Characterizing key thermophysical parameters to heat and not burn tobacco in a tobacco heating product glo™

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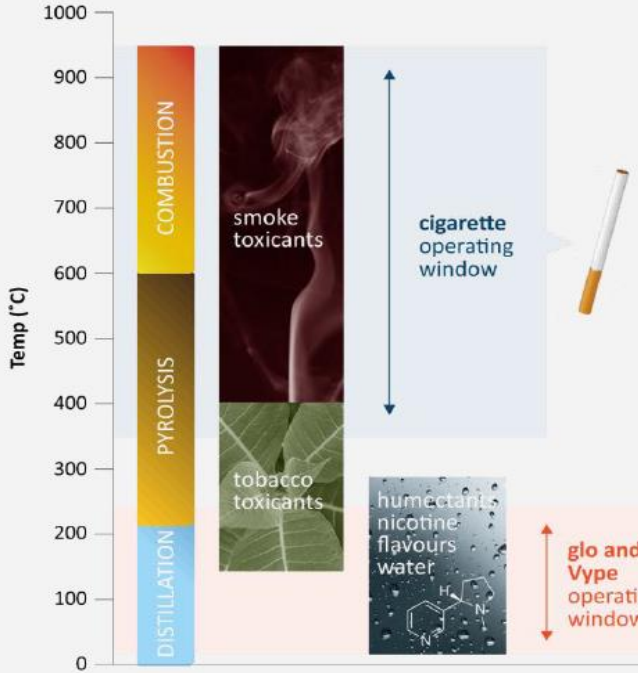
OneR&D

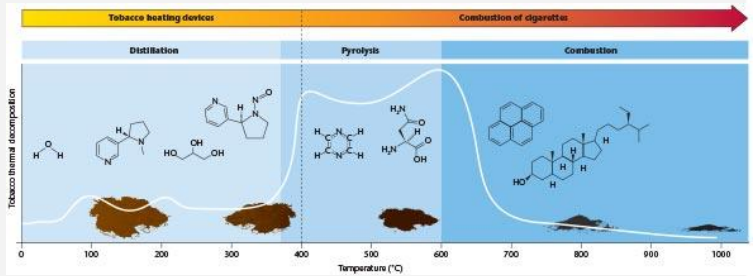
British American Tobacco

Outline

- Tobacco thermophysics and why tobacco heating product (THP)
- THP1.0 (glo™) designed not to burn tobacco like cigarettes
- A 5-step assessments to verify heating-not-burning

Tobacco Thermophysics & Thermochemistry



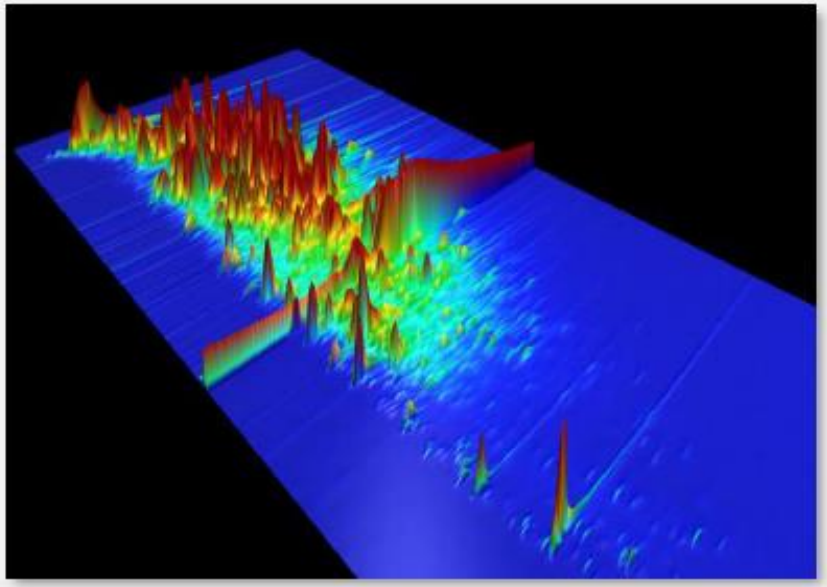


- Cigarettes burn tobacco at around 900˚C[b]
- glo™ heats tobacco up to a maximum of 240˚C[c]
- Vype™ heats liquids at around 250˚C

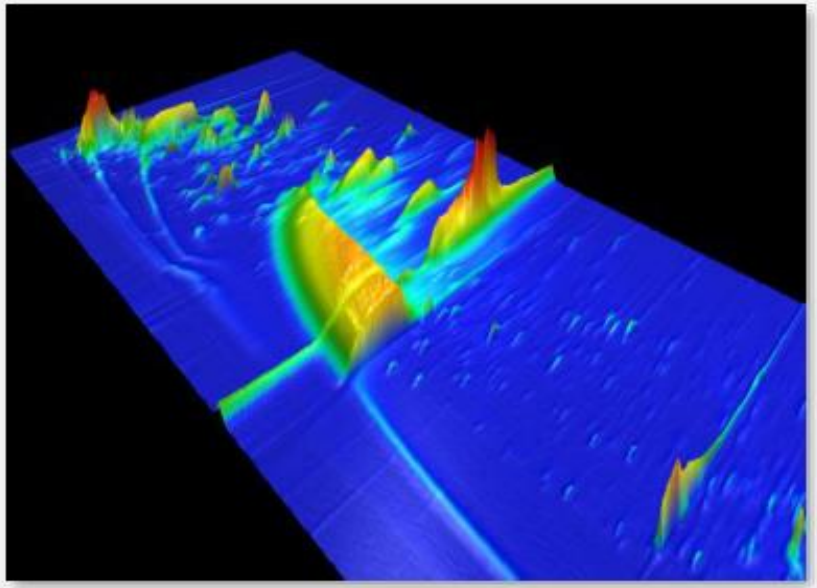
[a]These qualities do not necessarily mean this product produces less adverse health effects than other tobacco products; [b]RR Baker, (2006) *Progress in Energy and Combustion Science*, 32 (4), 373; [c]Method adapted from: Forster *et al*, (2015) *Chemistry Central Journal*, 9, 20.

THP1.0 (glo™): a Novel Tobacco Heating Product

To Achieve Simpler Aerosol & Reduced Toxicant Concentration



Cigarette smoke



glo™ emissions

A Proposed 5-Step to Assess Extent of Tobacco Heating

Step 1 – Overview of tobacco thermal conversion

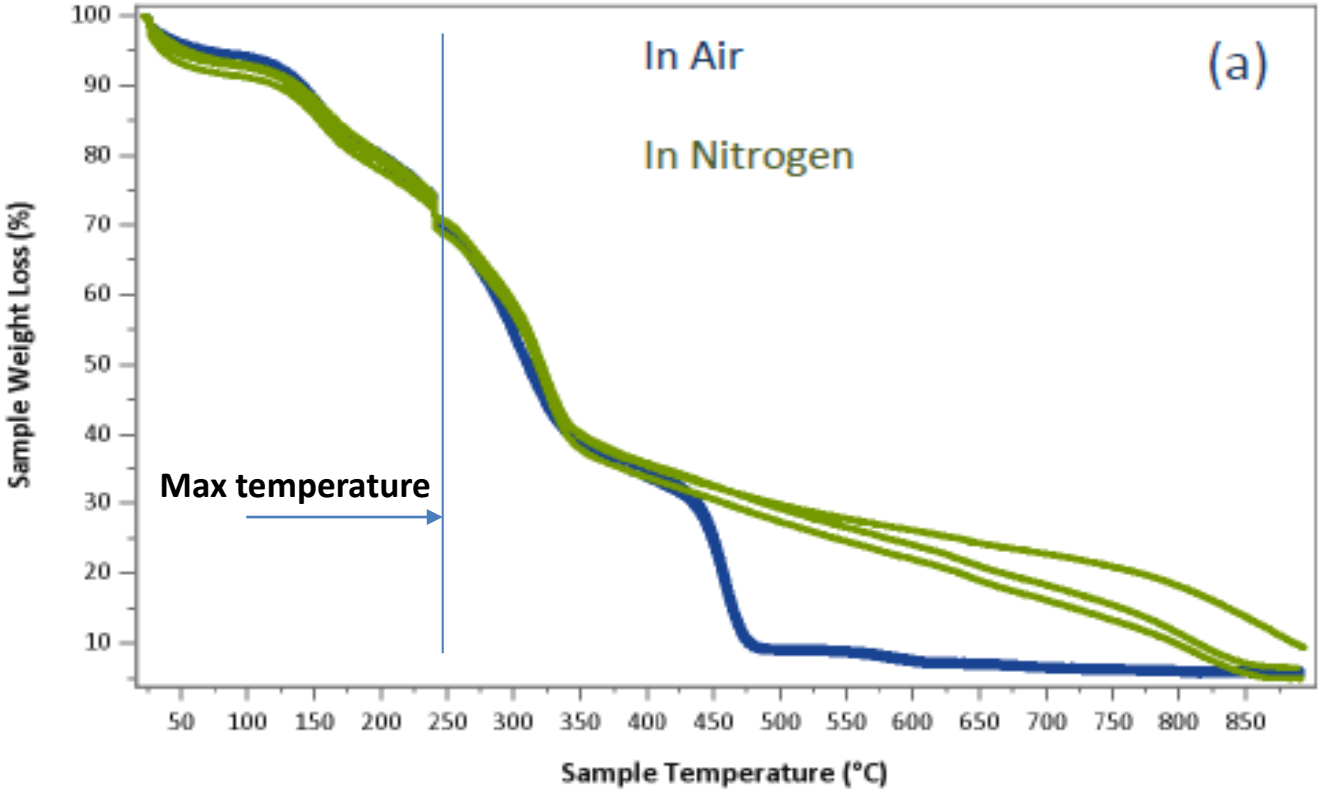
Step 2 – Temperature profiling of tobacco material in use; device temperature and temperature control

Step 3 – The levels of tobacco combustion markers (CO, CO2, NO and NOx) in aerosol emission

Step 4 – The levels of compounds with established thermal precursor-yield, e.g., WHO TobReg 9 compounds (CO, acetaldehyde, formaldehyde, benzene, 1,3-butadiene, B[a]P, NNN, NNK)

Step 5 – Physical integrity and appearance of the tobacco rod post-use

Step 1 – Overview of Extent of Tobacco Thermal Conversion



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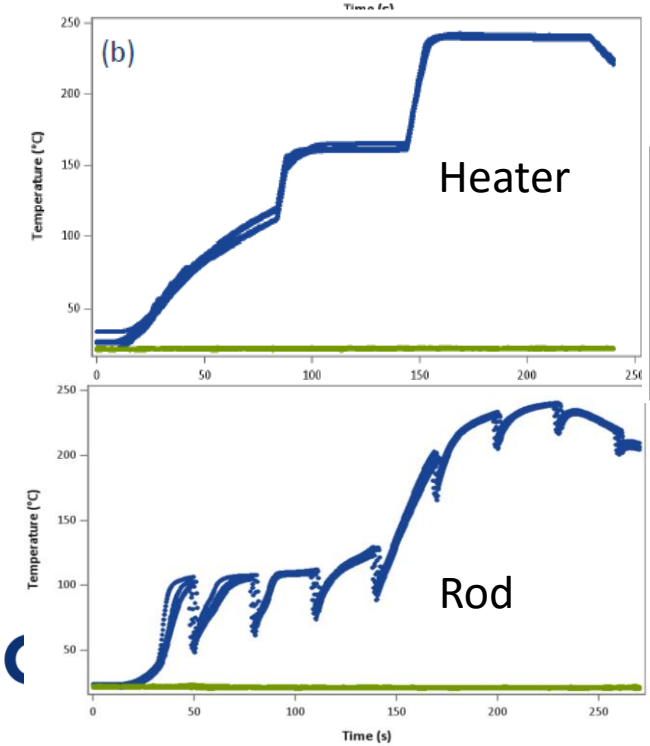
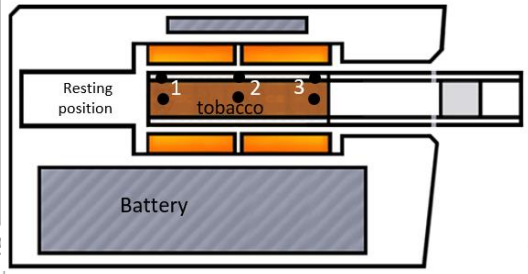
Step 2 – Temperature Profiling: In-Use Tobacco Heating

Back





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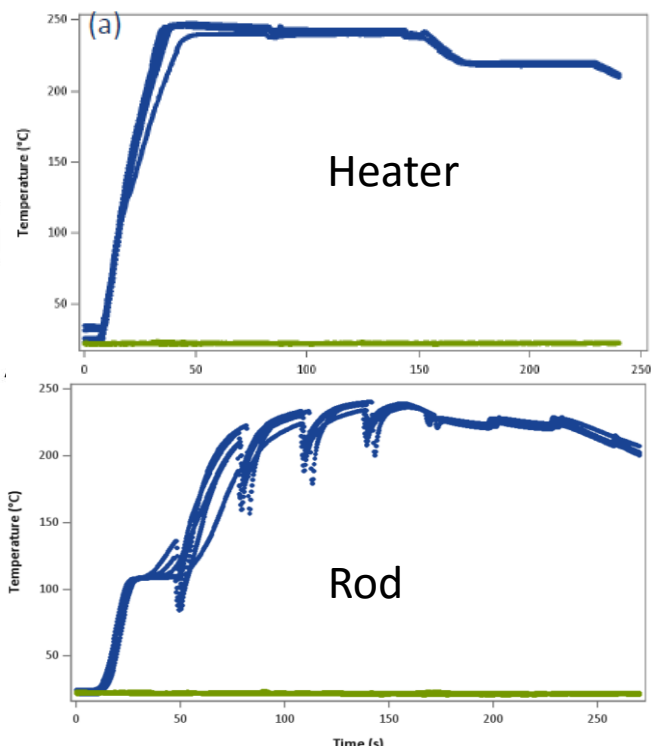

Step 3 – Reduced Levels of Combustion Markers in Aerosol

Marker(per stick)	THP1.0 (8 puffs/per stick)	THP1.0 – "smoked" (5.1 puffs/per stick)	3R4F (10.3 puffs/per stick)
CO, mg	NQ (<0.233)	14.4 (± 0.4)	32.0 (±0.9)
CO_2, mg	2.35 (±0.14)	29.6 (± 1.0)	85.1 (±4.0)
NO, µg	10.1 (±0.4)	75.3 (±3.9)	496 (±16)
NO_x, µg	12.0 (±0.4)	90.0 (±5.1)	553 (±16)

Step 4 – Reduced Extent of Tobacco Thermal Conversion

TobReg 9 analytes	THP1.0		3R4F	
	Mean (±SD) emission per stick	Formation mechanism	Mean (±SD) emission per stick	Formation mechanism
Acetaldehyde, µg	111 (±8)	Initial degradation of carbohydrates	2200 (±103)	Decomposition of carbohydrates by pyrolysis
Acrolein, µg	2.22 (±0.52)	Same as above with glycerol breakdown	157 (±9)	Decomposition of carbohydrates and leaf polymers and glycerol if added
Benzo(a)pyrene, ng	N.Q. (<0.354)	Transfer from tobacco	12.9 (±1.3)	Decomposition of leaf terpenoids and transfer of contaminants
Benzene, µg	N.Q. (<0.056)	Not quantified	78.6 (±4.6)	Decomposition of leaf polymers with C6-ring moieties, above 300°C
1,3-Butadiene, µg	BDL (<0.029)	Not detected	108 (±4)	Similar mechanisms as benzene with thermal cracking involving tobacco char
CO, mg	N.Q. (<0.223)	Significantly reduced	32.0 (±0.9)	Combustion of tobacco, pyrolysis and char reaction
Formaldehyde, µg	3.29 (±0.30)	Initial decomposition of sugars	54.1 (±6.0)	Decomposition of sugars and cellulose
NNN, ng	24.7 (±2.5)	Thermal transfer	263 (±12)	Transfer and pyrosynthesis
NNK, ng	6.6 (±0.86)	Thermal transfer	281 (±16)	Transfer and pyrosynthesis

Summary

- Adequately assessing the degree of tobacco heating is important in designing a tobacco heating product
- A 5-step process is outlined to evaluate tobacco heating
- The evidence shows THP1.0 (glo™) forms its aerosol by eliminating combustion and minimizing tobacco thermal conversion
- THP1.0 consequently has less tobacco odour and significantly reduced impact on indoor air quality compared to cigarettes (*for further details, please see our poster*)

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Thank You for Your Attention!

A comprehensive programme of aerosol chemistry, toxicant exposure and clinical trials have been performed using THP1.0.

For further information: www.bat-science.com

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