#### CASE STUDY :

# Flavored Beverages

**Results of Evaluation of Flavored Waters** 





Consumers' drive for more healthy and functional beverages has led to a huge jump in the flavored water market in recent years. Interest in new and sometimes unusual taste combinations that support well-being is leading to an increasingly competitive market.

The emphasis on clean, natural flavors has translated to a consumer perception that these beverages taste crisper and fresher than their traditional soda counterparts. As brands seek to expand their flavor offerings, achieving the right flavor essence for still or sparkling waters continues to be a challenge. Digital olfaction offers a solution for both new product formulation and existing product quality control. However, given the low intensity of odors to achieve the "hint" of flavor, this use case requires a sensory analysis tool that is not just objective and dependable, but also highly sensitive and selective.





## Challenge

As the flavored water market continues to grow, there is more competition in both brands and flavors available to consumers. The ability to deliver the right balance of flavor both in product manufacturing and R&D formulation for new products — is important to customer acquisition and loyalty.

Sensory analysis still heavily relies on human panels—which can be expensive and prone to subjectivity. Digital olfaction provides a consistent, objective way to characterize and control the olfactive experience for flavored waters.



## Solution

Digital olfaction combines biosensors, advanced optics and machine learning to mimic the human sense of smell which can then be used for objective classification and characterization of flavors.

To illustrate the potential for this technology in the flavored water field, Aryballe tested eight different flavored waters to determine the ability of their NeOse Pro and Amplifier accessory to classify the different products. Unflavored water was also used as a control in the experiments.

Sample	Flavor
Control	Non-flavored Water
Α	Grapefruit
В	Lemonade
С	Lemon
D	White Peach
E	Organic Strawberry
F	Strawberry
G	Organic Apple
Н	Red Tea, Mango, and Passion Fruit

Phase One experiments (Direct Measurement) were performed with a NeOse Pro equipped with a HeptaValve to ensure repeatability and consistency of samples. A small volume (5 ml) of each flavored water was placed in a 50 ml vial and stored at room temperature for 2 hours to allow the headspace to develop.



Figure 1: Phase One experiment set up with HeptaValve and NeOse Pro allows for direct measurement.

The first phase experiments are presented in Figure 2 showing the PCA result of the products against the control. There was significant intensity above the limit of detection (LOD) of the NeOse Pro for all samples.







The PCA in Figure 2 shows two well defined clusters for Sample A (Grapefruit) and Sample G (Organic Apple) while the rest of the samples are clustered together on the left side of the horizontal axis.

While the results of direct measurement showed some clustering, it was not possible across the full portfolio of products tested, meaning that as an analysis tool the NeOse Pro could not feasibly replace current evaluation methods.

In Phase Two of the experiments, we implemented the NeOse Pro coupled with an Amplifier, which is an accessory with a Tenax TA cartridge which allows for the concentration of odors pre-measurement.

During this concentration step, the humidity signal is also removed from the captured odor data. For this reason, no signal was achieved for the Control (non-flavored water) as there is no remaining flavor (i.e. odor) after the sample is concentrated. For this reason, the data in Phase Two experiments does not include datapoints for the Control.



Figure 3: Phase Two experiment set up with Amplifier and NeOse Pro allows for concentrated measurement.

In this setup, 10 ml of each flavored water was added to a 100 ml vial and stored at room temperature for 2 hours to allow the headspace to develop. In the concentration step, odors were collected in the Amplifier for 180 seconds. After the 180 second concentration, all flavored water samples provided a signal above the Limit of Detection for the NeOse Pro device.





The PCA shows a good separation for all the flavored waters with a 95% confidence for those with a signal above the limit of detection for the device.



## Conclusion

In general, the direct measurement with the NeOse Pro device (phase one experiments) did not show good distinctions across the flavored water portfolio in this experiment. However, when coupled with the Amplifier accessory, the NeOse Pro was able to distinguish all the samples due to the Amplifier's "drying" effect on the odor signals, which makes the flavor easier to distinguish from the water background.

The results of the tests showed that when coupled with a concentration accessory, the NeOse Pro can be used to distinguish differences in flavored water portfolios even across very similar flavors like Strawberry versus Organic Strawberry and Lemonade versus Lemon. The addition of the Amplifier accessory allows the NeOse Pro to overcome common challenges around sensitivity and specificity that is commonly found in high humidity use cases like beverages.



#### About Aryballe

The best human noses can distinguish 10,000 odors. Unlike color and sound, smell does not fall along a clear spectrum, making it hard to compare various odors. But Aryballe is helping to change this by evaluating characteristics of individual scent molecules and testing them against a data-base of known smells using a combination of biochemistry, advance optics and machine learning.

Based in Grenoble, France, Aryballe develops and manufactures bioinspired "digital nose" sensors enabling groundbreaking applications in the food, cosmetics and automotive industries. Founded in 2014, it released its first product, the digital nose NeOse Pro in early 2018. Fast, portable and sensitive to hundreds of odors, NeOse Pro is used for quality control in the cosmetic industry, new flavors development in the food & beverage industry, or materials quality monitoring in the automotive industry.

#### **HEADQUARTERS**

7 rue des Arts et Métiers 38000 Grenoble, France +33 4 28 70 69 00

🕀 aryballe.com

US

101 Crawfords Corner Rd Suite 4-101R Holmdel, NJ 07733 USA



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