ANALYSIS OF VANILLA FLAVORED FOOD PRODUCTS USING ATMOSPHERIC-PRESSURE SOLIDS ANALYSIS PROBE

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Peter J. Lee, Joe Romano, Cecilia Mazza, Alex Tisserand, Ann Marie Ruel, Alice J. Di Gioia, Michael P. Balogh, and Jennifer Burgess
Waters Corporation, 34 Maple Street, Milford, MA 01757, USA

INTRODUCTION

Flavor, which entices our sense of taste and smell, is one of the paramount factors contributing to successful food products. Each food product manufacturer creates and maintains its own flavor profiles to distinguish its products from competitors. To ensure product quality and accurate labeling, the flavor ingredients and the final products are analyzed and authenticated through chemical analysis. However, most chemical composition analysis methods require sample preparation procedures including extraction, filtration, dilution, and chromatographic separation which are time-consuming and laborious. It is therefore most desirable to have a screening tool to quickly examine flavor profiles and authenticate product quality.

Vanilla extract is one of the most widely used flavoring ingredients in food and beverages. The authentic vanilla extract commands a premium price because demand exceeds supply. As a result, artificial vanilla flavorings, usually containing synthetically produced vanillin and ethyl vanillin, were often used as substitutes. Since synthetic vanilla cost only a fraction of the price of natural vanilla extracts, they are frequently used to counterfeit pure vanilla extracts. To make adulterated vanilla extracts taste like natural vanilla extracts, coumarin is often added. Coumarin, a toxic compound, is banned from all food products sold in the United States. In the EU, the maximum tolerance limit for coumarin in foods is 2 mg/Kg (EC Directive 88/388/ECC). It is essential for food companies to analyze vanilla extracts as well as food and beverage products to ensure product quality and accurate labeling for regulatory compliance.

Atmospheric Solids Analysis Probe (ASAP) is an ambient desorption ionization technique for mass spectrometric analysis.[1] The technique depends on both a heated nitrogen desolvation gas to vaporize the sample and a corona discharge for ionization. It is a useful ionization technique for directly analyzing volatile, semi-volatile, solid and liquid samples. This presentation demonstrates the use of ASAP to analyze flavor ingredients and screen banned substances in food products without sample extraction and chromatography separation.

METHODS

ASAP coupled to a TQD mass spectrometer was used to directly analyze food samples. The sample was loaded onto the sealed glass melting point capillary tube of the ASAP probe. The probe was inserted into the sealed MS source enclosure and the desolvation gas was rapidly heated to 200 °C. Data were acquired using full mass scan mode at 15V cone voltage and 100 °C source temperature for fingerprinting flavor ingredients. For screening coumarin in food products, the data were acquired using multiple reaction monitoring (MRM) mode with the following MS/MS parameters.

Precursor ion	Product ion	Cone voltage	Collision energy
147	103	30	22

RESULTS

Fingerprinting Flavor Ingredients in Various Food Products

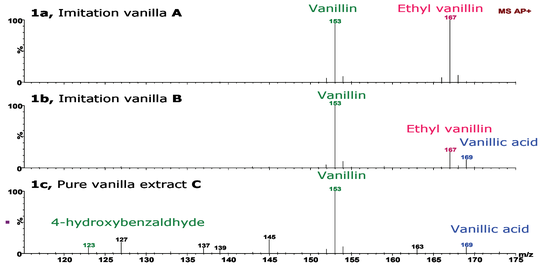


Figure 1. Comparison of imitation and pure vanilla extracts

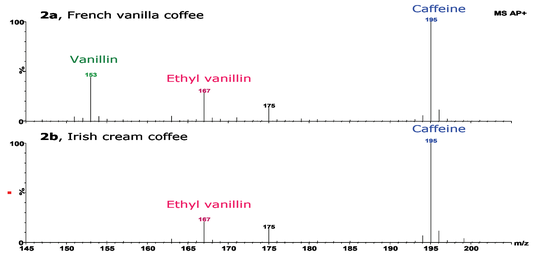


Figure 2. Comparison of French vanilla and Irish cream coffee samples

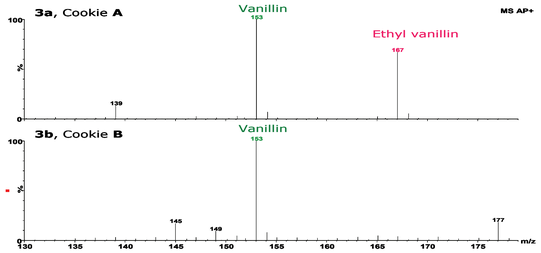


Figure 3. Comparison of two different cookie brands

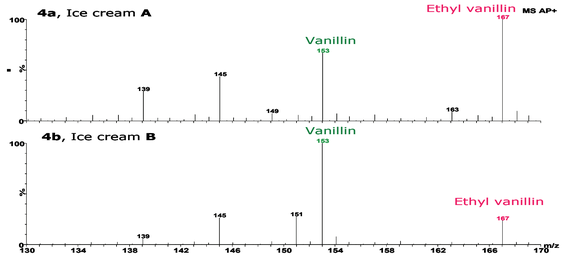


Figure 4. Comparison of two different brands of ice cream samples

Screening for Coumarin in Various Food Products

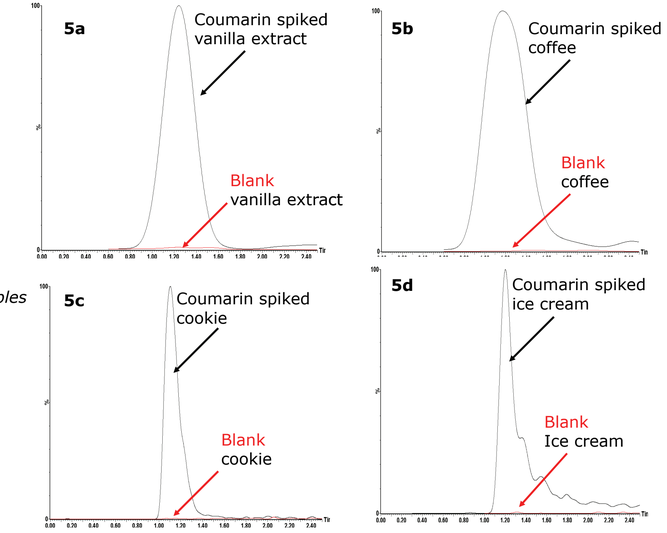
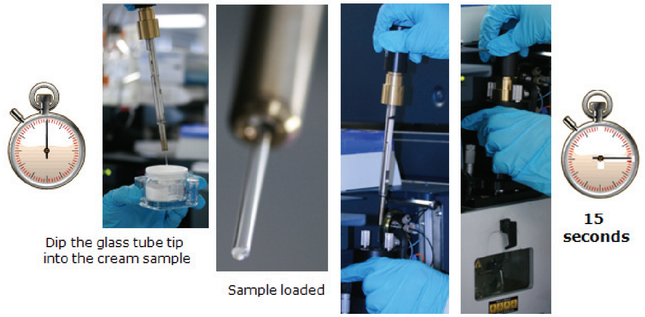


Figure 5. MS/MS ion current profiles (m/z 147 → 103) of coumarin spiked at 2 mg/kg (black traces) versus blank (red traces) in imitation vanilla extract (A), coffee (B), cookie (C) and ice cream (D).

ASAP Sample Loading Procedures



CONCLUSION

- ASAP can rapidly identify artificial vanilla and be used to fingerprint flavor profiles of various food products without sample extraction, sample dilution, and chromatographic separation.
- ASAP is capable of rapid screening the presence of coumarin at the level relevant to legislation (2 mg/kg) in various food matrices.
- The data illustrate the potential of using ASAP in a QC environment to rapidly screen raw materials and finished food products for specific components and banned substances.
- The ASAP solution greatly increases lab productivity through analytical time savings and greatly reducing operating cost of labs.
- In addition, the ASAP approach lessens the impact on the environment by reducing solvent consumption requirements.

REFERENCE

1. McEwen, C. N., Anal. Chem. 77 (2005) 7826-7831

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