IJBPAS, August, 2012, 1(7): 1012-1019

ISSN: 2277–4998

International Journal of Biology, Pharmacy and Allied Sciences (IJBPAS)

'A Bridge Between Laboratory and Reader'

www.ijbpas.com

FACTORS AFFECTING WITHHOLDING AND ROLE OF FLAVOUR COMPOUNDS IN FOOD VITAMINS

SHUKLA A* AND PRIYADARSHI S

Gautam Buddha University, Yamuna Expressway, Gautam Budh Nagar, Greater Noida, U.P.-201308, India

Corresponding Author: E Mail: anubhashukl@gmail.com

ABSTRACT

The retention and release of flavour compound in foods, vitamin such as ascorbic acid and riboflavin are also increasingly used in food industry in term of main product and food additive. Furthermore, vitamins are the most common matrix used to entrap flavour compounds. Vitamins influence the retention and release of volatile flavour compounds. Thus, an understanding of behaviors of interaction between food vitamin and flavour compounds is required for suitable flavour retention and release during processing and eating. It is useful to improve new food flavouring and develop new carriers for flavour encapsulation in vitamin such as physicochemical properties of flavour compounds, type of vitamin and their concentration.

Keywords: Vitamins, Flavour compounds, Ascorbic acid and Riboflavin

INTRODUCTION

In present time food flavor is of great interest because consumers are depending on better-tasting food. Naturally, food aroma is an equilibrium mixture of aroma compounds. All aroma compounds are relatively small (<400 Da), usually organic compounds **[1]**. The chemical structures of aroma compounds include acids, neutral compounds, sulfur and nitrogen compounds, alcohols, aldehydes, ketones, hydrocarbons, and esters. The release of aroma compounds from foods is determined by the partition coefficient between the air phase and food matrix. If an aroma compound is added to the water matrix in a closed system and allowed to reach equilibrium, it will distribute between the air and water phases according to its air-to-water partition coefficient **[2]**. Flavour retention and release depend on the nature and concentration of volatile compounds present in the food, as well on as their availability for perception as a result of interactions between the major components and the aroma compounds in food **[3]**. Of the major food constituents, vitamins have generally the greatest influence on aroma compound release and retention.Vitamins are widely used in the food industry as antioxidants, viscous, colourants, odourless, crystalline, white, beverages, jellies and sauces. The formulation of new food products containing vitamin has led to an increased demand for knowledge of their mechanical and physical properties, including the flavour release and retention properties of vitamins. Vitamins are also claimed to affect the release and retention of the flavour compounds. However, these effects depend on many factors such as the physicochemical characteristics of the aroma compounds, type of vitamin and concentration of vitamin **[4, 5, 6]**.

Flavour

Flavor is the sensation produced by a material taken in the mouth, perceived principally by the senses of taste and smell, and also by the general pain, tactile, and temperature receptors in the mouth. Flavor also denotes the sum of the characteristics of the material which produces that sensation. Flavor is one of the three main sensory properties which are decisive in the selection, acceptance and ingestion of a food.

Classification of Food Flavors

S. No.	Flavor Class	Subdivision	Representative Example
1.	Vegetable flavors	---------	Lettuce, Celery
2.	Stench flavors	---------	Cheese
3.	Spice flavors	Aromatic	Cinnamon, Peppermint
		Lachrymogenic	Onion, Garlic
		Hot	Pepper, Ginger
4.	Processed flavors	Smoky Flavors	Ham
		Broiled, Fried Flavors	Processed Meat Products
		Roasted, Toasted, Baked Flavors	Coffee, Snack Foods, Processed Cereals
5.	Meat flavors	Mammal Flavors	Lean Beef

		Sea Food Flavors	**Fish, Clams**
6.	**Fruit flavor**	**Citrus-Type Flavors (Terpeny)**	**Grapefruit, Orange**
		Berry-Type Flavors (Non-Terpeny)	**Apple, Raspberry, Banana**
7.	**Fat flavors**	**---------**	**Olive Oil, Coconut Fat, Pork Fat, Butter Fat**
8.	**Cooked flavors**	**Broth**	**Beef Bouillon**
		Vegetable	**Legume, Potatoes**
		fruit	**marmalade**
9.	**Beverage flavors**	**unfermented flavors**	**juices, milk**
		fermented flavors	**wine, beer, tea**
		compounded flavors	**soft drinks**

Food-Flavour Interaction

Flavour-matrix interactions in food products have been widely investigated with respect to influences on flavour release and perception. Defining key matrix parameters that influence the release of flavour compounds from foods would provide useful information to control the flavour response of food products and allow for the effective use of flavor materials **[7]**. Food matrix components can bind, entrap or encapsulate volatile and nonvolatile flavour compounds if the “binding sites” of food components are still available. The mechanism of binding between flavour compounds and food matrices can be classified into three categories **[8]** (1) Binding (Binding means the inclusion, adsorption, absorption and retention of flavour compounds onto nonvolatile substrates). (2) Partitioning (Partitioning means the distribution of flavour compounds between phase such as the oil, water and gas phases). (3) Release (Release means the availability of flavor compounds from the bulk foods into the gas phase for sensory perception). The type of interaction depends on the physicochemical properties of flavour compounds and food components. Flavour also changes with time and processing conditions. There are four main groups of flavour compound interactions in food matrices compounds **[8, 9, 10]**, including (1) covalent bonding (this is irreversible bonding such as the interaction between aldehyde or ketone and amino group of proteins). (2) hydrogen bonding (this is occurs between polar or volatile alcohol and heteroatom (N,S,O) of food components) (3) hydrophobic bond (this is weak and reversible bonding such as Vander Waals bond between a polar compounds and fat molecules). (4) Physical binding (for example inclusion complexes, which occurs between flavour compounds and starch or starch derivatives).

Scope of Flavor Chemistry

1. Chemical compounds responsible for food flavor

1) Even distribution: Brandy

2) Star compound: A star compound cannot be identical to the total true Flavor but is close and cannot produce the true flavor without the luminary Compound like Almond-benzoaldehyde,

Green pepper- 2-methoxy-3-isobutyl-pyrazine, Both pyrazin and thiazol are important flavor compound groups, Vanilla-4-hydroxy-3-methoxy-benzolaldehyde etc.

2. Flavor of foods

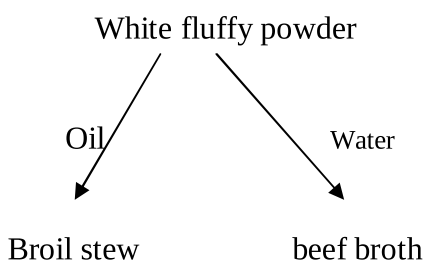
1) Desirable flavor: orange juice, potato chip, roasts beef.

2) Undesirable flavor (off-flavor): oxidized, stale, rancid, warmed-over.

3. Precursors of Flavor Compounds

Linoleate ⟹ 2-pentylfuran

(i) Non-enzymatic reaction: Precursor of beef flavor can be isolated as a white fluffy powder.



Amino acid + Sugar

⇓

Maillard reaction

(ii) Enzymatic reaction:

Processed banana → no fresh banana flavor

Enzyme extracted from banana peel ↓

Fresh banana flavor

4. **Reconstitution of flavor compounds**

GC → composition

Factors Affecting Retention and Release of Flavor Compounds in Food Carbohydrates

Flavour release from food matrix and the subsequent delivery of flavour to the olfactory and gestation receptors is greatly dependent on the type of food ingredients and physicochemical properties of flavour compounds **[11, 12]**. Factors affecting retention and release of flavour compounds in food vitamins are depending on (1) physicochemical properties of flavour compounds (2) type of vitamins and (3) concentration of vitamins.

Physical Properties of Flavour Compounds

When the same vitamins are used as a carrier, it has been observed that the retention rate varies according to the aroma compound encapsulated. This can lead to an unbalanced aroma **[11]**. Several physicochemical characteristics of the volatile compound could partly explain these Differences such as molecular weight, chemical group and polarity.

- Shelf stable up to 12 months
- Moisture content less than 3%
- Water activity less than 0.3
- Melting point 37° C
- Maintain flavor and color even during baking and cooking

Improved Sensory Properties

- Smooth and creamy mouthfeel
- Bright, stable colors
- Intense, stable flavors

Improved Handling Properties

- Minimal risk of fat separation
- Easy dosing due to smooth consistency
- Rapid incorporation during processing

Flavour Vitamin Interactions

Vitamin A: In dehydrated foods, vitamin A and provitamin A are highly susceptible to loss by oxidation. The extent of this loss depends on the severity of the drying process, protection provided by packaging materials and conditions of storage. Vitamin A in pure form is unstable in the presence of mineral acids but stable in the presence of alkali. Naturally occurring vitamin A is insoluble in water but soluble in oil. In this form the vitamin has limited applicability. Vitamin A fortificants are commercially available in a wide range of forms adapted for use under various conditions. For use in fat or oil based foods such as margarines, oils and dairy products, vitamin A as the acetate or palmitate have been used. They are stabilised with a mixture of phenolic antioxidants or with tocopherols. For mixing with dry products, a dry form of the fortificant was required with the appropriate size and density.

Vitamin D: The principal forms of the vitamin are D_3 and D_2. They are white, crystalline fat-soluble vitamins, formed by irradiation of the appropriate sterol followed by purification procedures. These compounds are sensitive to oxygen and light, with the D_3 form of the vitamin being slightly more stable. Trace metals such as Cu and Fe act as pro-oxidants.

Vitamin E: Vitamin E is a slightly viscous, pale-yellow oily liquid obtained from molecular distillation of by-products from vegetable oil refining or by chemical synthesis. The naturally occurring form of the vitamin is the d-isomer. The synthetic compound is a racemic mixture of the d and

1 isomers. The 1-isomer doesn't have the full biological activity of the d-isomer, but due to the stability of the racemic mixture and the ease of purification, the IU of vitamin E has been defined as 1 mg dl-a tocopheryl acetate.

Vitamin C: Vitamin C or ascorbic acid is an odourless, white, crystalline compound which is stable in its dry form. Due to its high water solubility, losses due to leaching can be a problem in some processing procedures. Ascorbic acid is readily oxidised. In dehydrated citrus juices the degradation is dependent on both temperature and water activity. Other factors as well can influence the degradation behaviour of vitamin C; these include salt and sugar concentration, pH, oxygen, metal catalysts and ratio of ascorbic: dehydroascorbic acid.

Food Applications

Care Cream™ is used in a wide variety of finished goods across many categories:

Bakery Products: Flavor enhancer in doughs for pizza, breads, croutons, biscuits. Partial replacement of fat in biscuits, laminated doughs, crackers, pastry and cracker fillings. Toppings for pizzas, crackers, breads.

Fresh and Dry Filled Pasta: Taste, flavor and color, enhancement in pasta fillings.

Soups and Sauces: Flavor and color enhancement in soups, pasta sauces, risotto sauces, meat sauces, glazes and marinades.

Dips and Spreads: Flavor and color enhancer for dips and fat-based spreads.

Concentration of Vitamin

The texture or consistency of industrially liquid foods is often controlled by the used of vitamins and thickeners. The concentration of carbohydrates affect on viscosity of system and effect on retention and release of flavour compound. Several solute parameters affect the viscosity, molecular weight, molecular weight distribution, degree of hydration, extent of intramolecular interaction and intermolecular interaction. Diffusion of flavour molecules is reduced as solution viscosity increases. The volatility of a flavour molecule may also be affected by the formation of barriers occurring in high-viscosity matrices and by specific binding interactions with the thickener.

CONCLUSION

The use of vitamin in food industry increase significantly. These compounds are highly Recommend for application in food processing and as food additive. However, the use of carbohydrates may induce a significant decrease in flavour perception and release as report in previous studies. Moreover, even when use at low concentrations, carbohydrates not only can change the structure and texture of product, but also lead to modification of flavor profile and perception. To optimize product quality, it is important to understand factor affecting retention and release of flavour compound on vitamin. Some factors affecting on the retention and release of volatile flavour compounds by vitamin are depending on physicochemical properties of flavour compounds, type of vitamin and their concentrations. Firstly, high molecular weight flavor compounds tend to retain in carbohydrate than low molecular weight flavour compounds. Additionally, long linear chain length molecules will be retained in polysaccharide matrix higher than short chain molecules or aromatic one. Among the volatile flavour compounds such as alcohol, aldehyde, ester and ketone, alcohol are usually the best retained in Vitamin. The retention of polar (hydrophilic) volatiles flavour compounds is expecte to be very low in vitamin complex which indicate in terms of log P. The second factor is depending on type of Vitamin. Each type of vitamin presents different structure that influence on the interaction between flavour compounds and its structure and also the retention and release. Thirdly, the concentration of vitamin generally shows that an increase in the concentration of sugar is proportional of the release of flavour compounds due to the salting out effect. On the other hand, an increase in vitamin concentration leads to a decrease the release of flavor compounds due to viscosity effect. Therefore, this knowledge can be used to optimize product quality in term of flavour retention during preparation or processing and its release during eating.

REFERENCE

[1] Landy P, Courthaudon JL, Dubois C and Voilley A, Effect of interface in model food emulsions on the volatility of aroma compounds, Journal of Agricultural and Food Chemistry, 44, 1996, 526-530.

[2] De Roos KB, How lipids influence food flavor, Food Technology 51, 1997, 60-62.

[3] Bakker J, Brown W, Hills B, Boudard N, Wilson C and Harrison M, Effect of food matrix on flavour release and perception, In Taylor, A.J. and Mottram DS (Eds). Flavour Science, Recent Development, 1996, 369-374. Cambridge: Royal Society of Chemistry.

[4] Boland BA, Burh K, Giannouli P and Ruth, MS, Influence of gelatin, starch, pectin and artificial saliva on the release of 11 flavour compounds from model gel systems, Food Chemistry, 86, 2004, 401-411.

[5] Arvisenet G, Voilley A and Cayot N, Retention of aroma compounds in starch matrices: competitions between aroma compounds towards amylose and amylopectin. Journal of Agricultural and Food Chemistry 50, 2002, 7345-7349.

[6] Secouard S, Malhiac C, Grisel M and Decroix B, Release of limonene from polysaccharide matrices: viscosity and synergy effect. Food Chemistry, 82, 2003, 227-234.

[7] Schober LA and Peterson GD, Flavor release and perception in hard candy: influence flavour compoundcompound interactions, Journal of Agricultural and Food Chemistry, 52, 2004, 2623-2627.

[8] McGorrin RJ, Introduction In: Flavor-Food Interactions. In McGorrin, R. J. and Leland, J. V. (Eds). ACS Symposium Series 633, ix-xii. American Chemical Society: Washington DC, 1996.

[9] Solms J, Osman-Isamail F and Beyeler M, The interaction of volatiles with food components. Journal of Canadian Institute of Food Science and Technology, 6, 1973, A10-A16.

[10] Le Thanh M, Thibeaudeau P, Thibaut MA and Voilley A, Interaction between volatile and non-volatile compounds in the presence of water, Food Chemistry 43, 1992, 129-135.

[11] Goubet I, Le Quere LJ and Voilley JA, Retention of aroma compounds by carbohydrates: Influence of their physiochemical characteristics and of their physical state- A review, Journal of Agricultural and Food Chemistry, 46, 1998, 1981-1990.

[12] Terta M, Blekes G and Paraskevopoulou A, Retention of selected compounds by polysaccharide solution: A Thermodynamic and kinetic approach, Food Hydrocolloids, 20, 2006, 863 871.