COLD BREW COFFEE:
RECOMMENDATIONS FOR INDUSTRY

Product Description, Food Safety, & Stability Evaluation

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Important: About This Document. This document is intended as a starting point - not a definitive prescription. Each individual manufacturing process is unique, distinct brands have different goals, and industry, food science, and safety regulations continue to evolve. As a result, this document should only be used as a reference and as part of an overall food safety program designed specifically to meet the needs of your particular organization. Cold brew should only be produced under the guidance of qualified individuals. These materials have been produced by a committee of industry experts and are accurate and up-to-date at the time of publication and may be revised as new information becomes available.
Cold Brew Description

Introduction

Cold brew coffee has exploded in popularity in recent years. Consumers view it as a premium product, which offers both convenience and quality. Many businesses are considering cold brew as a potential revenue stream worth exploring, while others have already enthusiastically entered the market.

This report was produced by a working group of NCA members and experts from across the industry, in the interest of maintaining the integrity of cold brew as a method to craft premium quality and reliably safe beverages.

Our intent is to educate both the coffee industry and consumers on what cold brew coffee is (and is not), as well as provide best practices for preparation. This document does not provide legal advice and should not be relied upon to ensure compliance with applicable local, state, and federal laws.

Cold brew coffee has unique food safety considerations. By identifying the extensive and evolving range of product formats in the marketplace, we can better understand the industry's food safety and quality needs and develop educational and resource tools to aid in compliance with standards and regulations.

Cold brew's popularity expands beyond coffee to include products like tea, cascara, and cacao. For the scope of this discussion, we have focused exclusively on coffee. Other products have their own safety concerns, which should be considered on their own.

Description of Cold Brew

Cold brew coffee is made with roasted and ground coffee. The coffee is extracted with water at ambient or cooler temperatures. In most cases, the brewing process trades time for temperature – instead of brewing with very hot water over a very quick duration, cold brewing typically uses cool water and extended periods of time to extract an optimal amount of flavor compounds and solids from the beans. Factors such as contact time, temperature, roast level, grind size, or steeping method may all influence the final brew composition.
Cold Brew FAQ

At its core, cold brew is a *brewing method*, not a serving method. Here are some common questions to help clarify this concept:

**Is all iced coffee considered “cold brew”?**
No. Coffee brewed with hot water extraction methods, whether served hot or cold, is not cold brew. Cold brew is not simply a marketing term. It does not refer to coffee that was extracted with hot water and then chilled prior to serving. Instead, it refers to coffee extracted at ambient or cooler temperatures. The resulting product can then be chilled or served over ice and be considered iced coffee or iced cold brew.

**Is all cold brew coffee served as a cold beverage?**
No. Cold brew coffee can be served hot. Again, cold brew refers to a brewing method, not a serving method. In fact, historically in the United States cold brew coffee was brewed as a concentrate, diluted with boiling water, and served primarily as a hot beverage. (This was prior to iced coffee becoming popular.) Cold brew coffee is also used as an ingredient in a variety of food and beverage products.

**How does cold brew extraction work?**
Simply put, cold brewing extracts at a lower temperature and generally for a longer time than conventional hot water extractions. This unique combination of cooler temperature and longer contact time may produce a unique sensory and quality profile in the finished beverage.

**What are the sensory and flavor characteristics that result from the cold brew brewing method?**
Flavor profiles of cold brew may vary significantly from coffees brewed at higher temperatures. Common traits typical to cold brew include: less bitterness, smoother taste, and the enhancement of more delicate flavors. The same coffee brewed by cold or hot methods can taste either very similar or drastically different when evaluated side-by-side.

**Cold Brew Safety Considerations**

Hot, brewed coffee has a long tradition of being a low-risk beverage for food safety. Even so, there are still important safety considerations for product preparation and manufacturing processes. Anyone who makes or serves cold brew has an obligation to follow the appropriate steps to ensure the safety of their product.

Additionally, the Food Safety Modernization Act (FSMA) requires that certain establishments engaged in manufacturing, processing, or packing food or beverages
(including cold brew) comply with a wide array of regulations and practices, such as completing a comprehensive food safety plan, conducting a hazard analysis, and following Current Good Manufacturing Practices (cGMP).

**Specific Cold Brew Considerations**

When evaluating any food for the level of food safety risk, at each step we should ask: “If we do nothing to control the risk, will someone get sick or die?” If the answer is “We don’t know,” then more information must be gathered to definitively answer this question. In other words, the answer to this question must be assumed to be “Yes,” and maximum control must be used to mitigate the risk.

Traditional roast and ground coffee (R&G) has a very long history of being safe. There has never been a food poisoning outbreak related to coffee.

The reasons for this are several-fold:

- The way green coffee is grown and stored dry for long periods of time
- Coffee is exposed to high heat during roasting (Bonlander et al, 2013).
- That coffee is exposed to near-boiling water during brewing prior to consumption, and hot brewed coffee is typically consumed rapidly (with leftovers discarded once cool).
- The anti-microbial compounds produced during roasting, and the (potentially) low level of nutrients present to support microbial growth (Daglia et al, 1994; Almeida et al, 2006; Arora et al, 2009; Martinez-Tomé et al, 2011).

Cold brew removes the exposure to hot, near-boiling water during brewing. As such, an initial assessment of food safety should be carried out by each manufacturer based upon their unique production process. A re-assessment should be followed after any changes are made to the facility, formula, or equipment.

Despite all these unknowns, there are some tried-and-true ways to ensure that cold brew coffee is safe for consumption:

- Robust cGMP’s should be in place in the facility that produces the product. This will reduce the food safety risk by about two-thirds.
- A thorough risk assessment by an expert of the facility, ingredients, equipment, finished product, and process should be done (HACCP – Hazard Analysis and Critical Control Point, HARPC – Hazard Analysis and Risk-Based Preventive Controls, Challenge Studies). This will reduce the food safety risk by about one-fourth.
- A comprehensive change management program that adapts food safety controls to any new changes in facility, recipe, equipment, or process, and unique needs
such as in a retail or manufacturing setting. This will reduce most of the remaining food safety risk associated with the cold brew.

Ready-to-Drink Cold Brew

Ready-to-Drink (RTD) products are a fast-growing segment of the coffee industry. There are several key steps that must be taken to avoid a food safety related incident:

- Understand that the pH of the product must be closely controlled to mitigate the risk of *Clostridium botulinum*, a deadly pathogen, in hermetically sealed containers.
- Hire a qualified Process Authority to write up a recipe and process that will adequately control for *C. botulinum*.
- Follow the Process Authority’s instructions to the letter.
- If there is any deviation from the instructions provided, consult the Process Authority on their recommendations for disposing the finished product.
- Complete challenge studies, which involve testing the ability of unwanted microorganisms to grow in a product in use and abuse conditions (E.g., If a nitro cold brew is low-acid and processed under low-heat conditions, such as in pasteurization, and uses a refrigerated supply chain, a challenge study could assess for safety from spore-forming bacteria and compare against an existing formulation as a control.)

In summary, traditional roast and ground coffee is safe, but cold brew coffee must be evaluated to prove it is safe. This is done by assessing the ingredients, brewing process, manufacturing facility, cleaning and sanitation practices, and the finished product’s shelf life.

A robust cGMP program will go a long way to reducing food safety risk (about 70%). A competent risk assessment (HACCP, HARPC, Challenge Studies) of the facility, ingredients, equipment, finished product and process will significantly reduce food safety risk (about 25%). A comprehensive change control program involving food safety controls around any new changes in facility, formula, equipment or process will account for almost all the remaining food safety risk.

RTD products are a special category of products which have special requirements, such as hiring a qualified Process Authority when manufacturing and understanding the role of pH in controlling *C. botulinum*.
**Shelf-Life Testing Considerations**

Initiating a shelf-life test of a cold brew product is important for understanding how different factors may affect product quality or safety over time. These can include formulation and ingredients, the manufacturing process, packaging type, or storage and distribution conditions.

Conducting shelf-life testing can provide invaluable information for establishing the product best-by date, which is often determined by evaluating when a product fails to meet a minimum quality standard. This minimum standard is typically set by experienced and knowledgeable product formulators or is based on consumer data gathered from sensory testing and consumer complaint information.

*The best-by date should not be determined based on food safety. Food safety should be based on following a comprehensive food safety plan and food safety principles.*

This section will identify factors to consider in designing and conducting a shelf-life test to determine product stability and quality. Due to the complexity of regulatory requirements and the impact to human health, cold brew manufacturers should conduct challenge testing using a qualified food safety expert. Designing such a test is outside the scope of this document.

When initiating a shelf-life test, variables to consider in the experimental design may include:

- **Product Type** – Cold brew product formats are often present as dry grounds in roasted and ground (R&G), in liquid form as concentrate, or ready-to-drink strength.

- **Packaging Format and Material** - R&G is often sold in conventional cans or bags, or pre-measured into filter bags or sachets, which is often marketed for at-home or food service preparation. Industrial liquid preparations are often bottled in plastic or glass bottles or dispensed into stainless steel kegs. Choices in packaging material are made for reasons such as cost, size and dimensions, barrier property for moisture or oxygen, recyclability and sustainability, printability, and other functional attributes. Packaging can also contain plasticizer, or cause flavor scalping (i.e. migration of flavor components into packaging material). The functionality to the end consumer and for the retailer/customer are also things to consider.

- **Temperature and Time** – The temperature at which a product is stored or exposed to over a specified duration of time can significantly affect product stability and food safety. When designing a shelf-life study, it is important to
consider the range of temperatures the product may be exposed to, and for what duration of time. Test designs often evaluate product at the main storage temperature predicted for the life of the product, and then may also stress the product by high or low temperature to determine if key quality attributes change or are compromised. Results can then affect how a product shelf-life date is set, as well as storage, handling, and distribution specifications.

- **pH** – The pH of a food or beverage product is a measure of its acidity, neutrality, or alkalinity. It can affect the storage stability of ingredients, the perception of sensory properties, and the favorability or inhibitory property of the food matrix to support the growth or survival of microorganisms.

- **Water Activity (aw)** – The aw (or % Relative Humidity/100) is indicative of the presence of free water available in the food matrix. Differences in aw can affect product stability, such as accelerating losses in product quality. At higher levels, it can support the growth of microorganisms, such as molds and yeasts (Jay, 2005).

- **Formulation Ingredients** – The addition of dairy or non-dairy whitener, sweeteners, acidulants, chemical preservatives, flavor systems, stabilizers, and other ingredients can significantly affect the quality and safety of a cold brew product, and its classification as cold brew. The incoming quality and microbial load for each ingredient should be carefully reviewed and evaluated for potential effects on product stability. E.g. When formulating a flavored cold brew coffee product, consumers often desire natural flavors. A challenge in formulating is that natural flavoring components often degrade more rapidly than flavors containing artificial constituents. The flavoring carrier, such as in dry powder or liquid, can also significantly impact product quality and the characteristics of the flavor’s sensory profile or fidelity.

- **Processing Conditions** – How a product is manufactured can have significant impact on quality and food safety. Factors to consider may include thermal processing time, temperature, holding conditions, impact of pressure, turbulent flow, exposure to ultraviolet light, oxygen, stabilizers, equipment make and model, and settings.

- **Headspace Gas Composition** – Atmospheric gases such as carbon dioxide (CO₂), oxygen, or nitrogen can have varying impact on product stability. Fresh roasted coffee actively degases, giving off volumes of carbon dioxide (CO₂), carbon monoxide (CO), and volatile organic compounds (VOC). Oxygen exposure may also interact with the roasted coffee and contribute to product oxidation. An inert gas, such as nitrogen, flushed into the product headspace may help reduce the rate of oxidation.

- **Light** – Light can contribute to sun-struck off-flavors and vitamin degradation in certain liquid beverage types. Its impact to RTD cold brew coffee is unknown.
An Example of a Shelf-life Test Experimental Design

Test Objective: To learn how storage temperature, time, and packaging material affect product quality through storage.

Experimental Factors and Levels:
- Temperature (e.g. 40°F, 70°F, 110°F)
- Time (e.g. 0 days – 6 months)
- Packaging (e.g. Clear glass bottle, stainless steel keg with screw cap)

Quality Attributes to Evaluate at Sample Pull Date/Time:
- Sensory (e.g. A difference-from-control test, comparing against a control)
- pH
- Titratable Acidity
- Opacity or Turbidity

When starting a test, it is desirable to take product produced from commercial-scale trials whenever possible, as this is most likely to represent the real-world conditions under which sale-able product is produced, distributed, and consumed.

The experimental design may also often include controls, which help to compare effects produced by experimental factors or variables. The controls can represent both a negative control (i.e. a control group that is not subject to the experimental condition or intended to develop an effect) and/or a positive control (i.e. a control group that is subjected to the experimental condition and is expected to develop an effect). An action standard may also be set, setting a minimum benchmark against which other products need to perform at parity or better through the duration of a test. When a product consistently fails to meet minimum standards defined for safety or quality, then a product would generally fail the test. If a product is distributed and sold at ambient conditions, then a shelf-life test may often, but not always, be conducted to include a room temperature variant. When a product fails to consistently meet minimum standards after being held at these conditions, then a shelf-life determination can often be made from this evaluation. If a variant is stored at a higher temperature, then this may often be called stressed or accelerated testing conditions. A determination to relate high temperature to ambient testing conditions can only be made after the product type has been thoroughly evaluated at both temperatures and related for quality or safety attributes.

When determining the number of samples to put into the study, a common practice is to evaluate samples at each time point in duplicate or triplicate. This helps to control for any outliers and minimize sample error and variances.
Ambient: Ambient or “room temperature” refers to the temperature of the surrounding air and is not necessarily correlated to a specific temperature range. For coffee brewing purposes, ambient temperature water has not been chilled or heated; ambient temperature brewing is usually brewing in an open room versus in refrigeration.

Bag in Box / BnB / BIB: One of many delivery systems for beverages sold through the Food Service channel.

Best by date: Last date that guarantees optimal quality of the product.

Body: The way the beverage is perceived on the tongue. ‘Heavy’ body is like full fat milk. ‘Thin’ body is like water.

*Brix: The percent of soluble solids in a given solution.

Challenge studies: Microbiological testing of a product to determine its capability of supporting or inhibiting the growth of microorganisms. Testing can be performed at different aspects of a product’s lifecycle, e.g. from initial formulation, processing at a specific time/temperature condition, at a preventive control, or at shelf-life stressed or accelerated testing conditions.

Coffee concentrate: Coffee that has been brewed stronger than typically consumed; intended to be diluted prior to serving.

Extraction: Coffee extraction, or brewing, is the process of dissolving soluble flavors and compounds from coffee grounds into water.

HACCP: Hazard Analysis and Critical Control Point. A defined process in which potential hazards and means of controlling the hazards are identified. Hazards can be biological, physical, chemical, or radiological in nature.

HARPC: Hazard Analysis and Risk-Based Preventive Controls. A provision of the Food Safety Modernization Act (FSMA) that requires any entity handling food to identify hazards, implement controls to reduce the hazards, conduct verification activities to show that controls function, and implement corrective actions for any deviations that may occur in a process.

Iced coffee: Coffee that has been brewed hot or cold and served chilled and/or over ice.

Low acid food: “A low acid canned food is any food (other than alcoholic beverages) with a finished equilibrium pH greater than 4.6 and a water activity greater than 0.85,
excluding tomatoes and tomato products having a finished equilibrium pH less than 4.7.”

Nitro coffee: Brewed coffee that has been infused with nitrogen to create a creamy body.

pH: Concentration of hydrogen ions in solution; Also, a measure of how acidic or basic a solution is.

Ready to Drink: A beverage that can be consumed as-is; no mixing or further preparation needed.

Shelf life: The duration of time that the product maintains optimal quality.

Titratable Acidity: A measure of the total acidity in solution contributed by all constituents.

Total Dissolved Solids (TDS): Inorganic salts and some organic matter dissolved in water.

References


coffee brewed in three different ways from different origins. *European Food Research and Technology*, 233, 497-506.

[https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/AcidifiedLACF/default.htm](https://www.fda.gov/Food/GuidanceRegulation/GuidanceDocumentsRegulatoryInformation/AcidifiedLACF/default.htm)
Appendix: Common Methods of Preparation

Whether brewing at home, in a café or at a production scale, the basic preparation methods for making cold brew remain virtually the same. But if you look more closely at the brewing method, there are several variables that can be manipulated to greatly change the resulting extract. As we illustrate in the Definition section, some changes to the brewing parameters render the coffee materially different than cold brew coffee.

The primary variables in the brewing process are grind size, water temperature and steeping time. Let’s take a closer look at several common preparation methods to understand how these variables can be altered.

**Full Immersion:** Cold brew with full immersion is akin to steeping coffee grounds in water – quite a few brewing devices on the market utilize this concept in one form or another. With full immersion, the coffee and water stay in contact during the full duration of brewing; at the end of the brewing duration, the coffee extract liquid is filtered out of the coffee grounds. The variables at play are typically:

- **Grind Size:** Grind size can impact the extraction rates of various chemical compounds, and therefore can impact flavor profiles, total dissolved solids (TDS) and body.

- **Brewing Duration:** Also referred to as dwell time, the amount of time that the water and ground coffee come into contact will impact the extraction of some compounds.

- **Water Temperature:** Water temperature impacts the extraction of temperature-sensitive compounds, the release of gas from the grounds and impacts the water’s ability to permeate dry pockets of ground coffee.

- **Ambient Temperature:** Similar to water temperature, the environmental temperature of the brew will impact the extraction of temperature-sensitive compounds.

- **Filtration:** Filtration impacts the amount of coffee solids in the final extract, which can impact flavor profile, body and shelf life.

- **Agitation:** Agitation can impact the water’s ability to saturate all the coffee grounds evenly and can speed the release of gas from the ground coffee.

- **Pressure:** Pressurized brewing can impact the extraction of some chemical compounds.
Drip Tower: Making cold brew with a drip preparation differs from full immersion in that drops of water drip over a bed of coffee grounds slowly during the full duration of the brew. As the coffee grounds become saturated, drips of coffee extract filter out. The variables at play are typically:

- **Drip Rate**: The speed of the drip impacts the amount of time that the water and ground coffee come into contact over the total duration of the brew and will impact the extraction of some compounds.

- **Batch Size / Vessel Size**: Batch size and vessel size can change how long it takes to get all the coffee grounds wet enough to extract and therefore can also impact the total amount of time that water and coffee come into contact.

- **Grind Size**

- **Water Temperature**

- **Ambient Temperature**

- **Filtration**

Hot Bloom: Hot bloom is a modification on the above preparation methods where near-boiling water is added at the beginning of the brewing process to initiate a “bloom,” followed by a quick dousing of cold water to stop hot water extraction and transition to cold water extraction. This hybrid brewing method aligns with some parts of the cold brewing definition and still has many of the same inherent food safety concerns. The addition of hot water, however, puts the hot bloom preparation method into a brewing method gray zone, as it creates a significant departure from many of the common characteristics of cold brew coffee.

* Certain variables, such as the specific coffee beans selected, water quality, water-to-coffee ratios, and the cleanliness of the brewing equipment are relevant to all preparation methods. Many of these variables are also relevant in hot water brewing methods.*