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Tobacco Column Influence on Cigarette Paper

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Agenda

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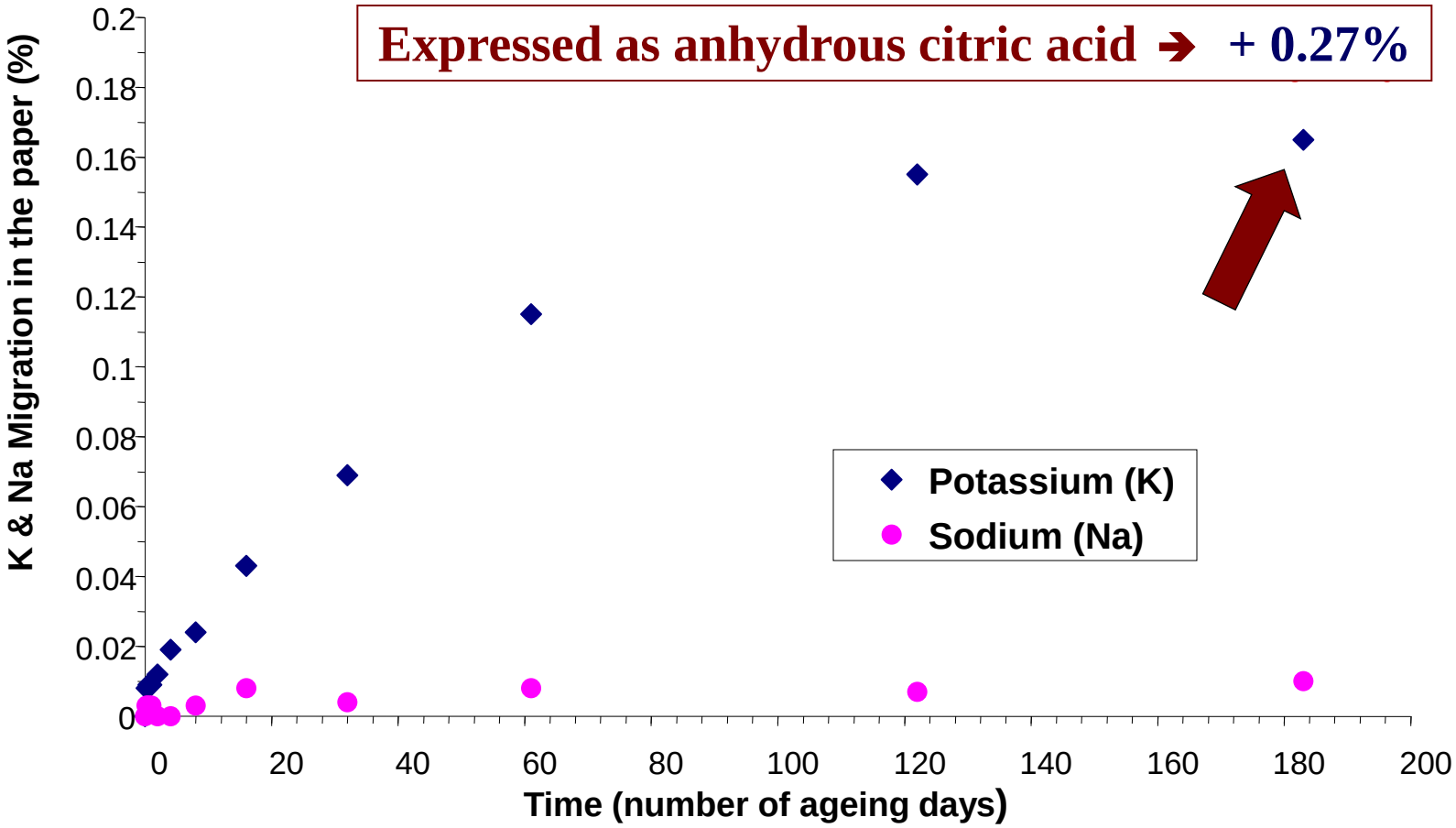
Introduction

- Cigarette paper has to be studied in context of the whole cigarette
- Tobacco affects cigarette paper prior to smoking
- Properties of both (tobacco & paper) impact cigarette smoking/burning characteristics
- SWM performed an earlier study on ion transfer from tobacco to cigarette paper[1]
  - Cigarettes were stored at 22°C and 60%RH from 3 to 29 months
  - K ions transfers to cigarette paper at up to 0.17% after 6 months
  - No impact from Na ions
  - Malate, chloride, and nitrate also migrate to cigarette paper

[1] T. Joyeux, G. Le Bourvellec, C. Le Moigne, and J. M. Loureau, "Migration of Cations and Anions from Tobacco into Cigarette Paper", Presentation at CORESTA 2006

Kinetic of cations migration[1]



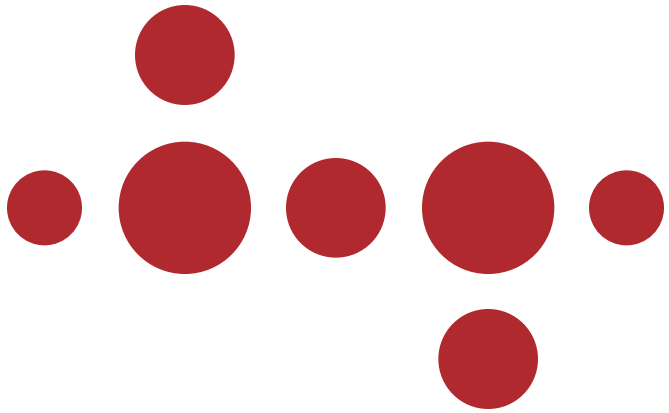
- High K migration up to 0.17% after 6 months ageing
- No Na migration (very low Na content in tobacco)

[1] T. Joyeux, G. Le Bourvellec, C. Le Moigne, and J. M. Loureau, "Migration of Cations and Anions from Tobacco into Cigarette Paper", Presentation at CORESTA 2006

Introduction

- This presentation will discuss:
  - Transfer of ions from the tobacco column to cigarette paper
  - Base and band diffusion at room temperature and after heating in an oven
- SWM made a presentation on the impact of filler and citrate on base and band diffusion at room temperature and after heating in an oven[2]

[2]J. Wanna and J.M. Loureau, “Band Diffusion at High Temperature”, Presentation at TSRC 2011



Experimental

Experimental – Cigarette blends

- Two cigarette blends were selected: American blend (AM) and Virginia blend (VA)

- Select blend components were analyzed

Blend Analysis		
Analyte	**VA**	**AM**
Sugars (%)	12.6	8.4
Nicotine (%)	2.30	1.28
Nitrates (%)	0.44	1.59
Chloride (%)	0.67	1.50
Sulfate (%)	0.85	1.13
Potassium (%)	2.88	3.99
Organic Potassium (%)	1.75	1.7
Virginia	56%	33%
Recon	22%	22%
Burley	11%	29%
Oriental	11%	10%
Stem	0%	6%

Experimental – Cigarette base paper properties

Cigarette Paper Properties	Paper Porosity (CU)	Citrate (%)	BW (gsm)	Filler (%)	Fiber
Bobbin VA Blend (Control – VA)	75	2 K	24	26	Wood
Bobbin AM Blend (Control – AM)	60	0.80 Na/K	28	28	Wood

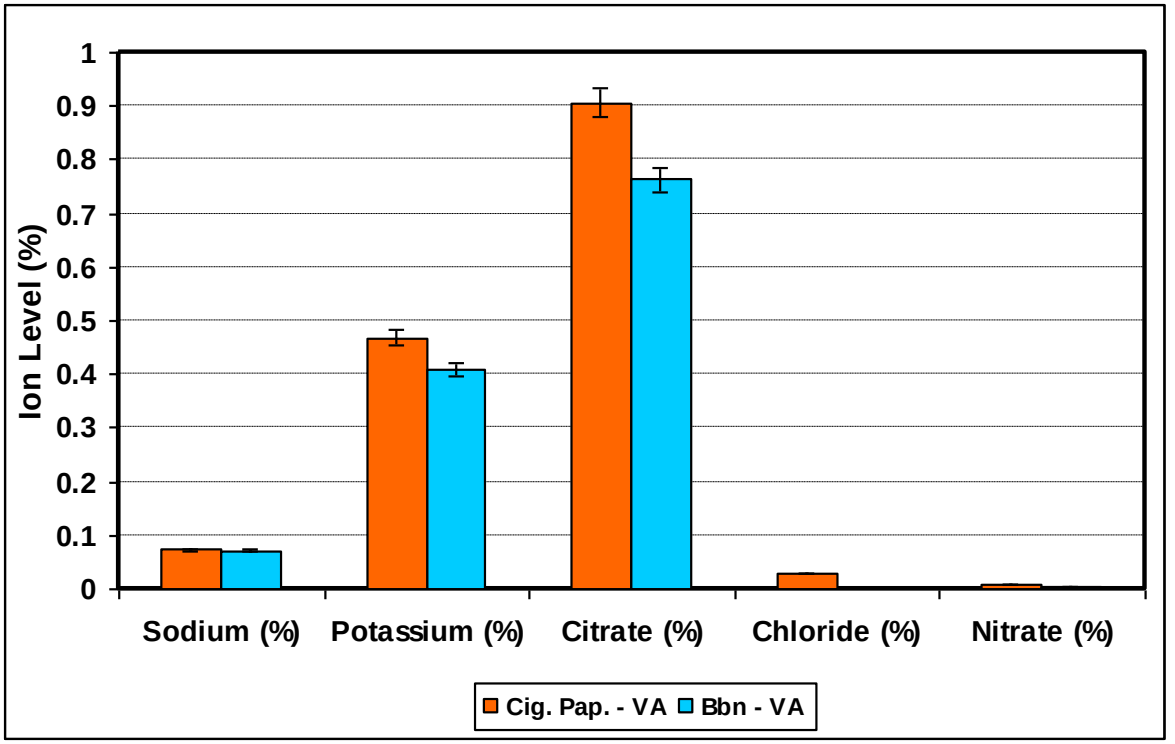
- Diffusion measurements performed using Sodim CO_2 Diffusivity Meter
- Lab condition at 50%RH and 23^{o}C
- Binder oven was used to heat cigarette paper at 230^{o}C for 30 minutes
- After heating, samples were conditioned in the lab for 30 minutes

Results: Cigarette Paper Ion Level

Results: Ion levels in cigarette paper and bobbin – VA blend

- Ion levels of cigarette paper from VA blend cigarettes compared to paper from bobbin (control)
- Minimal ion transfer among the measured constituents

	Cigarette Paper	Bobbin
	Cig. Pap. - VA	Bbn - VA
Sodium (%)	0.0733	0.0706
Potassium (%)	0.4678	0.4095
Citrate (%)	0.9063	0.7629
Chloride (%)	0.0294	0.0015
Nitrate (%)	0.0069	0.0030

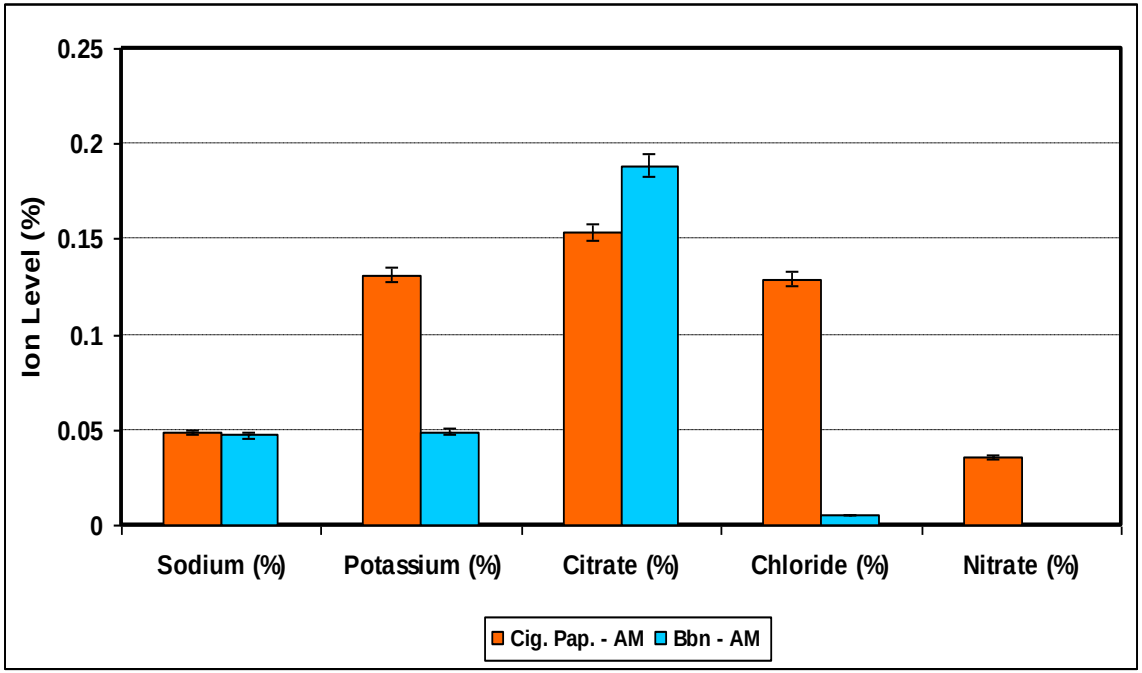


Paper Analysis: Materials Characterization Services, Austin, TX

Results: Ion levels in cigarette paper and bobbin – AM blend

- Ion levels of cigarette paper from AM blend cigarettes compared to paper from bobbin (control)
- Potassium, chloride, and nitrate ion increase in paper after contact with tobacco among the measured constituents.
- The lower K Citrate content in paper the higher the migration[1]
- Other ions e.g. phosphate can also be transferred

	Cigarette Paper	Bobbin
	Cig. Pap. - AM	Bbn - AM
Sodium (%)	0.0486	0.0471
Potassium (%)	0.1312	0.0490
Citrate (%)	0.1535	0.1888
Chloride (%)	0.1293	0.0055
Nitrate (%)	0.0362	0.0001



Paper Analysis: Materials Characterization Services, Austin, TX

Results: Cigarette Paper Diffusion

Results: Base paper diffusion at RT and high T

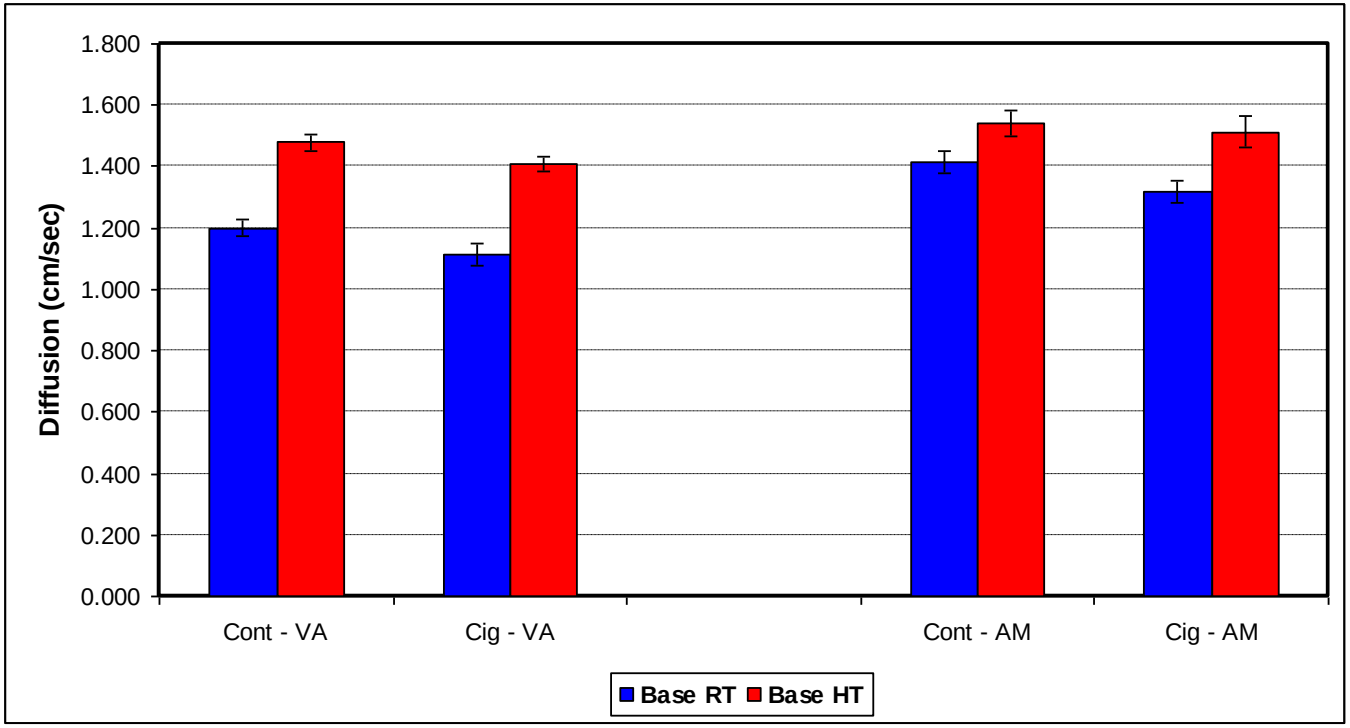
- RT D* for paper from bobbin used in AM blend cigarettes are slightly higher than D* for paper used with VA blend

- HT D* for paper used in VA blend cigarettes had higher increase (~24%) after heating compared to the increase (~12%) observed in paper from AM blend cigarettes

- Paper used with VA blend has higher potassium and ion

		Base D* (cm/sec)		
Code		**Base RT**	**Base HT**	**Increase (%)**
Bobbin	Cont - VA	1.200	1.478	23
Paper from Cig.	Cig - VA	1.114	1.408	26
Bobbin	Cont - AM	1.415	1.541	9
Paper from Cig.	Cig - AM	1.321	1.514	15

Results: Base paper diffusion at RT and high T



Results: Band diffusion at RT and high T

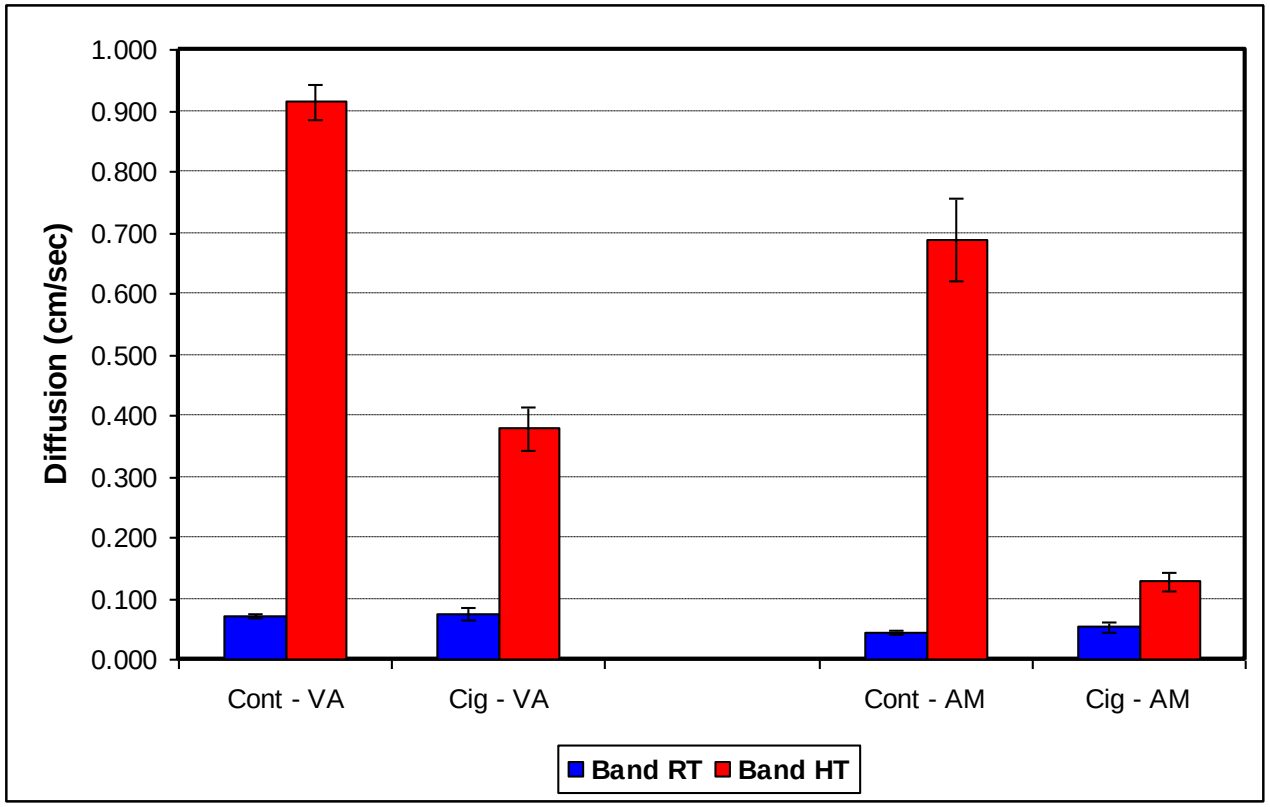
- RT D* for bands used in VA blend cigarettes were at 0.075cm/sec compared to D* of 0.045cm/sec for bands used with AM blend

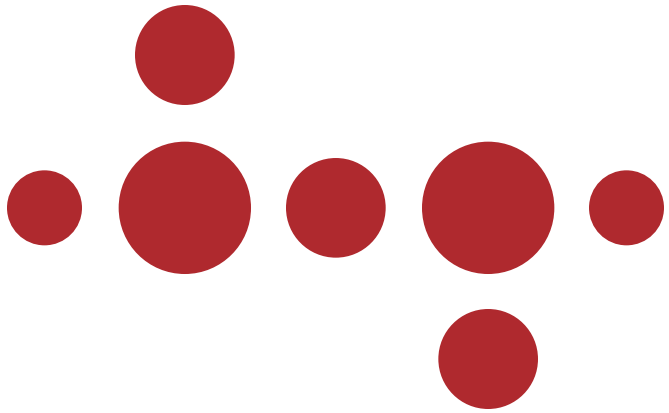
- HT D* for bands removed from cigarette papers used with VA blend were 59% less compared to bands from cigarette paper off the bobbin

- HT D* for bands removed from cigarette papers used with AM blend were 81% less compared to bands from cigarette paper off the bobbin

		Band D* (cm/sec)		
Code		**Band RT**	**Band HT**	**Increase (x)**
Bobbin	Cont - VA	0.070	0.914	13.1
Paper from Cig.	Cig - VA	0.075	0.378	5.0
Bobbin	Cont - AM	0.045	0.687	15.3
Paper from Cig.	Cig - AM	0.053	0.128	2.5

Results: Band diffusion at RT and high T





Summary

Summary

- Tobacco columns impact cigarette paper and thus alters its decomposition pattern
- Higher level of ion transfer from American blend – higher % increase for potassium ions
- Transferred ions impact band diffusion after heating at high temperature
- The impact is larger for papers that were in contact with the American blend and also base paper had Na/K at lower level compare to paper used wit VA blend
- Cigarette paper properties studied after contacting tobacco column give better indication of its final performance

Acknowledgment

Thanks to Brian Nguyen who performed the diffusion measurements.

Thank You

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