

Introduction to Rooibos as a Herbal Heated Product in a Heating System

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Introduction

The Rooibos based Herbal Heated Product (HHP), is an alternate substrate designed to be heated in glo™ hyper devices without combustion. This study will assess the comparison of TobReg9 emissions, defined by the WHO Study Group on Tobacco Product Regulation for proposed mandatory lowering of emissions of 9 specific toxicants in cigarette emissions between the studied HHP and a conventional reference cigarette (1R6F).¹ A comparison of Harmful and Potentially Harmful Constituents (HPHCs) of smoke as specified by the US Food and Drug Administration (FDA) Tobacco Products Scientific Advisory Committee, has also been assessed between the studied HHP and 1R6F.² Lastly, a comparison of aerosol compositions has been conducted between the studied HHP and 1R6F. The aim of these comparisons was to characterise the chemical composition of the studied HHP, to aid in establishing its emissions profile and to indicate whether the use of the studied HHP has the potential to offer a reduced risk profile alternative to continued smoking of combustible cigarettes.

Methodology

Test Articles

The Rooibos plant material undergoes a process in which pharmaceutical grade nicotine with a nicotine stabiliser and glycerol are added prior to forming a reconstituted substrate. The substrate is then cut, flavoured and formed into a consumable rod to make the HHP. A range of glo™ hyper devices were used to generate emissions, the details of these are outlined in Table 1. A reference cigarette (1R6F) was used to generate cigarette emissions.

Emissions generation

TobReg9 and HPHC emissions were generated using the CRM101 puffing regime (55 mL puff volume, 2 s puff duration, 30 s puff interval, 0% vent blocking)³ for the studied HHP with glo™ hyper devices. The Health Canada Intense (HCI) puffing regime (55 mL puff volume, 2 s puff duration, 30 s puff interval, 100% vent blocking)⁴ was used to generate emissions for 1R6F.

Device	Profile	Time to First Puff	Session Length
hyper+ (G403)	Standard	20 s	4 min
hyper X2 (G500)	Standard	20 s	4 min
hyper X2 Air (G6010)	Standard	30 s	4 min

Table 1. Information on heating devices used to generate HHP emissions.

Results

HPHC Emissions

HPHCs were analysed with the exception of polychlorinated dibenzo-p-dioxins, polychlorinated dibenzofurans and radioactive isotopes as previous studies had demonstrated results for all compounds in these classes would be below the limit of detection (LOD). N-nitrososarcosine, coumarin, aflatoxin B1 were also not measured as at present no standardised methods have been developed for the measurements of these compounds.⁵

On average, 70% of HPHC analytes were below either the LOD or limit of quantification (LOQ) in HHP emissions across all devices tested. This is significantly different to 1R6F emissions in which around 23% of HPHC analytes were below either LOD or LOQ. Of the quantifiable analytes in HHP emissions, most analytes were over 95% reduced compared to 1R6F with the exception of the 14 compounds shown in Table 2.

	1R6F N/A Reported	hyper+ Standard % Reduction vs 1R6F	hyper X2 Standard % Reduction vs 1R6F	hyper X2 Air Standard % Reduction vs 1R6F
Carbonyls [µg/stick]				
Formaldehyde	67.0	92.6	97.3	92.5
Alkaloids [µg/stick]				
Anabasine	0.969	94.1	94.1	94.1
Metals [ng/stick]				
Mercury	5.64	84.4	87	84.1
Arsenic	7.33	92.8	97.8	92.8
Chromium	6.37	48.2	18.4	69.9
Selenium	1.73	83.8	83.8	75.8
Ammonia [µg/stick]				
Ammonia	28.8	91.1	92.1	92.6
PAHs [ng/stick]				
5-methylchrysene	0.273	89.7	89.7	89.7
benzo(j)aceanthrylene	1.34	92.2	92.2	92.2
dibenz(a,h)anthracene	0.94	86.8	86.8	86.8
Volatile Nitrosamines [ng/stick]				
NDELA	3.36	83.2	85.8	57.1
NDMA	5.80	96.9	89.8	89.8
Volatiles [µg/stick]				
nitromethane	357	92.1	92.1	92.1
2-nitropropane	22.3	70.7	67.4	66.3

Table 2. HPHC analytes which are <95% reduced compared to 1R6F along with the reported 1R6F data with conditional formatting applied to highlight the differences in percentage reductions.

Average Reductions

The average HPHC and TobReg9 percentage reductions for each device tested compared to 1R6F are based on the mean of the reductions of each individual analyte and are captured in Table 3, these averages exclude nicotine.

Device Device Mode	hyper+ Standard	hyper X2 Standard	hyper X2 Air Standard
Average HPHC % Reduction	96.1	95.9	95.7
Average TobReg9 % Reduction	98.2	99.1	98.0

Table 3. Average HPHC and TobReg9 percentage reductions of the studied HHP compared to 1R6F.

Aerosol Compositions

The particulate aerosol composition is calculated by establishing the percentage of the major components in aerosol relative to the Aerosol Collected Mass (ACM). The aerosol composition of the test products compared to 1R6F are shown in Figure 1 & 2 and differ significantly with HHP aerosol from all devices tested consisting of higher percentages of glycerol and water content compared to 1R6F aerosol composition. 1R6F aerosol consists of significantly higher amounts of other compounds found in the particulate phase. Although only the aerosol composition of HHP used with hyper+ is shown below, all devices tested delivered similar aerosol compositions.

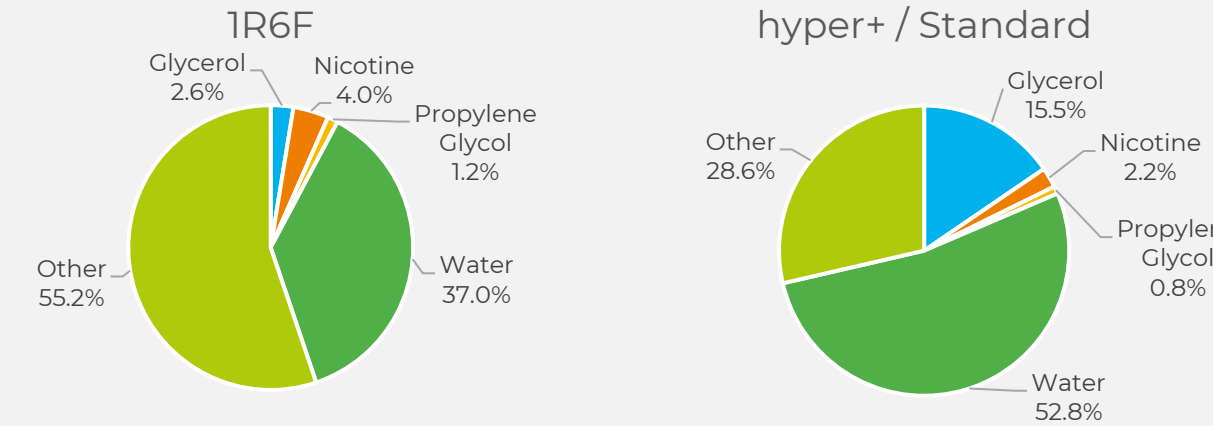


Figure 1. Aerosol composition of 1R6F.

Conclusion

A review of the emissions profile of a Rooibos-based HHP demonstrates that all HPHCs are reduced compared to 1R6F with the majority of compounds showing a significant reduction (>95%). TobReg9 analytes are also significantly reduced, >98% on average, compared to 1R6F. The aerosol compositions also differ significantly with HHP aerosol consisting of lower proportions of HPHCs found in the aerosol compared to 1R6F. This review indicates that the studied HHP has the potential to offer a reduced risk profile alternative to continued smoking of combustible cigarettes.

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Contacts

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