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The chemistry inside innovation™

Impact of Carbon Particle Size & Pressure Drop in the CelFX™ Section on Carbonyl Reduction at Constant Total Cigarette Pressure Drop

S. Basu

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CelFX™ technology is not intended for use in cigarettes manufactured for commercial distribution in the United States

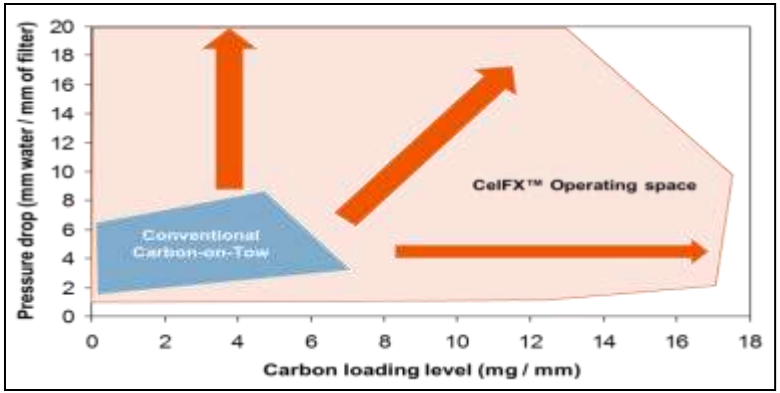
Outline

- Overview
- Key Objectives
  - Impact of **carbon particle size** in CelFX™ matrix on carbonyl reduction
  - Impact of **pressure drop** of CelFX™ matrix on carbonyl reduction
- Smoking Conditions & Filter Design
- Results and discussion
- Conclusions
- Acknowledgement

CelFX™ Filter Rod

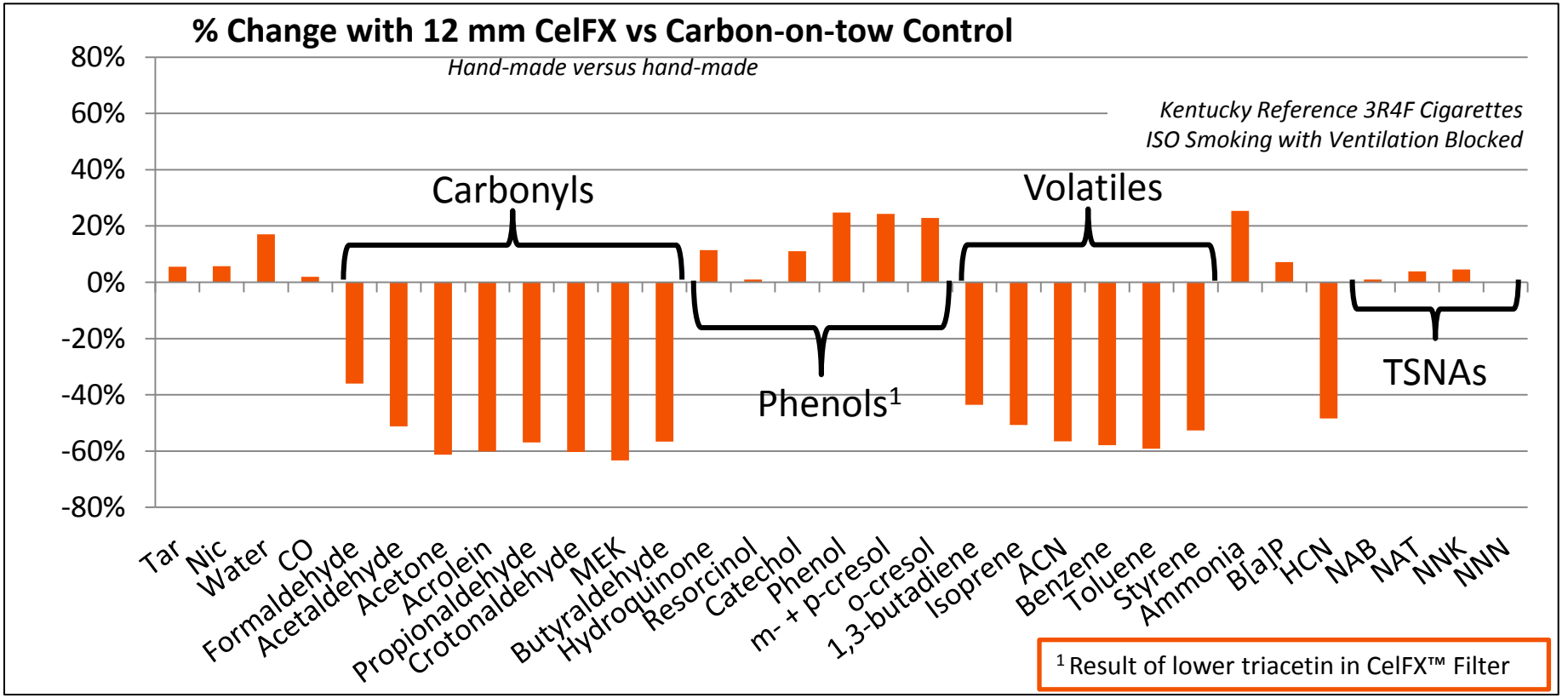
CelFX™ Matrix Technology: *Overview*

- Commercially available cigarette filter developed by Celanese
- Uses proprietary binder & manufacturing process to achieve:
  - Excellent gas phase filtration
  - High active ingredient loading (activated carbon)
  - Lower dust products, despite high loadings
- Design flexibility
  - Super-slim capable
  - Pressure drop control
    (low or high, no impact of loading)

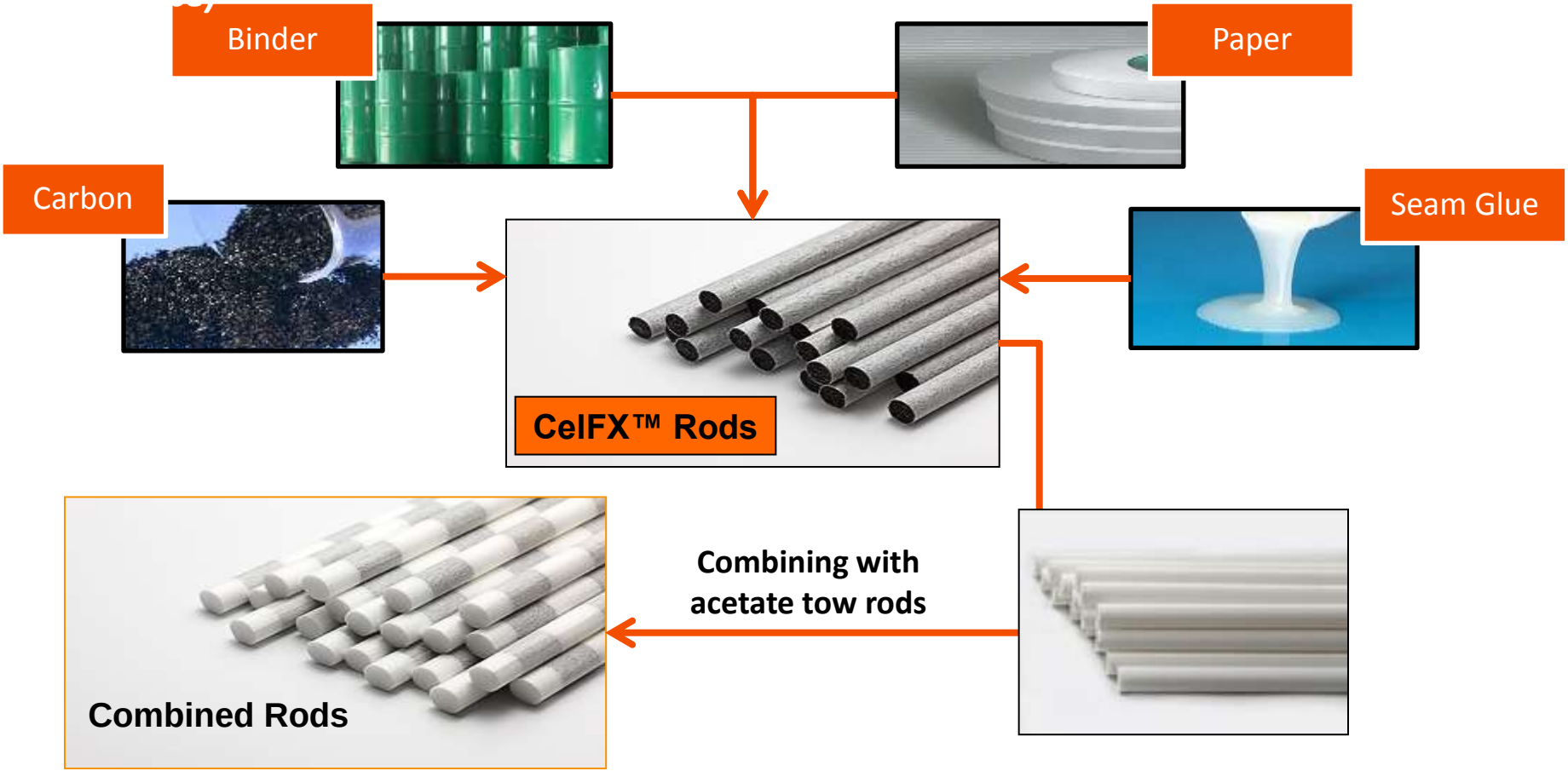


Overview: *Filter Performance*

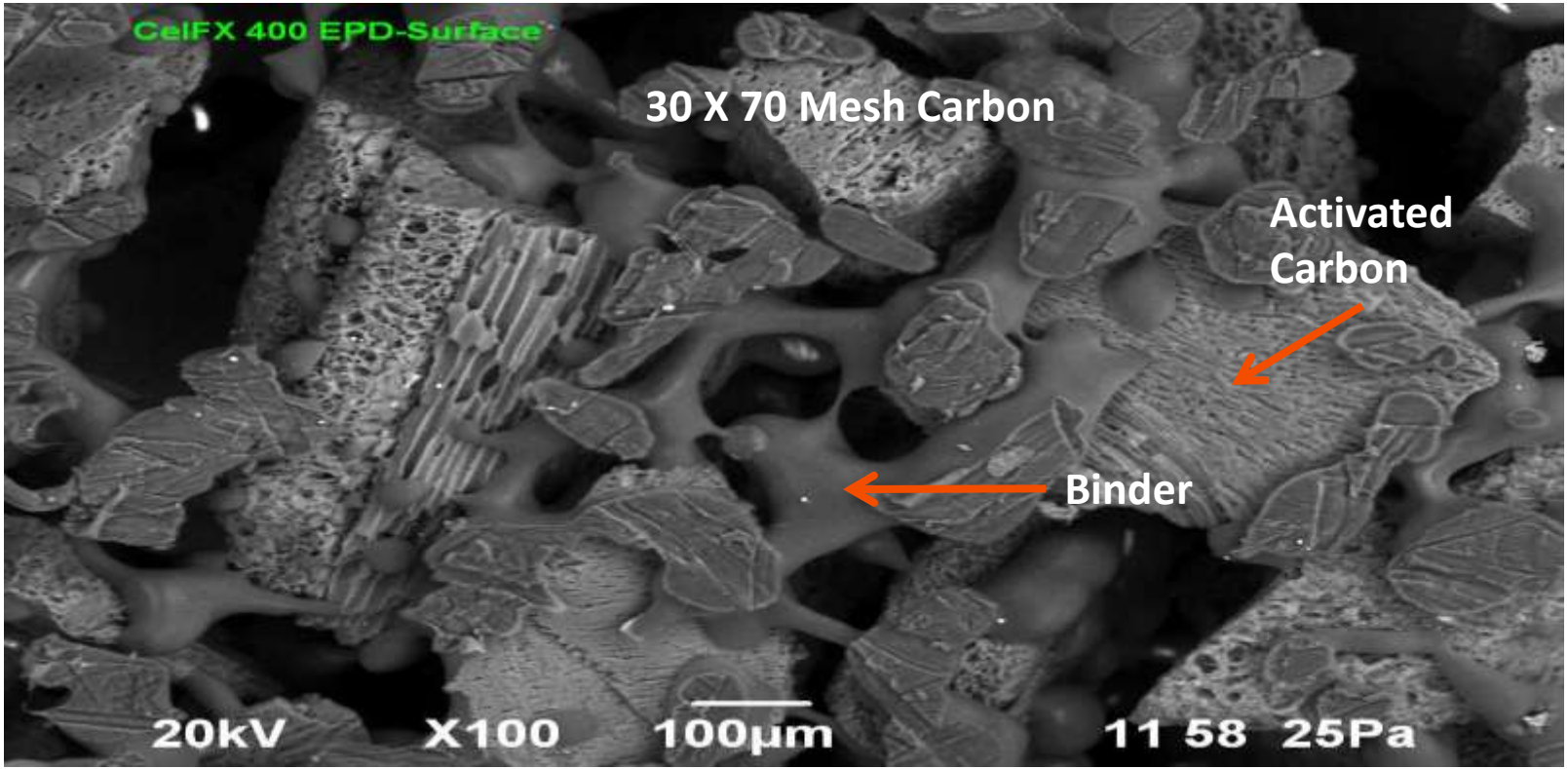
Significant improvement in removal efficiency of gas-phase components vs. carbon-on-tow
(40-60% improvement)



Overview: *Approved Ingredients*



Overview: *Close-up View*



Key Objectives

1 - Determine impact of carbon particle size in CelFX™ matrix on carbonyl reduction

Coconut Shell Carbon Sizes (US Mesh Size)	Carbon Rod Pressure Drop, mm of H_2O (length 120 mm)
12 X 30	300
18 X 40	300
20 X 50	300
30 X 70	300

2 - Determine impact of pressure drop of CelFX™ matrix on carbonyl reduction

Coconut Shell Carbon Size (US Mesh Size)	Carbon Rod Pressure Drop, mm of H_2O (length 120 mm)			
30 X 70	150	200	400	500

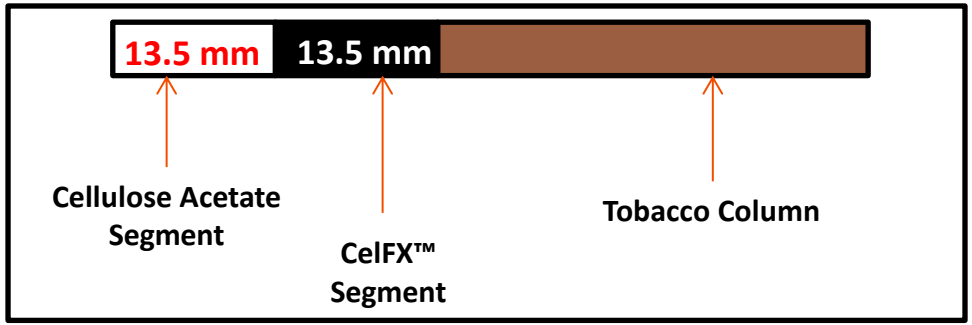
Smoking Conditions & Filter Design

Smoking Conditions

- 3R4F Monoacetate Reference
- All carbon rods are lab made
- Cigarettes are hand-assembled
- Total Cigarette Pressure drop constant at 160-170 mm of H_2O
- All carbons have same activities ~ 60%
- ISO 3308 smoking with vent holes blocked
- Carbonyls - CORESTA recommended method Nº 74

Cerulean SM 450 Smoking Machine

Filter Design

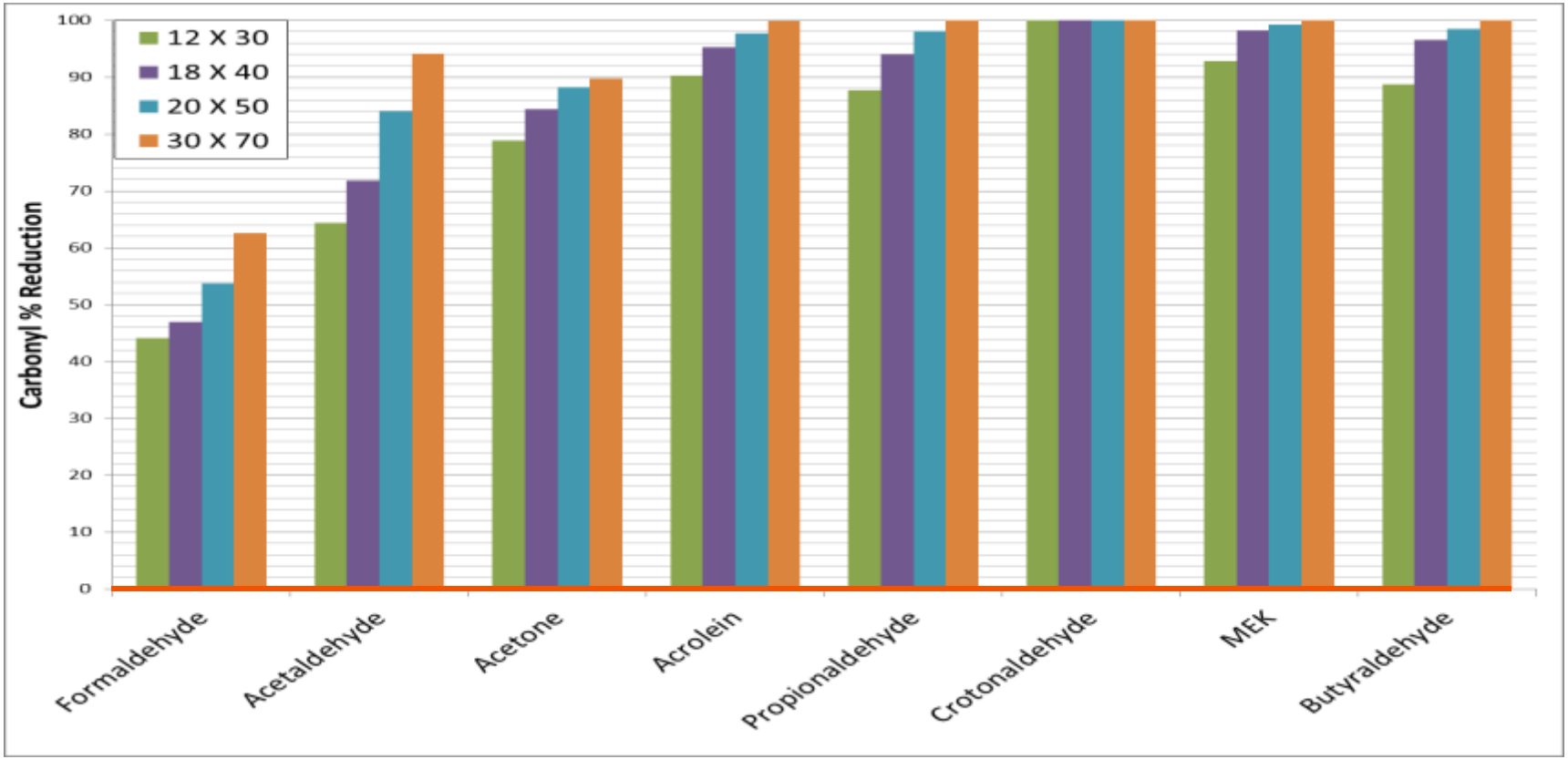


Objective 1 – Impact of Carbon Particle Size

Experimental Design

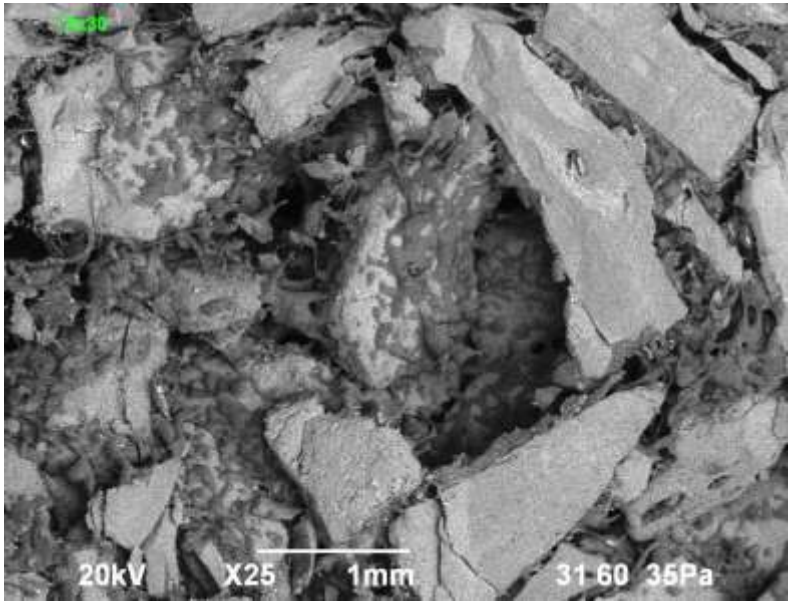
Coconut Shell Carbon Sizes (US Mesh Size)	Particle Size (mm)	Carbon Loading (mg/mm)	Carbon Rod Pressure Drop, mm of H_2O (length 120 mm)
12 X 30	0.60 - 1.70	25.93	300
18 X 40	0.42 - 1.00	22.57	300
20 X 50	0.30 - 0.85	17.16	300
30 X 70	0.21 - 0.06	17.87	300

Objective 1 – Results and Discussion

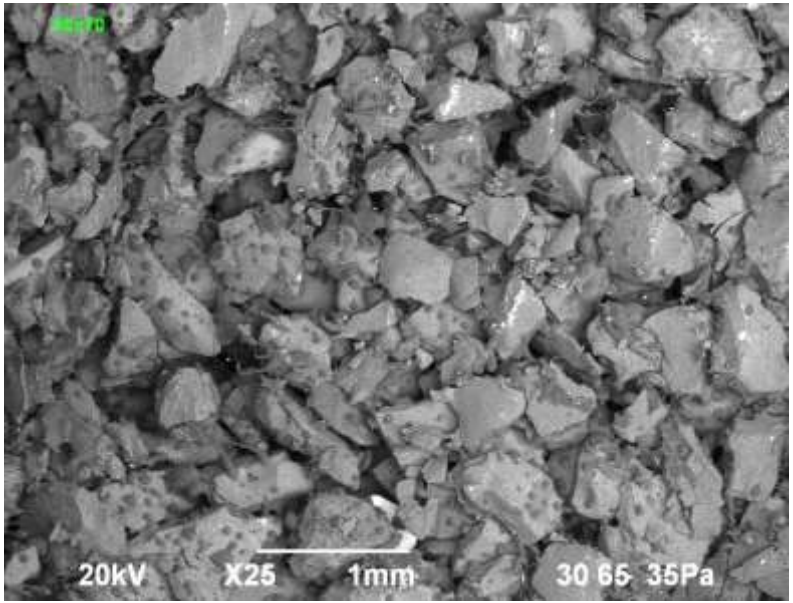


Conclusion: Carbonyl reduction increases as carbon particle size decreases (at constant pressure drop)

Objective 1 – SEM Image Comparison



12 X 30 Mesh Size



30 X 70 Mesh Size

Conclusion:

Finer particles increase surface interaction and increase adsorption

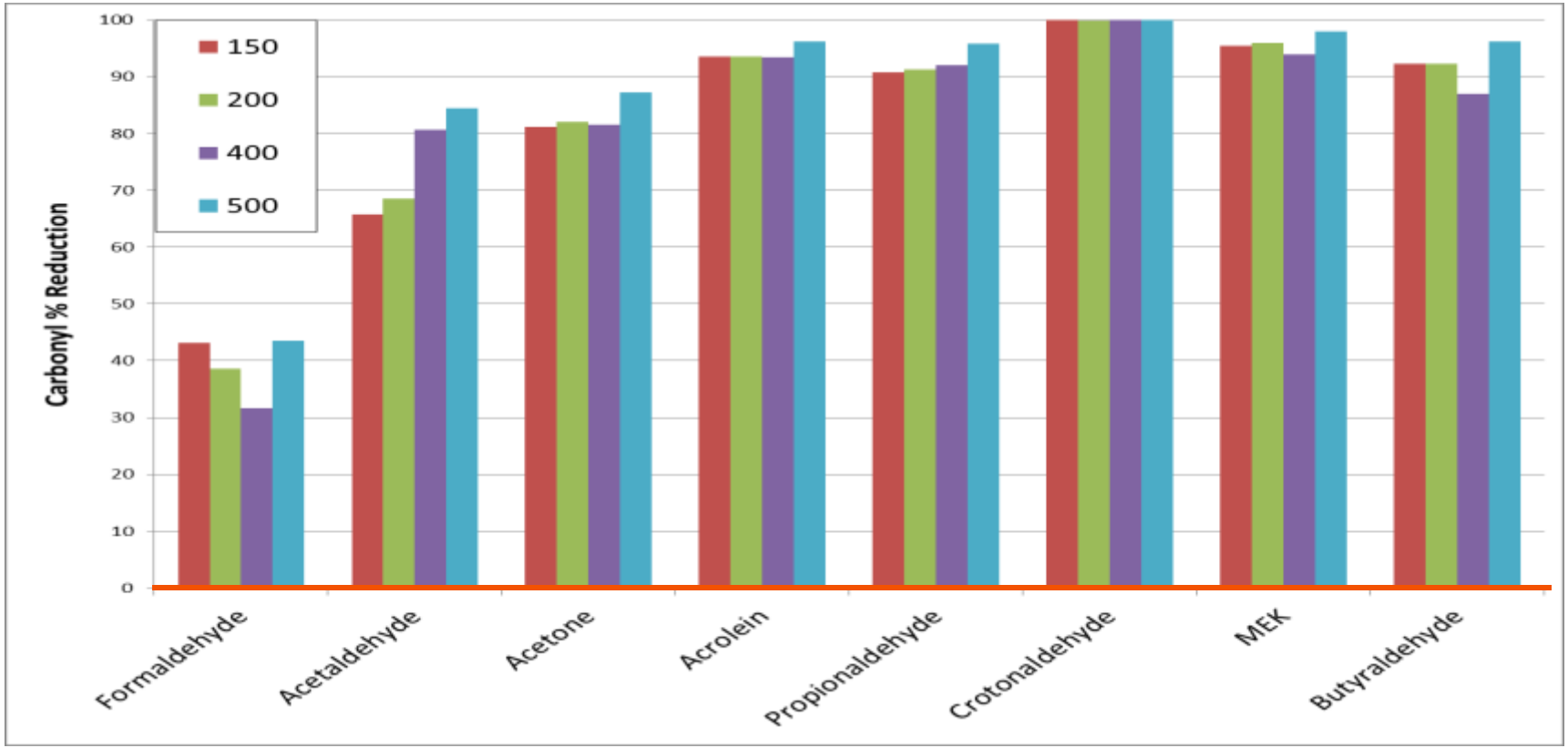
Objective 2 – Pressure Drop Impact of CelFX™

Experimental Design

Coconut Shell Carbon Size (US Mesh Size)	Carbon Rod Pressure Drop, mm of H_2O (length 120 mm)	Carbon Loading (mg/mm)
30 X 70	150	15.17
30 X 70	200	15.71
30 X 70	400	19.73
30 X 70	500	21.63

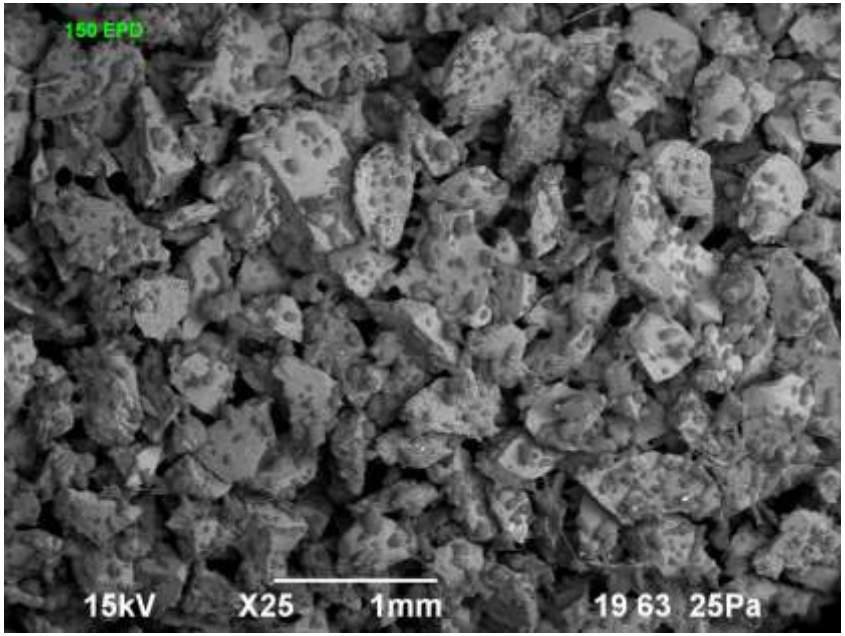
- All samples lab made
- Cigarettes are hand assembled

Objective 2 – Results and Discussion

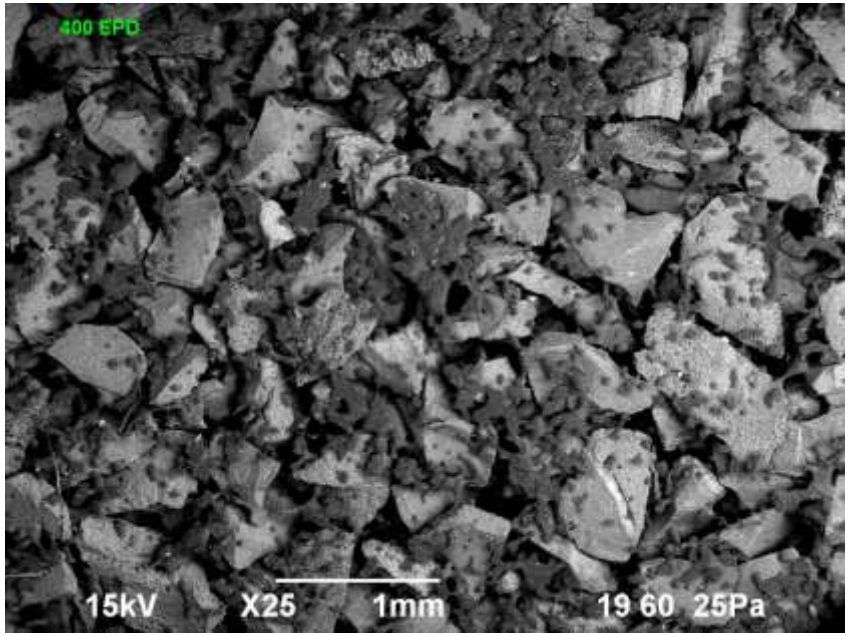


Conclusion: No discernible difference between the various pressure drop rods

Objective 2 – SEM Image Comparison



150 mm Water Pressure Drop



400 mm Water Pressure Drop

Conclusion: SEM images for 150 and 400 pressure drop do not show significant difference

Conclusions

Objective 1: Impact of Carbon Particle Size

- As the carbon particle sizes decreases at constant pressure drop, carbonyl removal increases

Objective 2: Impact of Pressure Drop

- Insignificant correlation between carbonyl removal and CelFX™ pressure drop
- At low pressure drop and high carbon loading, significant carbonyl reductions were achieved

Thanks

- Dr. Ray Roberston
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- Melissa Aldrich-Welch