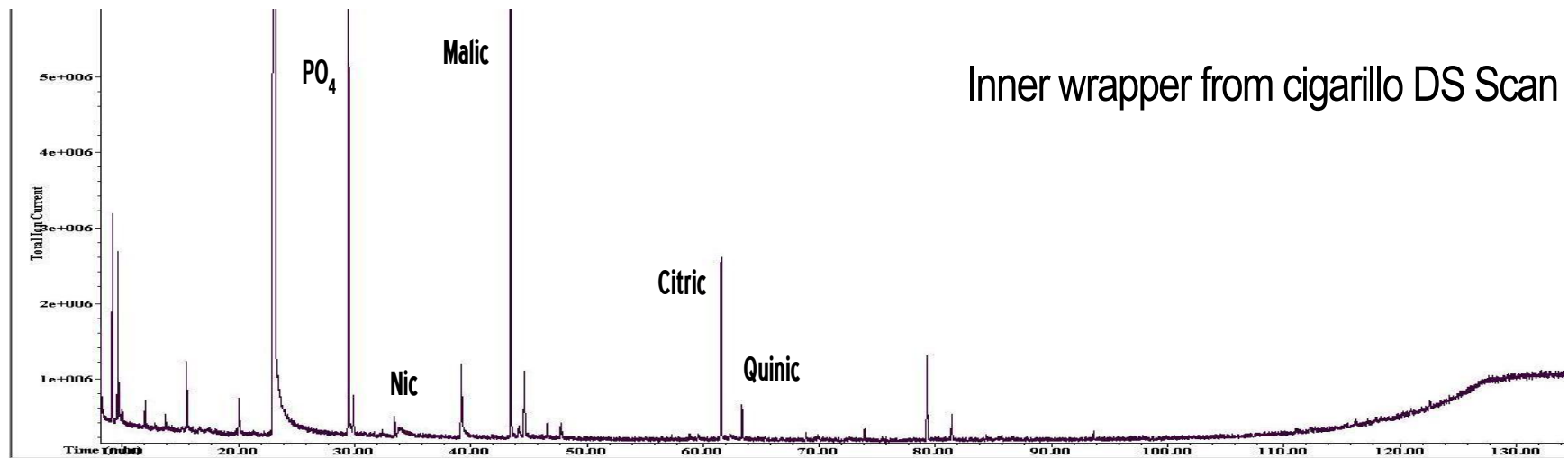
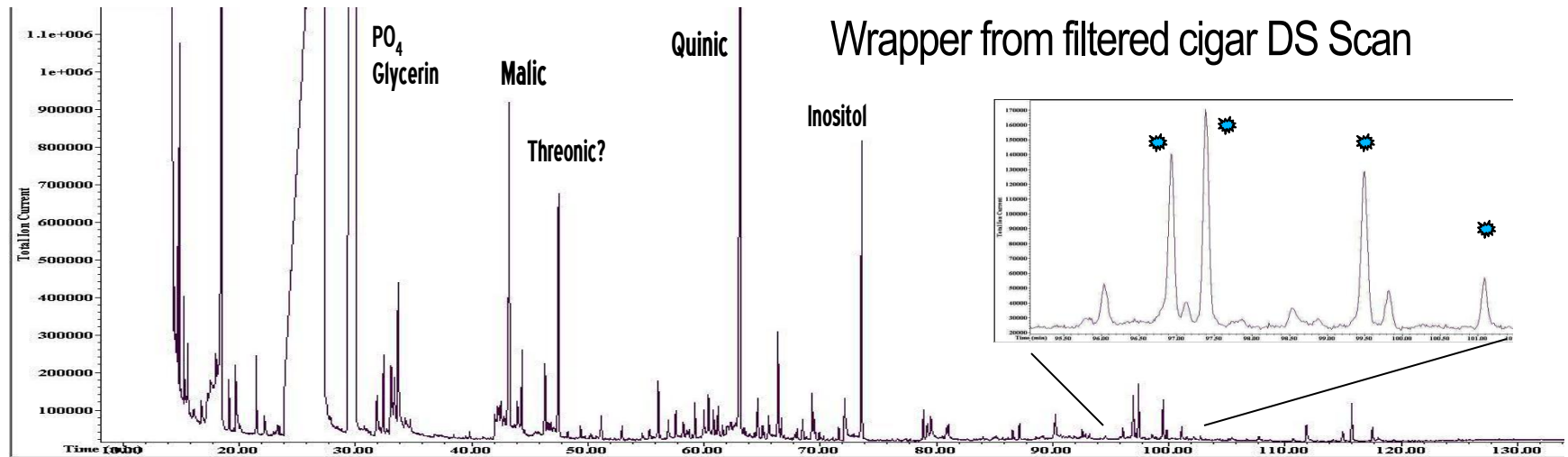
Comparison with light air-cured tobacco



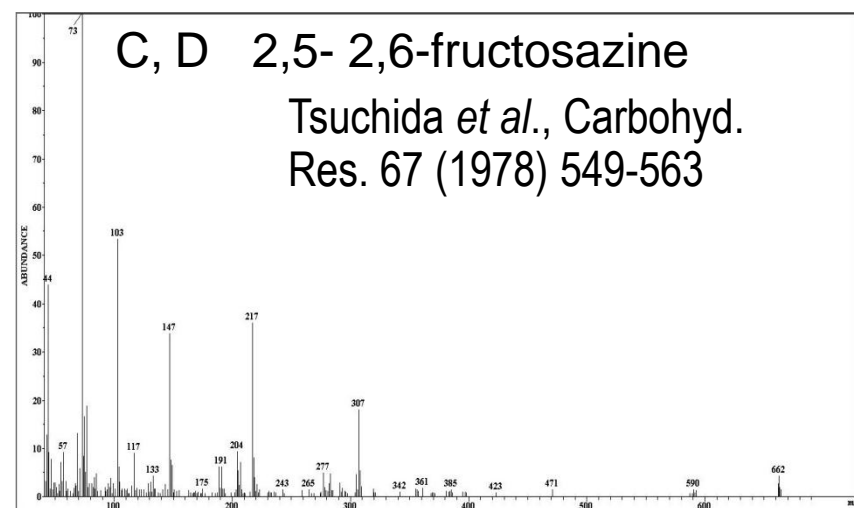
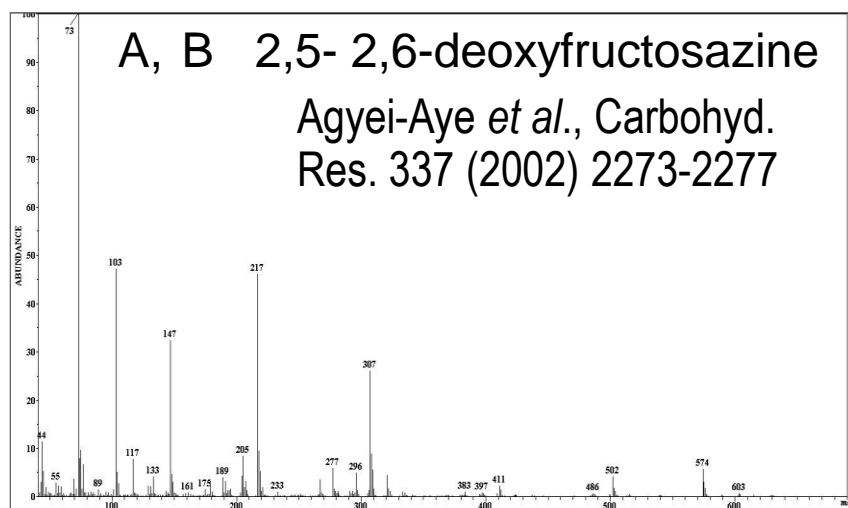
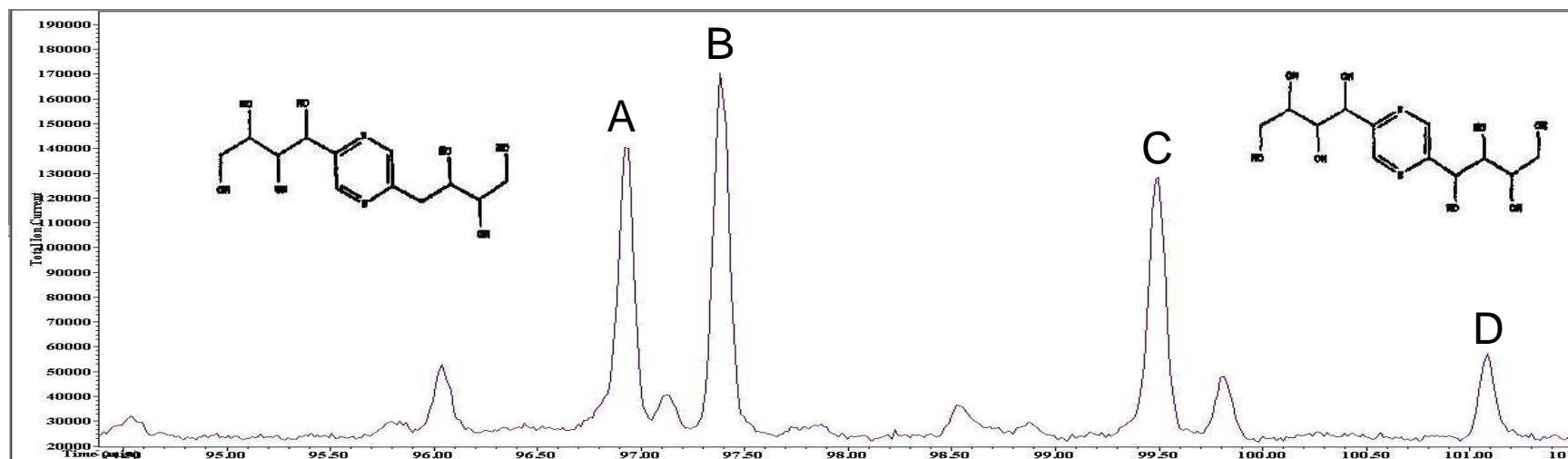
Comparison with light air-cured tobacco



Reconstituted tobacco wrappers



Unexpected ammonia chemistry



Inferences from the analytical data

- **Tobacco blends in filtered cigars**
 - **Blends appear to be light air-cured tobaccos**
 - **Need to confirm drought-stressed tobacco**
 - **Even though endogenous glycerin present (~0.15%)
no evidence for casing other than PG**
 - **PG suspected to be flavor carrier**
 - **Non-characterizing flavors used in some brands**
- **Reconstituted tobacco wrappers**
 - **Wrappers analyzed taken from product**
 - **Evidence of ammonia chemistry not from blend**
 - **More complex chemistry than expected**

Conclusions

- **Nothing in blend that would lead to reported smoke cytotoxicity findings**
 - **Points to wrapper chemistry as likely cause**
 - **However, wrappers taken from finished product so any interactions with blend not known**
- **Additional studies planned to understand wrapper chemistry and effects on smoke chemistry and cytotoxicity**