



Chemical Composition of “Instead” Electronic Cigarette Smoke Juice and Vapor

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Study: Chemical Composition of “Instead” Electronic Cigarette Smoke Juice and Vapor

LIMS #: 20090399

SUMMARY

Two different liquid formulations (Instead Zero and Instead High) used in electronic cigarettes were tested by gas chromatography with a flame ionization detector (GC-FID) to identify the major ingredients in the mixture (nicotine, glycols, and glycerin) and their relative concentrations. In addition, vapor produced from an electronic cigarette containing each formulation was also assayed with GC-FID to compare the relative smoke composition in the vapor to that of the liquid. Propylene glycol, nicotine and glycerin were observed in the high formulation for both liquid and vapor, but diethylene glycol and ethylene glycol were not. Only propylene glycol and glycerin were observed in the Blue Zero formulation for both liquid and vapor samples. An estimate of the nicotine content was found to be 1.3% in the product.

EXPERIMENTAL

One bottle of Instead Zero and Instead High Smoke Juice along with an electronic cigarette were submitted for these experiments. The liquid formulations and vapors generated from the cartridge juice were characterized by GC-FID. The samples were designated as follows:

Table I: Sample Designations

LIMS #	Client ID	Description
20090399-01	Instead Zero	Liquid Product
20090399-02	Instead High	Liquid Product

For the liquid product analysis, an aliquot of each was diluted with methanol to obtain a solution with a concentration of 1000 ppm. The solutions were characterized on a Shimadzu 2010 GC-FID instrument equipped with a ZB-624 (Phenomenex, 30m x 0.32 x 1.8µm film) capillary column. Observed peaks were identified based on retention times in comparison to authentic specificity

standards of propylene glycol (PPG), diethylene glycol (DEG), ethylene glycol (EG), nicotine, and glycerin. Relative peak intensities were used to estimate the concentrations of the major components. These glycol specificity standards, the GC-FID column and the GC temperature program were based upon a modified version of a USP draft procedure for propylene glycol.

To capture the vapor emitted from an assembled electronic cigarette containing either the Instead Zero or Instead High formulation, a 125 ml evacuated glass bulb was used to draw air through the device and into the bulb. The smoke vapor was subsequently dissolved in MeOH for GC-FID analysis.

RESULTS & DISCUSSION

Specificity standards of propylene glycol, ethylene glycol, diethylene glycol, nicotine, and glycerin were used to determine the retention times and resolution of each component in both the liquid smoke juice and captured vapor samples. Based on these standards, the identity of each major peak was identified in the liquid and vapor samples.

Chromatograms of the Instead Zero solution (Figure 1) and vapor (Figure 2) showed only PPG and Glycerin present while the Instead High samples (Figures 3 and 4) showed an additional peak due to nicotine. Figures 5 and 6 compare the Zero and High sample chromatograms with the chromatogram of a solvent blank for the liquid and vapor samples respectively. No other glycols were observed at levels greater than 0.1%.

Based on the integrated peak areas of each chromatogram, the relative concentrations of major components could be determined (Table II). Since this study focused on the major ingredients in a smoke juice product and the generated smoke juice vapor, under the conditions employed, other minor components were not observed. A separate study with different sample dilutions and/or instrument settings could be employed to characterize minor volatile components that may be present in these samples.

Using data obtained using a single 1% nicotine standard solution, the actual nicotine content of this Instead High liquid product was estimated to be 1.3%. Quantitative analysis using a series of nicotine calibration standards would provide a more accurate measure of nicotine in this product.

Table 2: Composition Profile for Liquid and Vapor

	20090399-01 Instead Zero Liquid	20090399-01 Instead Zero Vapor	20090399-02 Instead High Liquid	20090398-02 Instead High Vapor
Propylene Glycol	72.9%	99.6%	69.6%	81.0%
Diethylene Glycol	nd	nd	nd	nd
Ethylene Glycol	nd	nd	nd	nd
Nicotine	nd	nd	3.9%	0.8%
Glycerin	27.1%	0.4%	26.5%	18.2%

nd = not detected

Method Detection level: Propylene Glycol = 1000ppm, Diethylene Glycol = 20ppm, Ethylene Glycol = 20ppm and Nicotine = 0.1% (1000ppm)

Figure 1: GC-FID Chromatogram of 20090399-01 Instead Zero Liquid

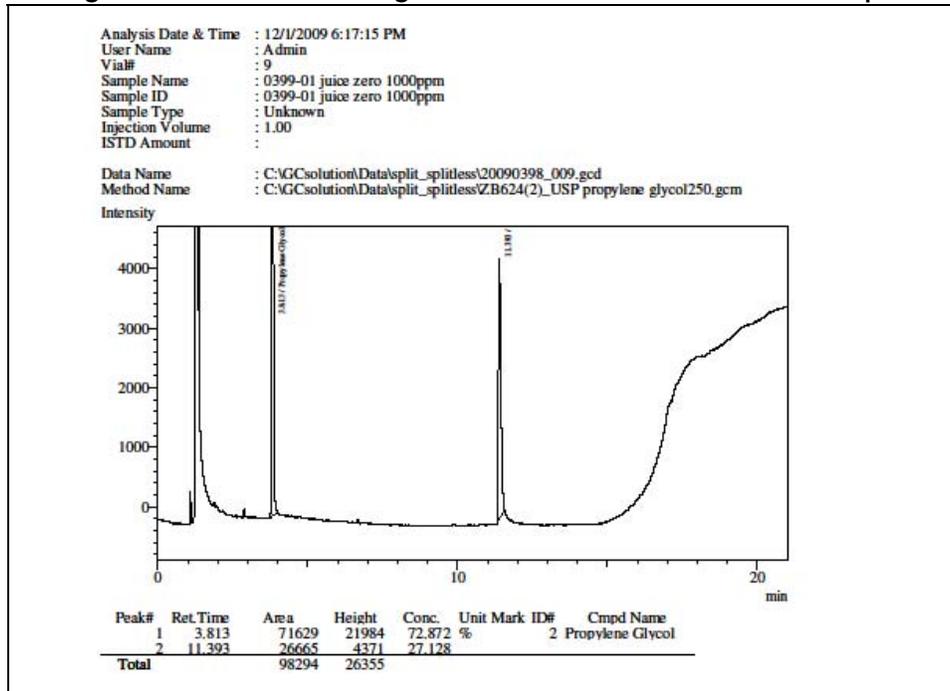


Figure 2: GC-FID Chromatogram of 20090399-01 Instead Zero Vapor

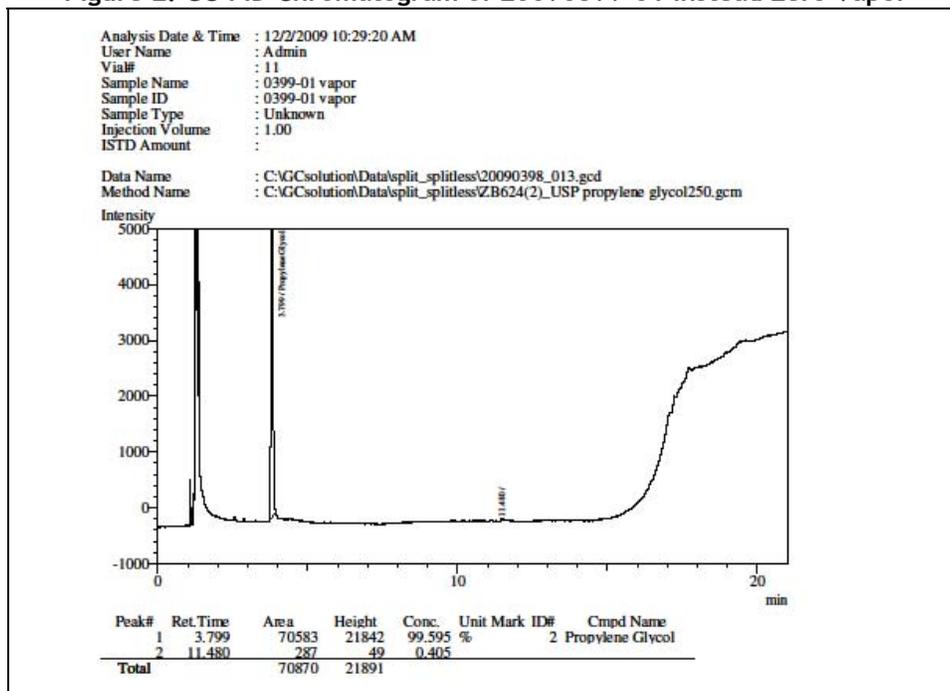


Figure 3: GC-FID Chromatogram of 20090399-02 Instead High Liquid

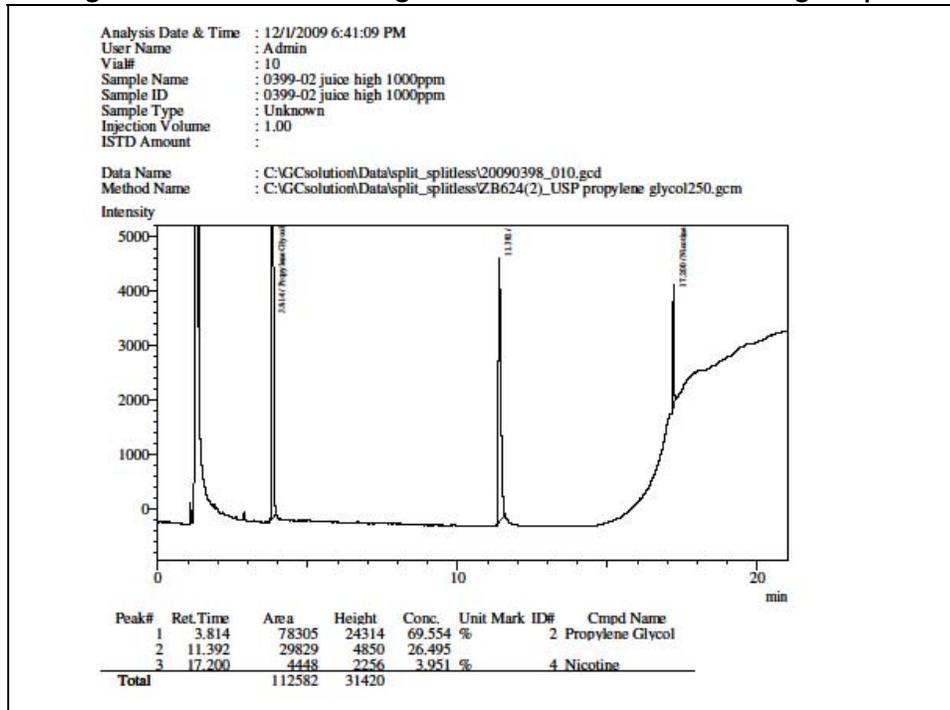


Figure 4: GC-FID Chromatogram of 20090399-02 Instead High Vapor

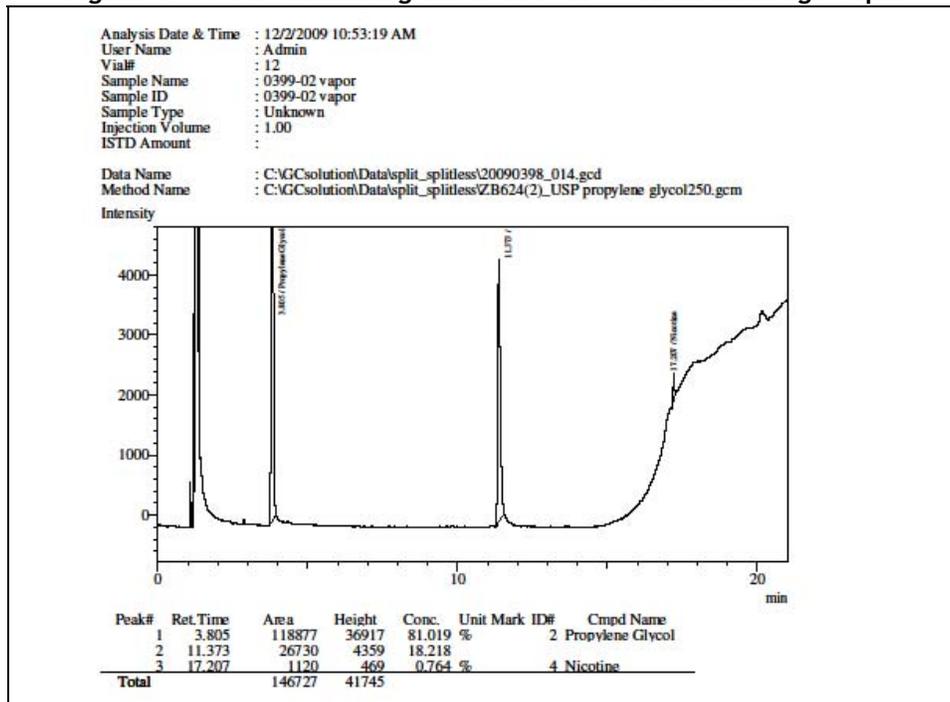


Figure 5: GC-FID Chromatogram Overlay of methanol blank (black), 20090399-01 Instead Zero Liquid (red) and 20090399-02 Instead High Liquid (blue)

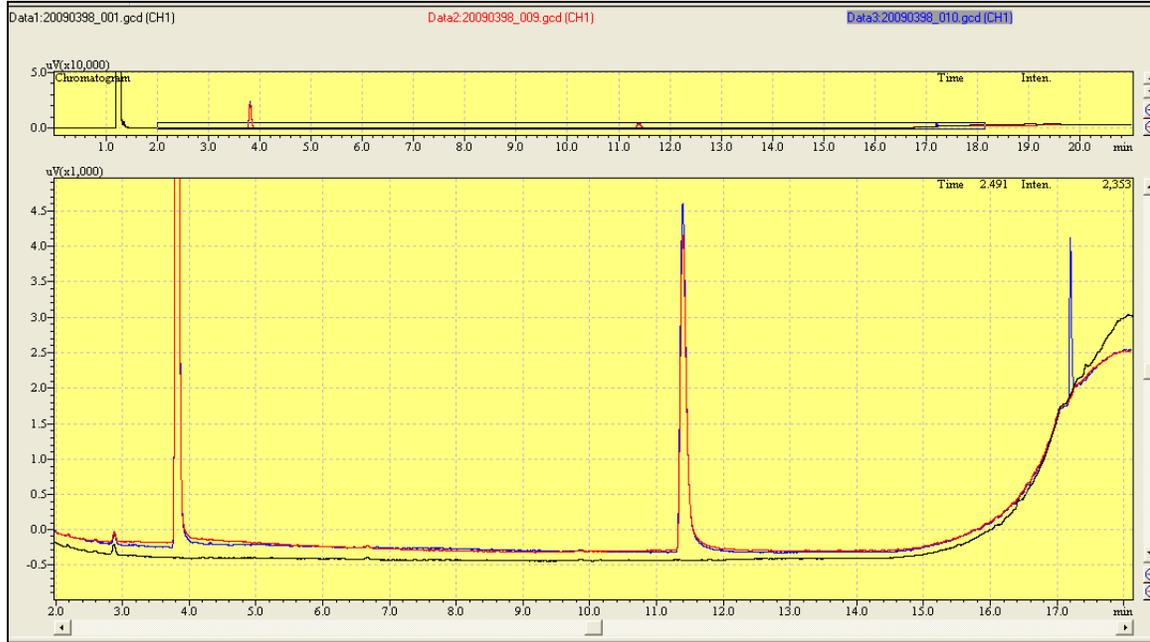


Figure 6: GC-FID Chromatogram Overlay of methanol blank (black), 20090399-01 Instead Zero Vapor (red) and 20090399-02 Blue Instead Vapor (blue)

