



# Comparative Characterization of Smoke Residue Collection Efficiency of Cryo-impinger and Ambient Temperature Vapor-phase Tedlar Collection Bags

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**Session B - Tobacco Chemistry**

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**The environmental conditions of collection methods affect the efficacy of volatile organic residue retention and recovery.**

**This study examines collection efficiency of cryo-impinger vs. ambient temperature polymer bags for selected volatile organic residues in mainstream cigarette smoke.**

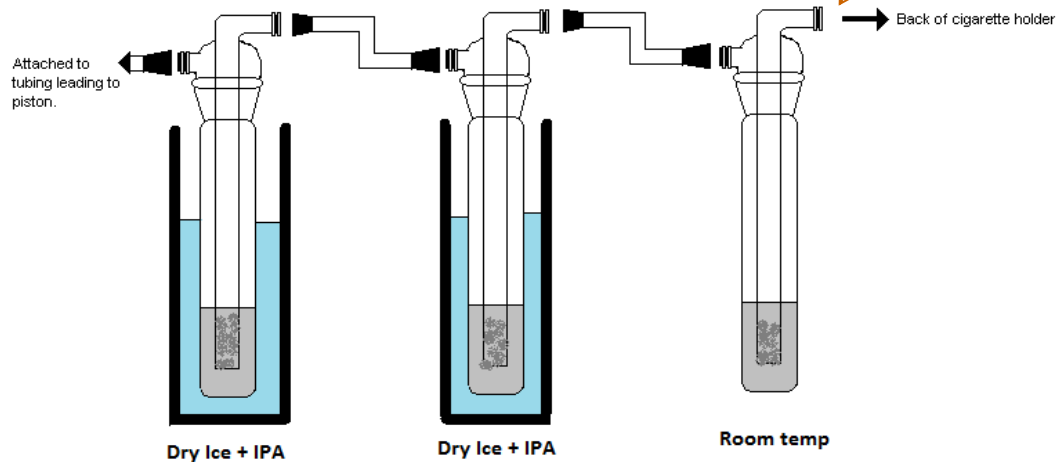
# Methods Compared – 11 Products



Rotary smoke  
Machine



Cambridge  
Filter Pad



Tedlar Bag  
Gas Trapped  
CFP Discarded  
10 cigs ISO  
3 cigs HCl

Impinger – CFP combined with methanol  
+ isotope matched internal standards  
20 cigs ISO    10 cigs HCl

# Technique and Product Used



**Bag Method – Rotary smoker, 92mm CFP, 10 liter tedlar bag.**

**Impinger Method - Rotary smoker, 92mm CFP, 3x methanol/ISTD impingers (15 mL each), 1 at room temp, 2 at -70C (CO2/IPA).  
Combine with CFP, sonicate, inject.**

**11 Products examined with Tar levels ranging from 1 – 22.**

# Impinger Partitioning

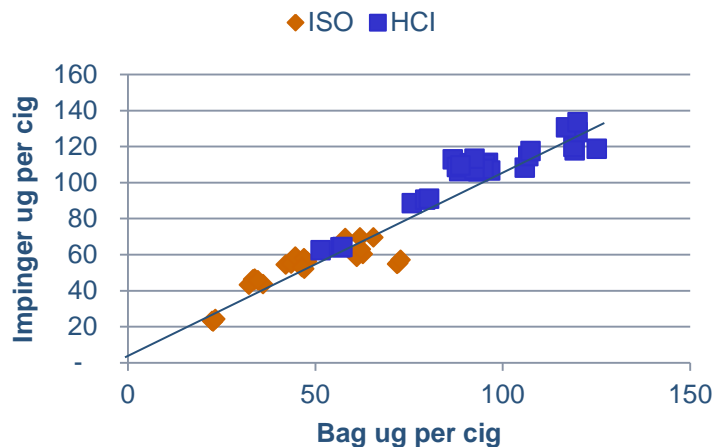


	<u>Propylene oxide</u>	<u>Toluene</u>	<u>Acrylonitrile</u>	<u>Benzene</u>
<b>Recovery - 3-Impinger Test – 3R4F ISO</b>				
Imp_RT_#1	75%	96%	80%	89%
IMP_-70C_#2	23%	3%	9%	8%
IMP_-70C_#3	2%	1%	5%	2%
CFP	0%	0%	6%	0%
<b>Recovery - 4-Impinger Test – 3R4F ISO</b>				
Imp_RT_#1b	67%	92%	75%	82%
IMP_70_#2b	31%	6%	10%	13%
IMP_70_#3b	3%	2%	6%	4%
IMP_70_#4b	0%	1%	5%	1%
Pad_1b	0%	0%	4%	0%

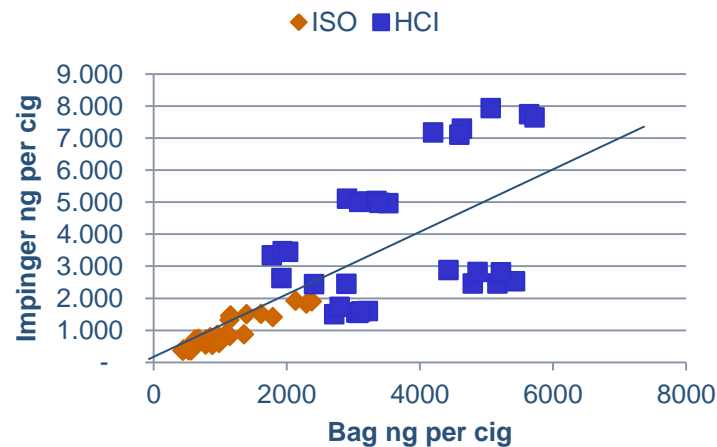
# Impinger vs Bag



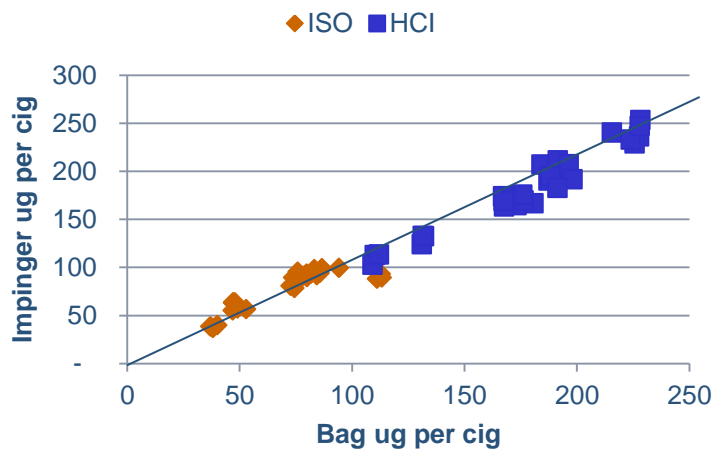
## Benzene



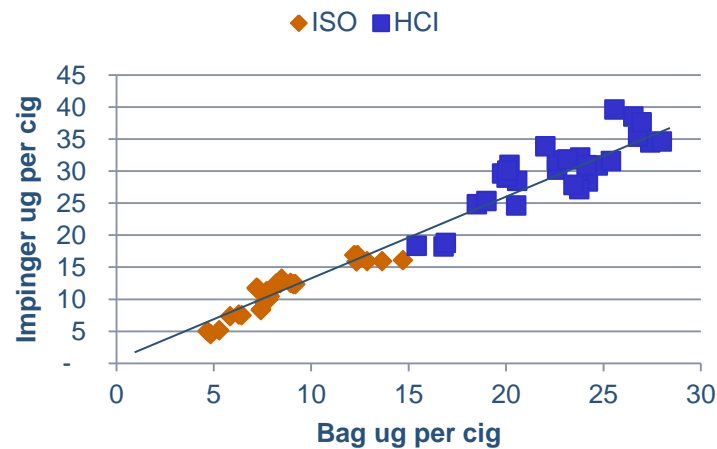
## Propylene Oxide



## Toluene



## Acrylonitrile



# Raw Results Comparison

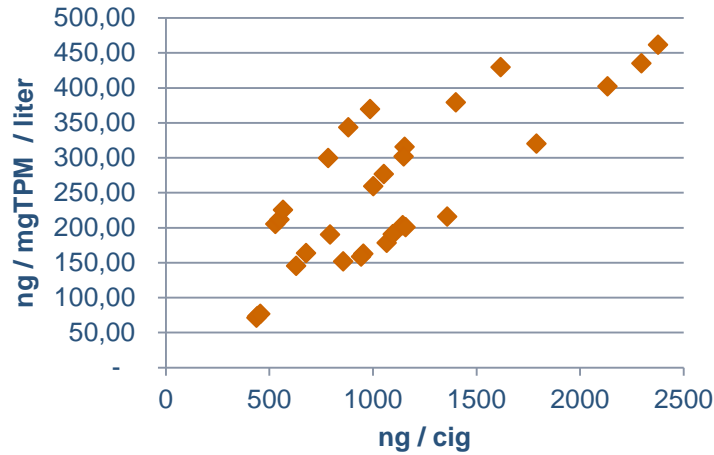


	PropOx	Acrylonitrile	Benzene	Toluene
CORREL	94%	98%	96%	99%
Slope	0.65	0.72	0.89	1.09
Intercept	-363	-0.1	6.3	15.0
n	48	60	60	60

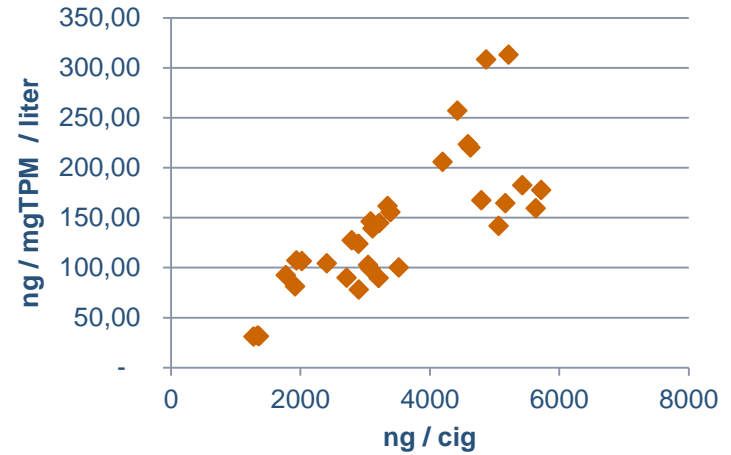
# Propylene Oxide



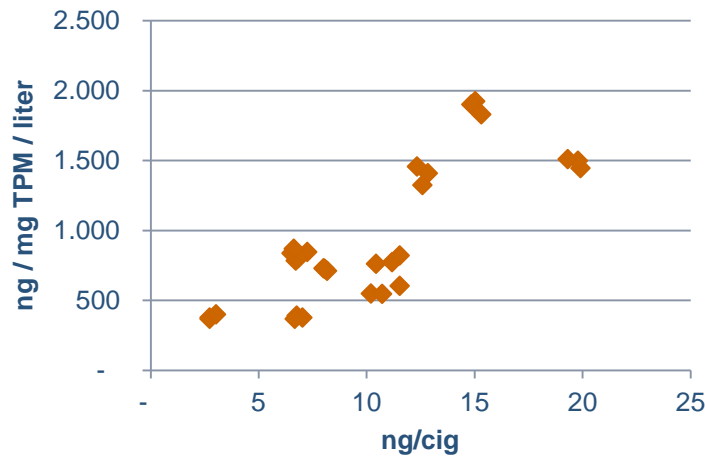
## Bag (ISO)



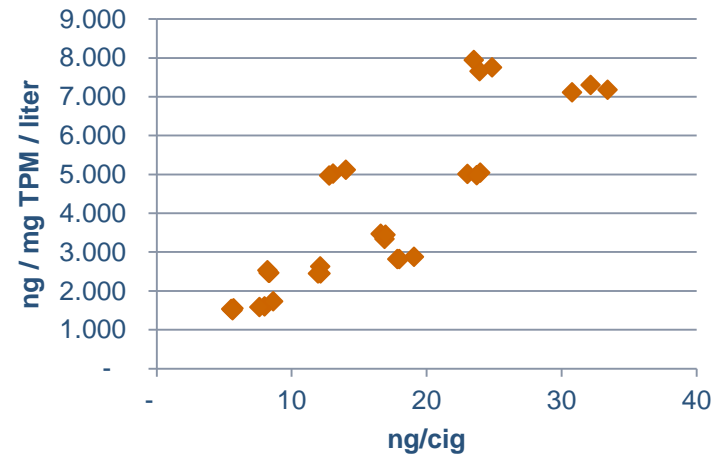
## Bag (HCl)



## Impinger (ISO)



## Impinger (HCl)

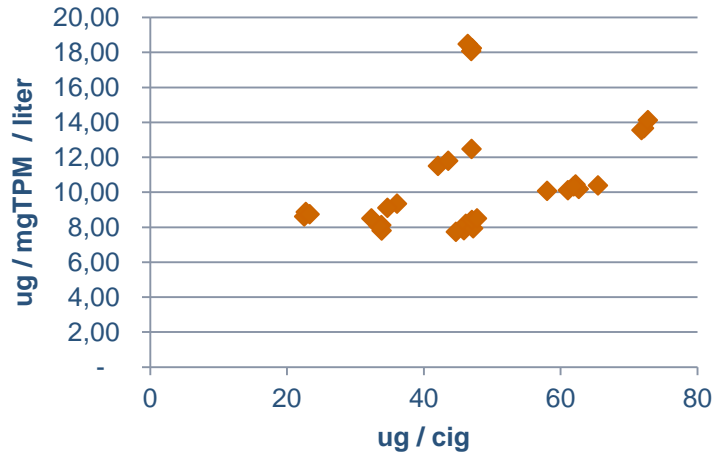




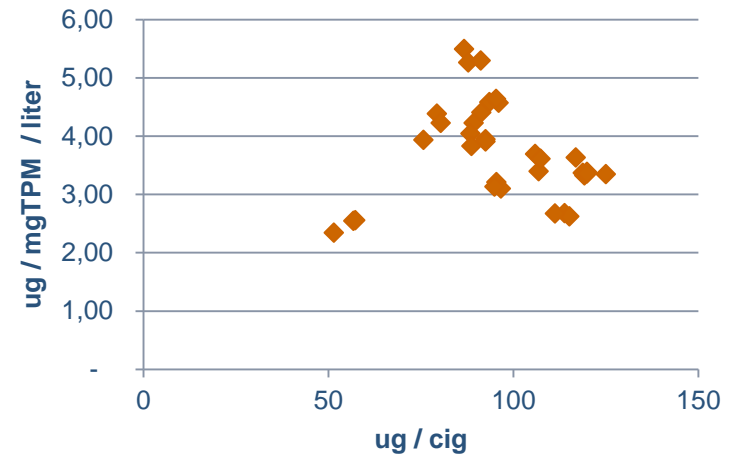
# Benzene



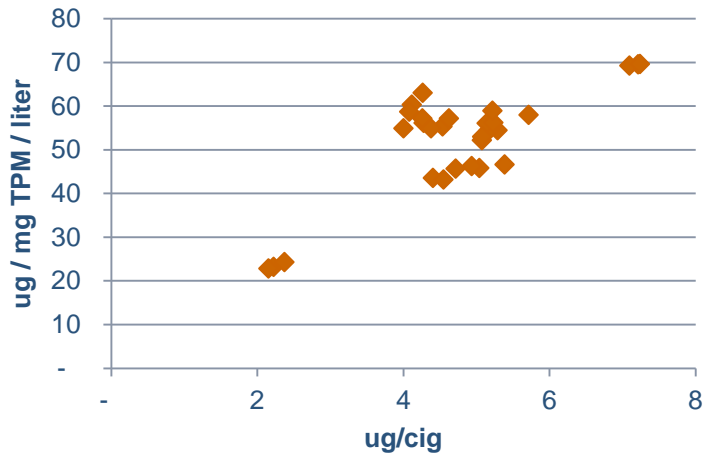
## Bag (ISO)



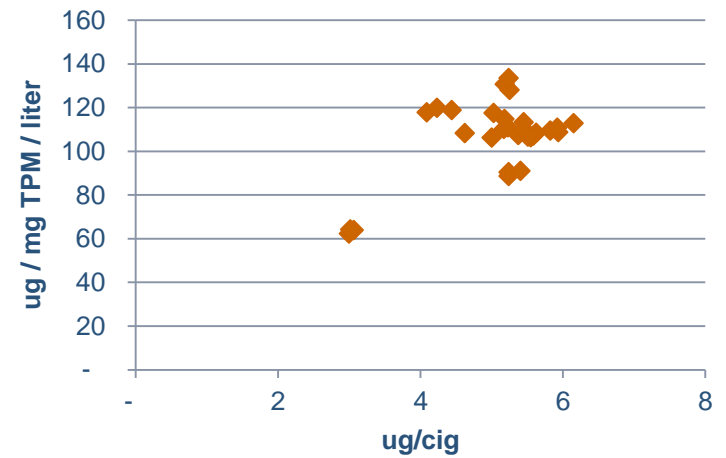
## Bag (HCl)



## Impinger (ISO)



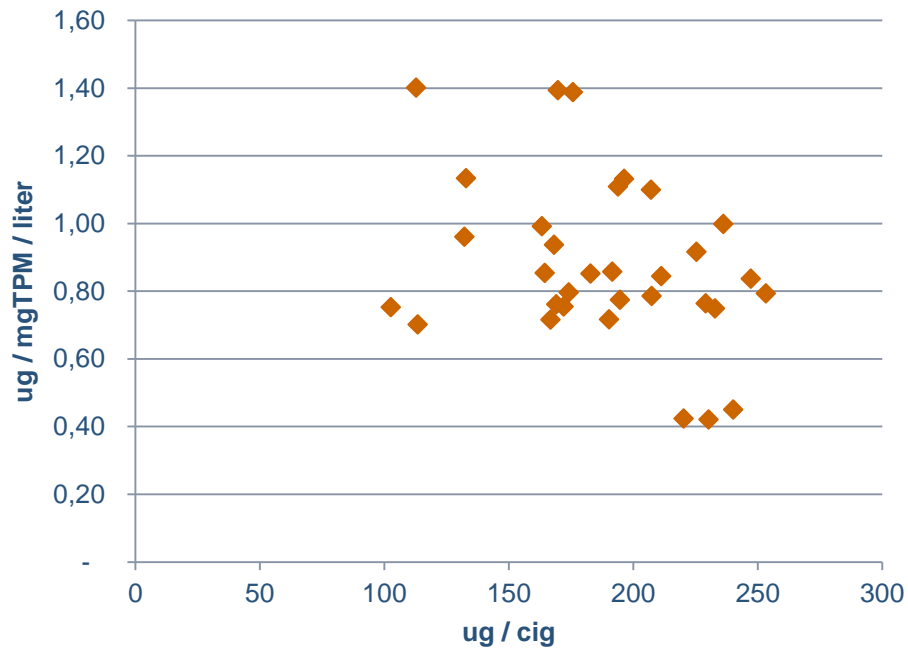
## Impinger (HCl)



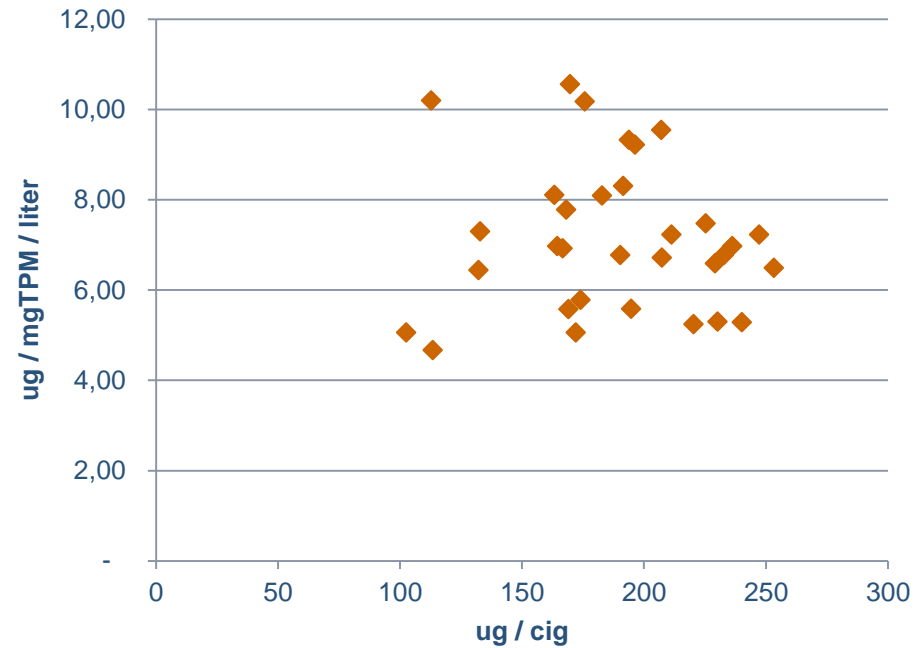
# Tedlar Bag



## Acrylonitrile (HCl)



## Toluene (HCl)





## Using Propylene Oxide, Acrylonitrile, Benzene and Toluene

- **Gas trapping in Tedlar bags and in methanol impinger show good correlation across 11 product types in ISO**
- **Gas trapping in Tedlar bags and in methanol impinger show good correlation across 11 product types in HCl except for Propylene Oxide**
- **WHY when normalized for TPM and puff volume, only Propylene Oxide shows a proportionality to analyte per cig?**

# Acknowledgments



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