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Science Made Understandable

Toxicological Review:
Combustion Products of Rolly Receipts Rolling Paper

Final Report: November 6, 2020

Summary Statement

Rolly Receipts brand receipt paper is sold as an environmentally friendly, safe alternative to traditional, thermal-printed receipt paper. Rolly Receipts paper is also marketed as "Rolly Receipts Smokeable Receipt Paper" in which consumers may use purchase receipts as a rolling paper. It does not claim to be "non-toxic" or a "safer" alternative to cigarettes. Chemical analysis of combusted Rolly Receipts paper was performed to demonstrate the expected range of combustion products when it is used as a rolling paper, and to make comparisons with the reported range of components of typical cigarette smoke.

Rolly Receipts Smokeable Receipt Paper

Rolly Receipts paper is a new form of printable receipt paper that uses a proprietary technology to produce food-safe, touch-safe printed receipts. Unlike traditional thermal receipt paper, Rolly Receipts paper does not contain chemical inks or dyes, nor does it contains bisphenol A (BPA) or bisphenol S (BPS). The product is also marketed such that Rolly Receipts Smokeable Receipt Paper used in ATMs and credit/debit processing terminals may subsequently be used as rolling paper by the consumer.

Laboratory Analysis of Rolly Receipts Combustion Products

Avomeen (Ann Arbor, MI) is an analytical laboratory that services the life sciences, chemical analysis and product development sectors, including a dedicated Nicotine & Tobacco Products Testing Laboratory. Avomeen is accredited by the International Organization for Standardization under ISO17025, the Food and Drug Administration, and the Drug Enforcement Administration, and is a GLP and GMP compliant facility.

A sample of Rolly Receipts Smokeable Receipt Paper was delivered to Avomeen for chemical analysis. A headspace analysis followed by gas chromatography/mass spectrometry (GC/MS) was used to assess the range of chemicals liberated when the paper is burned. Headspace analysis is a routine and standard method for sampling volatile and semi-volatile chemicals. GC/MS is a sensitive analytical technique that separates and identifies individual components of a chemical mixture.

Briefly, a 30 gram sample of Rolly Receipts paper was combusted within a glass vial in such a manner as to trap the combustion fumes. A solid phase microextraction fiber (SPME) was introduced into the vial to absorb the combustion products. The SPME fiber was subsequently introduced into the GC/MS for semi-quantitative analysis of the absorbed combustion products.

The results of the analysis (Appendix I) indicate a range of combustion products including styrene and various alkyl benzene, alkyl biphenyl, substituted polyaromatic, dioxobenzoyl, substituted naphthalene and dioxopyridazino compounds. This range of chemicals is typical and expected for a combusted paper product. The semi-quantitative analysis showed the chemicals to be in the low part-per-million range (i.e., <1 to 50 ppm) for the 30 gram sample. A lesser mass portion of the paper, as would be used as an individual rolling paper, would therefore yield these chemicals in the parts-per-billion range.

Composition of Cigarette Rolling Paper and Cigarette Smoke

Cigarette rolling paper is composed of a lightweight, semi-porous paper that includes a variety of chemicals added to control porosity, taste and burn rate. While the mass of the rolling paper relative to the quantity of tobacco in an individual cigarette is relatively minor, the chemical components of the paper do constitute a measurable fraction of cigarette smoke, and contribute unique chemicals distinct from the combustion of the tobacco itself. The list of chemicals added to cigarette rolling paper includes organic and inorganic metal salts, organic acids and adhesive polymers[1,2].

As described in a report from the US Surgeon General[3], cigarette smoke is a complex mixture of chemicals in the vapor state as well as bound to particulate matter. Over 7,000 distinct chemicals have been identified in cigarette smoke. These represent chemicals present in the tobacco itself, chemicals added to the tobacco for flavor and to control smoking characteristics, additives in the paper and filter, and products of chemical reactions during combustion. Close to 100 of these compounds are harmful or potentially harmful[4], including the addictive stimulant nicotine, *N*-nitrosamines, polycyclic aromatic

hydrocarbons (PAHs), volatile organic compounds (VOCs), heavy metals, aromatic amines, and heterocyclic amines.

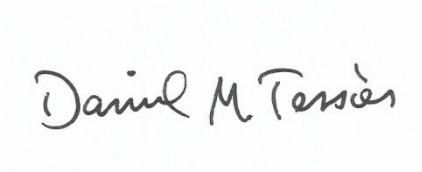
The harmful chemicals in cigarette smoke are variously categorized as carcinogens, respiratory toxicants, cardiovascular toxicants, reproductive or developmental toxicants (i.e., adverse health effects related to the ability to conceive children or on the developing fetus), and/or addictive compounds.

Rolly Receipts Paper as a Component of Inhalable Smoke

Chemical analysis of Rolly Receipts Paper indicates a limited range of combustion products relative to the thousands of chemicals present in cigarette smoke. Notably, this analysis revealed only a limited number of some of the concerning chemicals found in cigarette smoke (e.g. *N*-nitrosamines, PAHs). Therefore Rolly Receipts Paper does not produce toxic gases or particulates in excess of normal cigarette rolling paper, and may in fact yield less because it does not contain the chemical additives that are typically included in cigarette rolling papers.

While smoking has inherent health risks, the use of Rolly Receipts Paper as a rolling paper for smoking does not present any novel hazards when compared to the use of traditional cigarettes or cigarette rolling papers.

Reported and reviewed by



Daniel M. Tessier, Ph.D. November 6, 2020

References

1. Ullmann's Encyclopedia of Industrial Chemistry (7th ed.), Wiley, 2016.
2. Ken Podraza, Basic Principles of Cigarette Design and Function, Philip Morris USA, 2001. http://www.lsro.org/presentation_files/air/m_011029/podraza_102901.pdf.
3. US Dept of Health & Human Services, Office of the Surgeon General. How Tobacco Smoke Causes Disease: The Biology and Behavioral Basis for Smoking-Attributable Disease. 2010.
4. Food and Drug Administration. Harmful and potentially harmful constituents in tobacco products tobacco smoke; established list. Federal Register, 77(64), April 3, 2012.

Appendix I

Avomeen Analytical Report

AVOMEEN

Confidential Report

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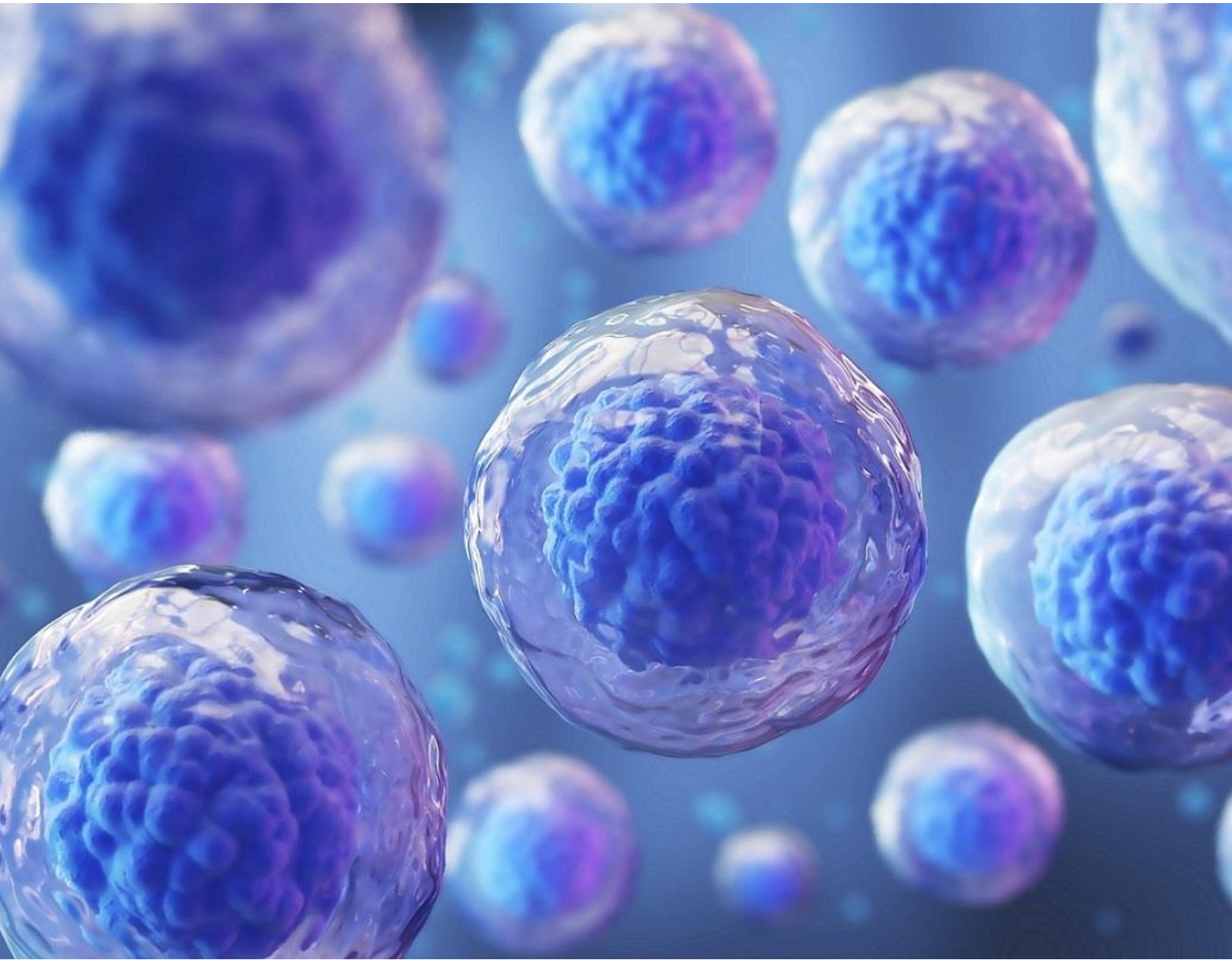

Analysis of Rolling Tobacco Paper

Thank you for contacting Avomeen for semi-quantitative analysis of combustibles from your products. Following are the results, methodology, and data associated with our analysis of the sample.

Table 1: Sample Description

Avomeen Sample ID	Sample Description
22JUN20RO2286	Sample #1 preferred tested rolling paper

Executive Summary

The goal of this analysis was to semi-quantitatively determine the amounts of the following materials in the burned sample: Amine Ether Nitrile, Furfural, Ethyl Benzene, Styrene, Hexadiene, Acetal, Benzaldehyde, Benzofuran, and Polyaromatic Hydrocarbons (PAH). The results are presented in Table 2.

Quality Statement

The work reported herein was conducted non-GMP and was not reviewed by Quality Assurance. All data in this report accurately reflects the raw data stored in the archives of Avomeen.

Analytical Testing

Initial Observations

The samples were received for analysis on 22JUN20. The samples were a small piece of folded rolling paper. A photograph of the samples "As Received" can be found in Figure 1.

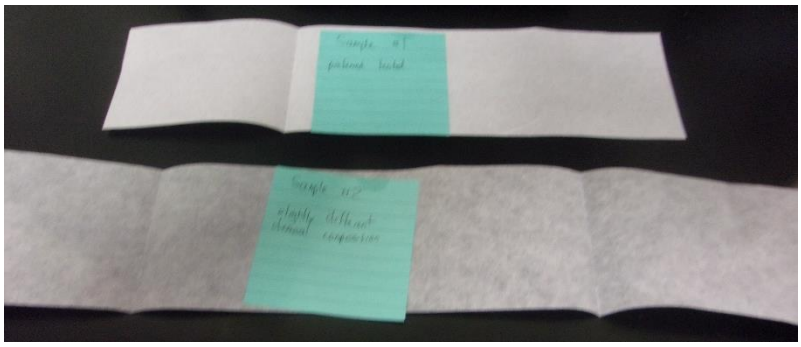

Figure 1: Photograph of the Samples "As Received"

Experimental

Gas Chromatography/Mass Spectrometry
Headspace analysis was performed using a SPME fiber being exposed to a sample in a crimped 20 mL headspace vial. An empty vial was used as a blank for analysis. For combustion, approximately 30 mg of paper sample was placed in a headspace vial and then burned. The SPME fiber was exposed to the sample for at least 30 minutes before GC/MS Analysis. For Semi-quant analysis, 30µL of xylenes was placed in a 20 mL headspace vial. The xylenes vial was heated to 50 ^{O}C before it was analyzed by GC/MS. The area for the xylenes was used for semi-quantitative analysis.

Instrumental Parameters

Instrument:	Agilent 6890N GC with Agilent 5973 Mass Selective Detector (MSD)
Column:	DB-5MS
SPME Fiber:	DVB/CAR/PDMS 50/30 µm (Manual Injection)
Temperature Program:	40^{O}C hold 4 min, ramp 25^{O}C/min to 300^{O}C, hold 3 min

Results and Discussion

Figure 2 shows the GC Chromatogram of the SPME Blank and the SPME from the combustion of the sample. This is a complicated chromatogram with over 100 tentatively identified compounds. Table 2 shows Peaks (min), a tentative identification, and semi-quantitative analysis for concentration. They are expected compounds from the combustion of a processed paper.

Figures

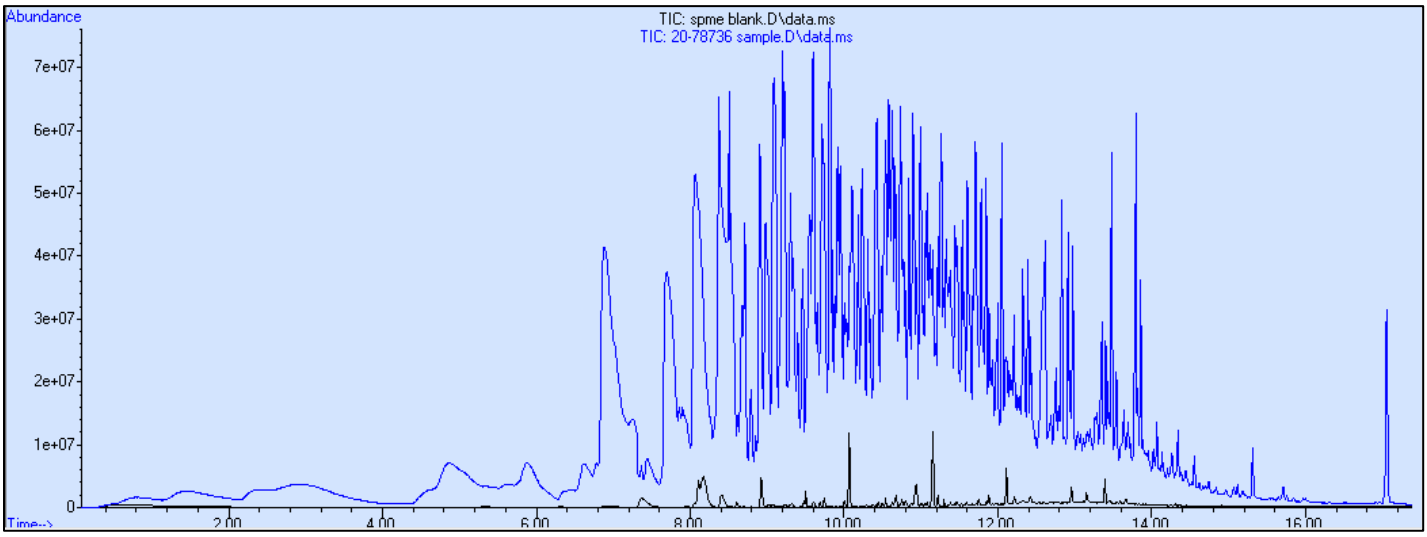

Figure 1: GC Chromatogram of the Combustion SPME Collection Compare to the Blank SPME Fiber

Table 2: List of Identified Volatiles and Semi-volatiles with the Peak Area Counts that Correlate with Concentration

Peak #	Retention Time (min)	Semi quantitative Amount (ppm)	ID/Family
14	7.374	1.6	Amine Ether Nitrile
15	7.446	7.6	Furfural
16	7.704	32.7	Furfural
19	8.073	50.3	Ethyl Benzene
20	8.375	40.0	Styrene
21	8.512	26.2	Styrene
22	8.617	2.3	Hexadiene
23	8.679	7.9	Hexadiene
24	8.706	50	Benzene, (1-methylethyl)-
25	8.797	5.2	Acetal
26	8.857	2.0	4H-1,3-benzodioxin-4-one, hexahydro-4a,5,dimethyl
29	9.091	27.5	Benzaldehyde
30	9.208	29.5	ά-methyl Styrene
31	9.308	10.7	ά-methyl Styrene
33	9.399	5.9	Benzofuran
47	10.241	16.0	2,4-dimethyl Styrene
48	10.315	12.3	2,4-dimethyl Styrene
49	10.426	21.1	Benzene, (1-ethyl-2-propenyl
50	10.485	5.9	Benzene, 4-pentenyl
51	10.543	17.3	Benzene, 4-pentenyl
52	10.589	14.0	Indene
54	10.670	11.8	Indene
55	10.737	15.6	Indene
57	10.844	9.7	Benzene, 1-cyclopenten-1-yl
58	10.901	14.6	Naphthalene
61	11.082	13.1	Benzene1-phenylbicyclo(2,1,1)hexane
66	11.333	9.0	Benzene1-phenylbicyclo(2,1,1)hexane
67	11.385	11.8	Hydrocinnamic Acid
68	11.449	7.4	Naphthalene, 1,2-dihydr-3methyl-
69	11.472	8.5	Naphthalene
70	11.539	12.4	Benzene, 1-cyclopenten-1-yl
71	11.605	15.9	Benzene, 1-cyclopenten-1-yl
72	11.715	19.11	Benzene
78	12.057	9.2	Biphenyl
79	12.108	6.5	Benzene
80	12.155	3.6	Benzene
87	12.612	4.9	1,1'Biphenyl, 4methyl-
91	12.835	12.9	Bibenzyl
93	12.975	13	Benzene, 1,1'-(1-methyl-1,2-ethanedyl)bis-
105	13.547	4.7	Benzene
109	13.796	12.0	Naphthalene (PAH)
110	13.863	13.9	Benzene
115	14.269	2.1	Benzene
116	14.343	2.5	Benzene, 1,1'-(1,3-butadienylidene)bis-
117	14.445	1.7	2,7-diphenyl-1,6-dioxopyridazino(4,5:2'3')
118	14.561	1.3	Dibenzene Ring
121	15.118	0.5	Naphthalele, 2-phenyl (PAH)

Description of Instrumentation Used

Gas Chromatography/Mass Spectrometry (GC/MS): GC/MS testing allows for the analysis of samples along multiple dimensions of chemical properties, providing specific identification of the different compounds separated during the GC analysis. The gas chromatograph separates a complex mixture into its individual components and delivers each one to the mass spectrometer. This analysis generates a chromatogram consisting of different peaks, one for each component of a mixture. The area of each peak is used to measure quantity. GC/MS analysis can be used both for qualitative and quantitative determinations of chemical composition.

History

Date	Revision	Changes
12OCT20	.00	New document
09NOV20	.01	Additional details of the method were added. Table 2 was updated with the identification results of higher certainty.

Wrap Up

Thank you for consulting with Avomeen. Results relate only to items tested. If you have any questions regarding this analysis, or if we can be of any further assistance, please call us at (800) 930-5450. Following the receipt of this final report, a final invoice indicating the remaining payment will be sent to you. Reports shall not be reproduced, except in full, without approval from Avomeen, LLC in writing.

It has been a pleasure working with you and we look forward to serving you again.

Sincerely,

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