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Researchers Develop AI-Based Test to Spot Fake Sherry Wine Vinegar

The approach pairs infrared spectroscopy with neural networks to screen for adulteration without destroying the product.

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Researchers have reported a method that could make it faster and easier to verify whether Sherry wine vinegar is authentic and whether it has been mixed with other substances. The study, published July 15, 2023 in Food Chemistry, tested a combination of infrared spectroscopy, chemometric analysis, and artificial neural networks to identify genuine samples and detect adulteration without destroying the product during testing.

The work focused on Sherry wine vinegar, often abbreviated as SWV in the study. The researchers said their goal was to create a rapid and reliable tool for authentication and fraud detection. To do that, they used attenuated total reflectance-Fourier transform infrared spectroscopy, or ATR-FTIR, a technique that measures how a sample interacts with infrared light and produces a spectral fingerprint based on its chemical composition.

The team analyzed FTIR spectral data from both genuine and adulterated Sherry wine vinegar samples. The adulterants included balsamic vinegar, cider vinegar, and synthetic acetic acid. Those are relevant substitutes because they can alter a product’s composition while making fraud harder to identify through routine visual inspection alone.

To interpret the spectral data, the researchers applied several analytical methods. They used principal component analysis, or PCA, as an exploratory tool to examine patterns in the samples. They then used partial least squares discriminant analysis, known as PLS-DA, and artificial neural networks, or ANN, to classify samples and support adulteration detection. In practical terms, the approach combined a fast chemical reading with statistical and machine learning tools designed to tell authentic vinegar apart from altered products.

According to the study, the method was able to successfully discriminate between genuine Sherry wine vinegar and adulterated samples with high accuracy. The researchers said the models also showed strong predictive performance, suggesting they could be used for rapid screening in quality control settings. The paper did not present the method as a replacement for all existing authentication procedures, but it did describe it as a useful addition for routine checks where speed and cost matter.

One of the main points of the study is that the method is non-destructive. That means the sample does not need to be consumed or heavily altered during analysis, which can be important in industrial and regulatory testing. The researchers also described the system as fast and cost-effective compared with more complex laboratory procedures. For producers, that could reduce the time needed to review batches. For regulators, it could help target suspicious samples earlier in the control process.

The study also points to the growing role of artificial intelligence tools in food verification. Artificial neural networks are designed to detect patterns in complex data, and in this case they were used alongside more established chemometric methods rather than on their own. That combination reflects a broader trend in food and beverage science, where machine learning is being used to strengthen traceability and identify fraud in products that carry added market value or strict labeling requirements.

That matters beyond vinegar alone. If the approach performs well in larger follow-up studies, it could give companies in the broader wine and beverage sector a quicker way to check authenticity and detect tampering in a high-value product. That could improve internal quality control, support traceability claims, and help protect brands from fraud risks that can damage consumer trust. It may also be useful for official oversight in markets where origin, composition, and production methods affect price and reputation.

At the same time, the researchers were careful not to present the method as finished. They said further studies are needed to expand the database of possible adulterants and improve model precision. That step is important because fraud methods can change, and analytical models tend to become stronger when they are trained on a wider range of real-world samples. A tool that works well against a limited set of adulterants may need additional validation before it can be applied broadly across different producers, storage conditions, and market channels.

Even with that limitation, the study adds to a growing body of work aimed at making food authentication more practical outside highly specialized laboratories. In this case, the research suggests that a sample of Sherry wine vinegar can be screened quickly through its infrared signature and then evaluated with statistical and AI-based models to determine whether it is likely to be genuine. For a product vulnerable to substitution

with cheaper ingredients, that offers a possible path toward faster fraud detection and more consistent quality control.