Book excerpt

Flavor Formulation

Practical dairy, mint and savory flavor creation

Perfumer & Flavorist is proud to present an exclusive peek inside the soon-to-be-released book, "Flavor Formulation," edited by Gerard Mosciano. With chapters written by top flavorists in their respective fields, this comprehensive book delves into many aspects of practical flavor creation, including mint, savory, naturals, confection, dairy and quality control.

Dairy

Judith Michalski, Edlong Flavors

Dairy flavors are a unique breed of animal, so to speak. Unlike many types of fruit flavors, with their dramatically different characterizing components, dairy flavors derive their characteristic qualities from the same components, just in differing ratios. These differences, plus the appearance of trace ingredients, make for subtle to dramatic variations in flavor. The trace components also lend themselves to making these differences even more noticeable as signature qualities or off notes, depending on how present they are in the final product.

The beauty of a milk flavor lies in its ability to lend richness and to round off a less-than-perfect base.

Dairy's rich, fatty notes of dairy products are highly suitable for a wide array of applications, including sauces, soups, margarine, oils, puddings, frozen dinners, cakes, confections and snacks. Milk and cream flavors specifically have the unique functionality of rounding out and deepening the flavor profiles in various applications.

One adjective common to all of the flavors mentioned is "rich." Because richness is a blend of satisfying, fatty, mouth-coating sensations accompanying the flavor, it will be left out of all the descriptor charts.

Milk Flavors

Fresh milk: One way to express the ideal flavor of milk is to say what it is not. Milk has a bland, pleasant, slightly sweet, pleasingly fatty taste devoid of any outstanding notes. It is not a flavor that usually has the dominant role in a food system. The beauty of a milk flavor lies in its ability to impart richness and to round off a less-than-perfect base. Milk flavors also blend well with more aggressive flavors, enabling technologists more versatility and creativity in designing flavor systems for applications.

Because of the high concentration of heavier components in milk flavors, they can be well suited to applications involving heat without losing too much impact. Other applications for which they are natural fits are nutraceutical products (to help mask vitamin/mineral notes), soy products, skim and low-fat dairy products, other low fat products, and baked goods.

Typical core descriptors for fresh milk flavors are: sweet, creamy, fresh, and, of course, milky (see T-1).

Heated milk: As previously stated, the flavor of milk is transformed when it goes through heat treatment. The degree of flavor development increases with temperature and/or time. Creamy notes are intensified as lactones and ketones are formed. In addition, caramellic undertones develop, after which the

Fresh milk flavor descriptors **T-1**

Descriptor	Components
animal	skatole, indole, p-cresol
brown	furaneol, maltol
buttery	diacetyl, acetoinbutyric acid
cereal	furfural, 2-acetyl furan, isovaleraldehyde
creamy	δ-decalactone, δ-dodecalactone, δ-nonalactone, δ-tetradecalactone, *cis*-4-heptenal
fatty	decanoic acid, palmitic acid, oleic acid, myristic acid
fresh	*cis*-4-heptenal
milky	δ-tetradecalactone, 5,6-decenoic acid, 2,3-pentanedione
plastic	2-nonanone
sweet	vanillin, maltol, lactose
waxy	2-tridecanone, nonanoic acid, 2-undecanone, stearic acid

Cooked milk flavor descriptors **T-2**

Descriptors	Components
animal	skatole, indole, p-cresol
barny (see animal)	
brown	furaneol, furfural, 2-acetal furan, 5-methyl furfural
buttery	diacetyl, acetoin, butyric acid, 2,3-pentanedione
caramelized	furaneol, maltol, furfuryl alcohol
cereal	furfural, isovaleraldehyde, 2-acetyl furan
cooked milk	sulfurol, 1-octen-3-ol, 2-heptanone, 2-nonanone, hydrogen sulfide
creamy	δ-decalactone, δ-dodecalactone, δ-tetradecalactone, *cis*-4-heptenal, δ-nonalactone
fatty	decanoic acid, palmitic acid, oleic acid, myristic acid
lipolytic	butyric acid, hexanoic acid, octanoic acid, decanoic acid
milky	5,6-decenoic acid, δ-tetradecalactone, γ-butyrolactone
nonfat dry milk	nonfat dry milk
oxidized	2,4-decadienal, 2,4-nonadienal, 2-decenal
phenolic	p-cresol, 3,4-xylenol
waxy	2-undecanone, 2-tridecanone, stearic acid

product takes on a cooked or scalded quality.

The flavor of condensed milk is richer and more full-bodied compared to fresh milk flavors, and can be used in many of same applications as fresh milk flavors, in addition to desserts and confectionary products.

Core descriptors for cooked milk flavors are creamy, milky, brown and cooked (see T-2).

Mint

Carl Holmgren, consulting flavor chemist

Chewing Gum and Confections

Chewing gums use the greatest volume of mint flavors due in part to the fact that they require a very high level of solvent-free or oil-soluble flavor to achieve a consumer-acceptable organoleptic profile (T-3 and T-4). A stick of gum basically consists of a gum base, sweeteners and flavor oil. In a dragee, the gum is formed into a pellet instead of a stick and then covered with a candy coating. Gum bases are highly proprietary formulations of polymers that tend to bind with flavor components, thus preventing them from being fully perceived during chewing. Additionally, the quicker consumption of the sweeteners during chewing greatly reduces their flavor-potentiating effect, resulting in the discarding of the gum before half of the flavor has been extracted. Usage levels

Peppermint flavor for chewing gum **T-3**

Raw material	Percent w/w
Mentha arvensis oil DMO	10.00
peppermint oil rar west	36.85
eucalyptol FCC	3.50
l-menthol FCC pellets, synthetic	15.00
l-menthone	4.00
l-menthyl acetate	4.50
10 percent phenyl acetic acid pure FCC in BA	0.30
thymol crystals FCC	0.05
l-menthol crystals, natural	25.00
anethole FCC	0.20
germacrene D, natural	0.10
menthyl lactate	0.50
Total	**100.00**

Wintergreen flavor for chewing gum **T-4**

Raw material	Percent w/w
methyl salicylate FCC	28.00
anethole FCC	2.00
menthol crystals, natural	20.00
peppermint oil FW redistilled	45.00
WS-3 (N-ethyl-2-isopropyl-5-methyl cyclohexane carboxamide)	1.20
vanillin FCC	0.50
ethyl salicylate	3.00
ethyl benzoate	0.20
methyl benzoate	0.10
Total	**100.00**

in the neighborhood of 2 percent are not uncommon in sugarless gums. The great challenge is to prolong the flavor perception and/or reduce the amount of flavor needed.

For most of the flavor industry's history, mint flavors for chewing have been composed of natural oil blends. Peppermint flavor profiles were produced by blending oils from different growing regions, which may have also been further refined through vacuum distillation or other means. Cornmint oil, in US regulations, could not be labeled as natural peppermint, thus limiting its use to WONF or artificial flavors. Adding some native spearmint oil to the peppermint blend also increased the consumer acceptance of the gum, but could only be labeled as natural "mint" rather than natural peppermint.

In the final decade of the 20th century, chewing gum manufacturers developed the "super-cooling" gums and re-introduced coated dragees. Since none of the super coolants are natural or nature-identical, the raw material palette was no longer limited to natural materials. Flavorists could alter the aroma profile of a lower quality peppermint oil to resemble that of a preferred regional oil, or create interesting, more cost-effective, consumer-preferred mint variations. The dragee coating provides an excellent means to increase flavor impact and maximize the cooling sensation because it completely dissolves, thus releasing the entire flavor system in a short time interval. The use of encapsulated flavors and coolants within the chewing gum core can extend the effect somewhat longer, since the volatile components are not in contact with the gum base until it's released when the gum is chewed. This greatly reduces flavor binding. Spray dried flavors may also be dusted onto sticks to yield a quicker flavor release before chewing adds to the flavor profile.

Mint Flavor Creation for Chewing Gum and Candy

It is best that the flavorist have the gum base that will be used in the finished product. This will allow the formulator to determine how flavor trials will display. The basic skeleton of a natural and artificial peppermint is made by combining one or more *M. piperita* oils, some *M. arvensis* oil, and boosting or modifying the profile with menthol derivatives (see T-3). The creamy notes can be enhanced with C-7 through C-9 γ-lactones. Sweetness can be increased by adding materials like anethol, methyl salicylate, vanillin, ethyl maltol and furanones. Impact can be boosted with raw materials like eucalyptus, methyl ketones and some conifer notes. Other notes that work well in combination are rose, berry, herb oils, ionone derivatives, citrus, honey and, of course, spearmint. The desired cooling effect is achieved by adding menthol, alone or in combination with one or more other coolants.

Wintergreen flavors are based on methyl salicylate and its homologues, usually with some *M. piperita* oil and menthol (see T-4). Vanillin, eugenol, lactones, orange oil, anethol, benzaldehyde and some lactones smooth out the profile, particularly if high cooling is desired.

Confectionery flavors are similar in character to those for chewing gum, but are usually more dilute and may need to be modified to withstand processing conditions or spray drying, rather than to compensate for binding to a gum base. Less volatile solvents like propylene glycol, triacetin and triglycerides are commonly used.

Savory

Douglas Young, Symrise

Compounding Flavor Creation

As with all compounded flavors, creation is all about the flavorist's imagination and familiarity with the ingredients that can be used to produce the desired flavor profile.

Characterizing meat chemicals and their descriptors **T-5**

Meat product	Characterizing component	FEMA #	Flavor description
Chicken or turkey	(E,E)-2,4-decadienal	3135	intense fatty, fried
	trithioacetone	3451	metallic, sulfury, brothy note
Beef	2-methyl-3-furanthiol	3188	mildly roasted meaty
	12-methyl tridecanal	4005	soapy, citrusy, tallow-like
Pork	2-methyl-3-furanthiol	3188	mildly roasted meaty
	T-2-decenal	2366	fatty, lard-like
Lamb	4-ethyl octanoic acid	3800	sweaty, sour, fatty, animalic, goaty
Seafood	trimethylamine	3241	alkaline, amineous

Reaction example formulation 1A: chicken type flavor **T-6**

Ingredient	Weight percent	Notes
water	50.00	
cysteine HCl H_2O	2.50	
cystine	0.10	
alanine	2.00	
ascorbic acid	0.10	
glutamic acid	5.00	
methionine	0.10	
lactose H_2O	8.70	
salt	10.00	
maltodextrin 10	17.51	starting pH: 2.22; reflux at 104.5°C for 2 h
sodium hydroxide 50 percent	3.99	pH: 1.94 => 5.38
Total:	**100.00**	

Reaction example formulation 3: pork type flavor **T-7**

Ingredient	Weight percent	Notes
water	47.52	
cysteine HCl H_2O	2.34	
cystine	0.08	
alanine	2.00	
arginine	0.66	
glutamic acid	5.00	
leucine	0.06	
lysine HCl	0.32	
methionine	0.10	
ascorbic acid	0.06	
dextrose monohydrate	1.16	
fructose	1.16	
lactose H_2O	5.80	
xylose	0.16	
rhamnose monohydrate	0.16	
salt	10.00	
maltodextrin 10	19.80	starting pH: 2.49; reflux at 104.8°C for 2 h
sodium hydroxide 50 percent	3.62	pH: 2.17 => 5.16
Total:	**100.00**	

The easiest way to begin creating flavors is to use a characterizing ingredient, one that, on its own could be perceived as the desired flavor. The materials in T-5 are common characterizing meat chemicals.

Speciation

There is an old adage that fat is flavor; actually, fat provides the characterizing flavor of the meat speciation. However, the fat (triglyceride) is only the carrier; it is the volatile oxygenated organic compounds (alcohols, aldehydes, ketones, lactones and fatty acids) found solublized within the fat that provide the characterizing notes that distinguish species from one another — beef from pork from lamb. As we can see from the above characterizing chemicals, 2,4-decadienal is commonly used to characterize both chicken and turkey; the inclusion of 1-octen-3-one (FEMA# 3515) to the decadienal can help develop the flavor into a more characteristically metallic turkey note. Similarly, the characterizing differences between beef, pork and lamb are within the fat-soluble components (12-methyltridecanal, T-2-decenal and 4-substituted octanoic/nonanoic acids).

Characterizing compounds alone do not make very good flavors; it is in combination with other flavor notes that round out the flavor to completion. (See T-6 and T-7 for example formulations of chicken and pork flavors.)

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