DETECTION OF AGRICULTURAL PRODUCTS USING SENSOR ARRAYS

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Certain agricultural products containing meat, fruits, and other farm products are prohibited in the United States, but are often brought in by individual travelers. Since most agricultural products emit volatiles to some degree, we investigated the possibility of using sensor array ("electronic nose") technology for rapid or handheld detection and identification, using meat products as the test set.

We used headspace sampling and a variety of commercial samples of preserved meats, such as corned beef, roast beef, ham, and smoked salmon, to examine the variables involved. Our findings from these experiments include: (1) An array of sensors selected from several different sensor classes give greatly improved resolution of all types of meat samples, compared with arrays selected from a single class, such as metal oxide or electrochemical sensors. (2) Different types of meat (beef, pork, chicken) were readily discriminated, as were different preparations of the same meat (roast beef and corned beef). (3) Samples of the same meat from the same manufacturer, but with different lot numbers, were not discriminated. (4) Attempts to conceal the sample by wrapping with waxed paper or polyethylene reduced sensor responses but did not affect the pattern. (5) Room-temperature deterioration of the samples over several days caused characteristic changes in the principal components plots.

Headspace samples were collected from meat samples using SPME fibers and analyzed using GC-mass spectrometry. Selected aldehydes and isoprene compounds were found to be associated with most meat samples.

We conclude that sensor array methods will prove important in high-throughput agricultural inspections. This information may be used as the basis for sophisticated handheld detection systems for use by inspection personnel at ports of entry.

Figure 1. Principal component plot of volatiles from triplicate samples of roast beef (RB) and two brands of corned beef, measured using three classes of sensors.

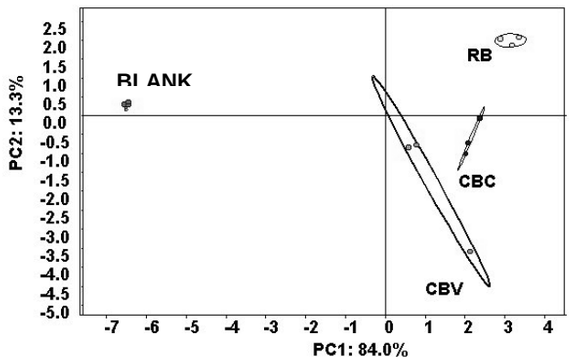

Figure 2. Trajectory of principal components of volatiles from a sample of cooked ham during ten days at room temperature, using electrochemical sensor data only.