

Perishable food monitoring via volatile tracking

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Dated: 12th July, 2023

INTRODUCTION

Perishable food items, such as meat and fish, are susceptible to decay and spoilage due to the complex interplay of microbial processes, temperature, and time. Monitoring these changes is crucial for ensuring food safety and quality. One valuable approach to achieve this is the detection of volatile organic compounds (VOCs) released during the decay process. This technical blog post explores the microbial processes of food decay, the volatiles involved, the impact of refrigeration, and how volatile tracking benefits both consumers and sellers in making informed decisions.

Microbial Processes in Food Decay

The decay of perishable food items is primarily driven by the growth of microorganisms, including bacteria, yeasts, and molds. These microorganisms break down the food's organic compounds, leading to undesirable changes in texture, flavor, and safety.

- **Bacterial Decay:** Bacteria are often the primary culprits in meat and fish decay. The microbial community shifts as different species of bacteria dominate at various stages of

spoilage. Some common spoilage bacteria include Pseudomonas, Shewanella, and Aeromonas, which produce VOCs as metabolic byproducts.

- **Yeast and Mold Activity:** Yeasts and molds can also play a significant role in food decay, especially in humid environments. They generate unique VOCs, contributing to the overall deterioration of the product.

Volatile Organic Compounds (VOCs) in Food Decay

As microorganisms metabolize food components, they release VOCs, many of which are responsible for the characteristic off-odors associated with spoiled food. These compounds vary depending on the type of food and the specific microbes involved. Common VOCs in meat and fish decay include:

- **Amines:** Putrescine and cadaverine, produced by bacteria, contribute to the foul odor of spoiled meats.
- **Sulfur Compounds:** Compounds like hydrogen sulfide and dimethyl sulfide are produced during spoilage, imparting a "rotten egg" smell.
- **Aldehydes:** Aldehydes, such as hexanal and octanal, are associated with rancidity in fats and oils found in meat and fish.
- **Ketones:** Certain ketones, like 2-heptanone, produce a musty or moldy odor, often associated with fungal growth.

The Impact of Refrigeration on Decay

Refrigeration is a common method for extending the shelf life of perishable food items. Lowering the temperature can slow down microbial activity, reducing the production of VOCs and the rate of decay. However, refrigeration is not a panacea, and some deterioration still occurs over time.

The cold storage temperature can affect the rate of decay:

- Chilling (0-5°C): Slows bacterial growth but may not halt it entirely. Some psychrotrophic bacteria can thrive at these temperatures.
- Freezing (-18°C or lower): Freezing can preserve food for longer periods by inhibiting microbial activity. However, freeze-thaw cycles can lead to structural changes and affect food quality.

Volatile Tracking for Consumer Decision-Making

Consumers are increasingly interested in making informed decisions about the food they purchase and consume. VOC detection technology provides valuable information to aid in these choices.

- Quality Assessment: Volatile tracking enables consumers to assess the freshness of perishable items. If specific VOCs associated with spoilage are detected, it is a clear indicator that the product may no longer be suitable for consumption.
- Product Selection: By monitoring the VOC profile of different products, consumers can select the freshest options, leading to better taste and nutritional value.

- Reducing Food Waste: Consumers can reduce food waste by identifying items that are nearing their shelf life. This allows for timely consumption or the decision to choose alternative products with longer shelf lives.

Volatile Tracking for Sellers

Sellers, including retailers and food service providers, can also benefit from volatile tracking in several ways.

- Quality Control: Monitoring VOCs allows sellers to ensure the quality of products on their shelves. They can identify items that have surpassed their optimal freshness and remove them from sale.
- Inventory Management: By tracking the freshness of perishable items, sellers can manage their inventory more efficiently, reducing the risk of unsold, expired products.
- Discount Strategies: Sellers can use VOC data to implement dynamic pricing strategies, offering discounts on items nearing their shelf life. This reduces waste while providing consumers with cost-effective choices.
- Brand Trust: Sellers who actively use VOC tracking to maintain product quality build trust with consumers who appreciate the commitment to delivering fresh and safe food.

CONCLUSION

Detection of volatile organic compounds in perishable food items is a powerful tool for assessing the quality, freshness, and safety of products like meat and fish. Understanding the microbial processes that drive decay, the VOCs associated with spoilage, and the impact of refrigeration allows consumers and sellers to make informed decisions. This technology not only reduces food

waste but also enhances overall food safety and quality standards in the perishable food industry. As advancements in VOC detection continue, its role in food assessment and decision-making will become even more significant.