SHARING THE STORY OF

The Science And Safety of Flavor Ingredients

Richard C. Pisano Jr. *President, Citrus and Allied*

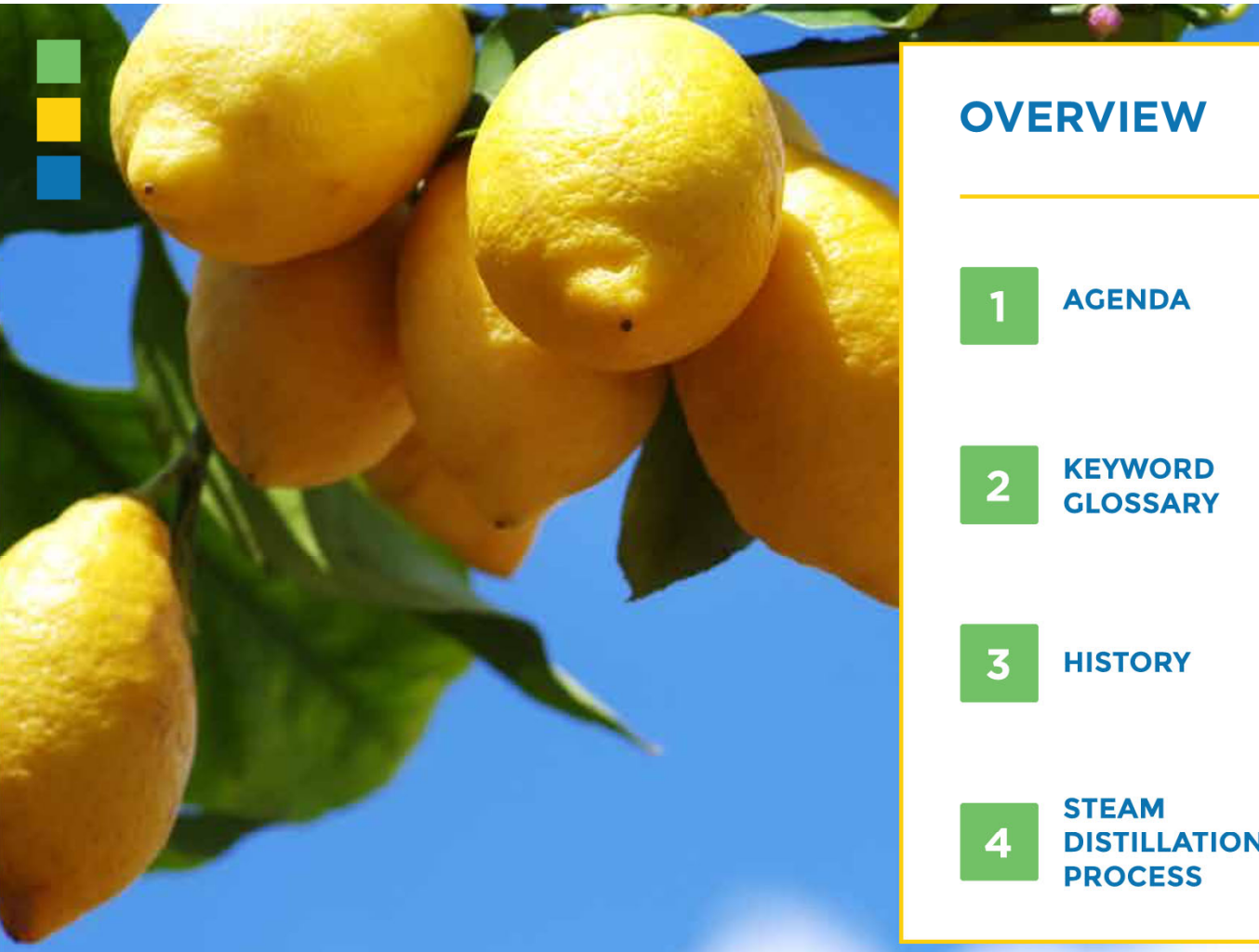
CITRUS AND ALLIED EST. 1933

This Presentation has been presented at the following Universities and Colleges

- University of Illinois
- Rutgers
- UMass
- Penn State
- Ohio State University
- Bucknell
- Cornell
- Delaware Valley College
- Texas A & M
- Chapman University
- Michigan State
- UNC – coming soon

In Addition

- Society of Flavor Chemists (2018)
- IFEAT Cartagena (2018)
- Long Island IFT
- Chicago IFT (November 2019)



OVERVIEW

1. AGENDA
2. KEYWORD GLOSSARY
3. HISTORY
4. STEAM DISTILLATION PROCESS
5. GRAS EVALUATION
6. MECHANICAL EXPRESSION PROCESSES
7. NATURAL VS. SYNTHETIC
8. CLOSING REMARKS

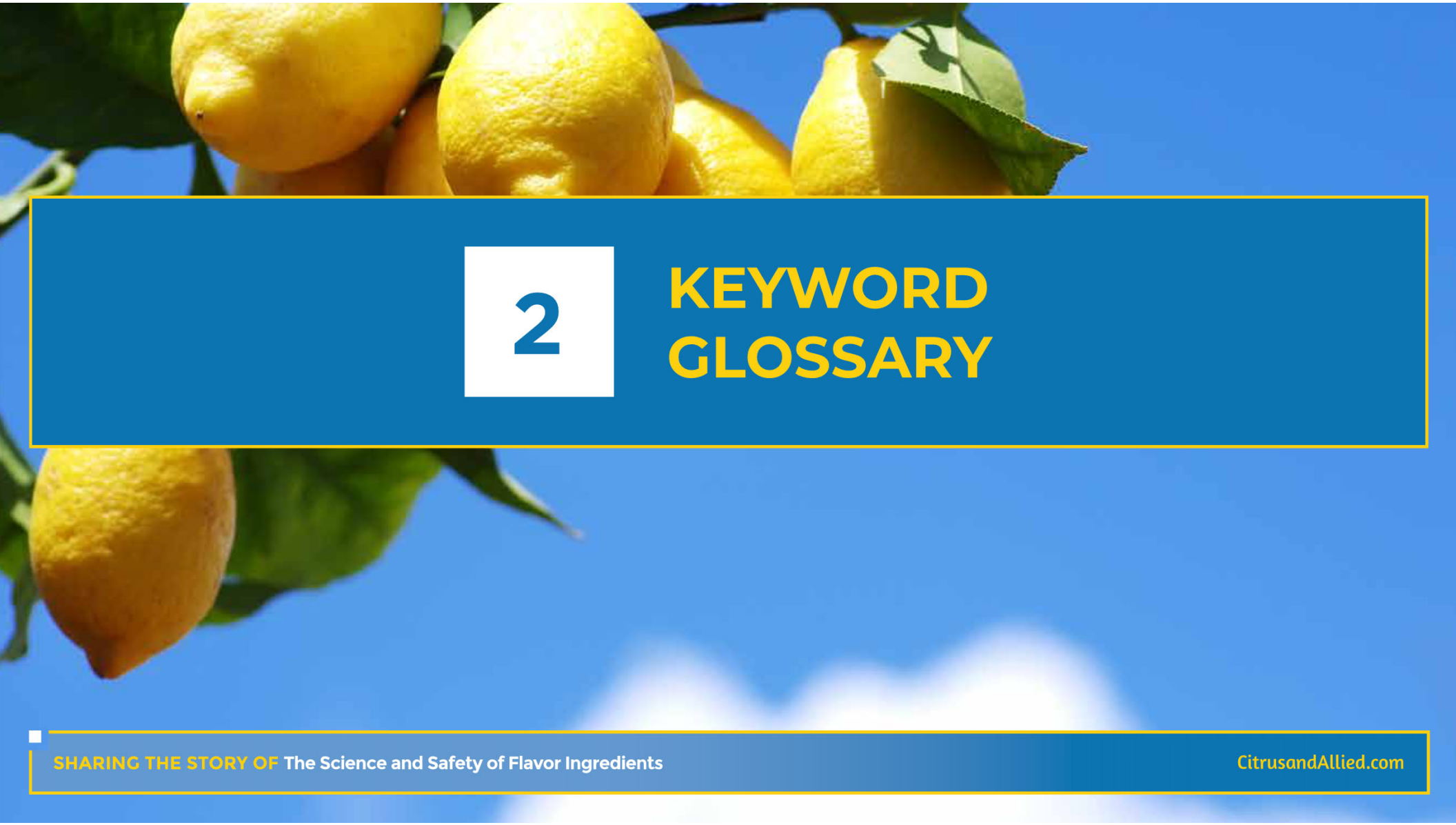
Richard C. Pisano Jr. *President, Citrus and Allied*

Agenda

1 Flavor Ingredients:
- What they are
- Why they are important
- Chemical structures
- Interaction with the human body

2 Flavor Safety

3 Interactive Kits:
Essential oils and aroma chemicals



2 KEYWORD GLOSSARY

A

Absolutes: *Alcoholic extractions of concretes to remove waxes, terpenes, sesquiterpenes and most odorless materials, and producing an alcoholic-soluble liquid or semi-liquid oil.*

B

Balsams: *Water insoluble, semi-solid or viscous, resinous exudates of trees and bushes, similar to gum resins, except that they are characterized by the presence of cinnamic or benzoic constituents (peru balsam, tolu balsam, styrax, benzoin).*

Botanical Extract: *An extract of a botanical substance manufactured with potable solvents such as Ethyl Alcohol, Propylene Glycol, and Water. They are somewhat dilute water-soluble and may contain all or part of the extracting solvent. Botanical extracts are divided into categories based on production methods. They include native extracts, solid extracts, fluid extracts, tinctures, hydroalcoholic extracts, and glycolic extract.*

C

Concretes: *Extractions of fresh natural plant materials, usually with non-polar organic solvents (hexane, benzene, etc.) which yield after removal of the solvent by vacuum distillation, fatty solid or semi-solid waxes.*

D

Distillation: *A physical technique for separation and purification of a liquid mixture based on differences in vapor pressure of components in the mixture. The process involves vaporization of the more volatile component(s) and then condensation of the vapor back to a liquid.*

E

Essence Oils: *These oils are collected in the water distillate during the production and concentration of fruit juices. They are then separated from the water and contain the highly volatile top notes of natural oils.*

Keyword Glossary

Essential Oils: *Volatile products obtained by distillation or expression from plant material of a single botanical form and species.*

Expression: *A production method used to obtain citrus oils and fruit juices. The expressed or cold pressed essential oils are obtained from the peels of the fruits. Expression yields essential oils which can contain a certain amount of non-volatile materials. Juices are produced by expression of fruit itself and then often concentrated.*

Extracts: *Extracts are generally, but not necessarily, concentrated forms of natural substances obtained by treating crude materials containing these substances with a solvent and then removing the solvent completely or partially from the preparations. Most commonly used extracts are fluid extracts (liquid extracts), solid extracts, powdered extracts (dry extracts), tinctures, and native extracts.*

Exudates: *Non-cellular, natural raw materials that are secreted by plants either spontaneously or after wounding.*

F

Fixatives: *Materials that slow down the rate of evaporation of the more volatile components in a perfume composition.*

Fluid-extracts: *Fluid extracts are also known as liquid extracts. The alcohol content varies with each product. Fluid extracts are either prepared from native extracts by adjusting to the prescribed strength with alcohol and water or by direct extraction of the botanicals with alcohol-water mixtures directed on official compendia. The latter usually produces more desirable products due to the fewer steps involved in processing.*

Folded-oils: *Essential oils that are concentrated by distillation.*

G

Gums: *Water soluble exudates consisting mostly of polysaccharides and used as thickeners or spray-dry carriers in the manufacture of water soluble fragrance and flavor compounds (gum arabic, agar)., gums, and small amounts of volatile components (myrrh, galbanum, and oppopanox).*

Keyword Glossary

Gum-resins: *Water soluble exudates consisting mostly of resinous constituents, gums, and small amounts of volatile components (myrrh, galbanum, and oppopanox).*

I

Isolates: *Simple separation of an aroma chemical from an essential oil via distillation (mechanically) or hydrolysis (chemically). Eugenol ex clove leaf.*

N

Native-extracts: *In the commercial manufacturing of extracts, a botanical is first extracted with an appropriate solvent such as denatured alcohol, alcohol, methanol, water or mixtures of these solvents. The extract is then concentrated under reduced pressure at low temperatures until all solvent is removed. The viscous semi-solid concentrated extract at this state is called a native extract by some manufacturers. The native extracts are usually of high potency from which solid, fluid, and powdered extracts of various strengths can be prepared by diluting with suitable diluents. If the botanical has resins and volatile oils as its active principles and the solvent used is a fat solvent, the resulting native extract is equivalent to a prepared oleoresin.*

O

Oleoresins: *Extractions, usually of natural food or flavoring raw materials, using selected non-potable solvents such as Acetone Hexane or Ethylene Dichloride, to remove the vital components. An oleoresin will contain the essential oil plus other important nonvolatile components which enhance the flavor, act as fixatives, or contain other desirable properties.*

P

Powdered-extracts: *They are prepared from native extracts by diluting the native extracts to the specified strengths with appropriate diluents (lactose, dextrose, sucrose, starch, etc.) and/or anti-caking agents (calcium phosphate, magnesium carbonate, magnesium oxide, etc.) followed by drying usually under vacuum to yield dry solids. These are then ground into fine powders to form powdered extracts or into coarse granules to produce granular extracts.*

Rectification: *A second distillation of an essential oil to remove color, water, resinous matter, and perhaps unwanted top notes.*

Keyword Glossary

Resinoids: *Viscous solid or semi-solid material, prepared from exudates by extraction with a solvent. These products are similar to concretes except that the starting material is not previously live cellular tissue.*

Resins: *This group of exudates includes both gums and balsams. They are water insoluble, solid or semi-solid, and are formed in nature by the oxidation of terpenes.*

S

Sesquiterpeneless: *Essential oils that have had the mono and sesquiterpenic hydrocarbons partially or completely removed to:*

- *Improve solubility in diluted alcohol or food grade solvents;*
- *Improve odor and flavor of the essential oil;*
- *Lift the overall fragrance of flavor since sesquiterpenes have a fixative effect;*

Solid-extracts: *They are usually thin to thick, viscous liquids or semi-solids prepared from native extracts by adjusting the latter to the correct strength with suitable diluents (liquid glucose, corn syrup, glycerol, propylene glycol, etc.).*

T

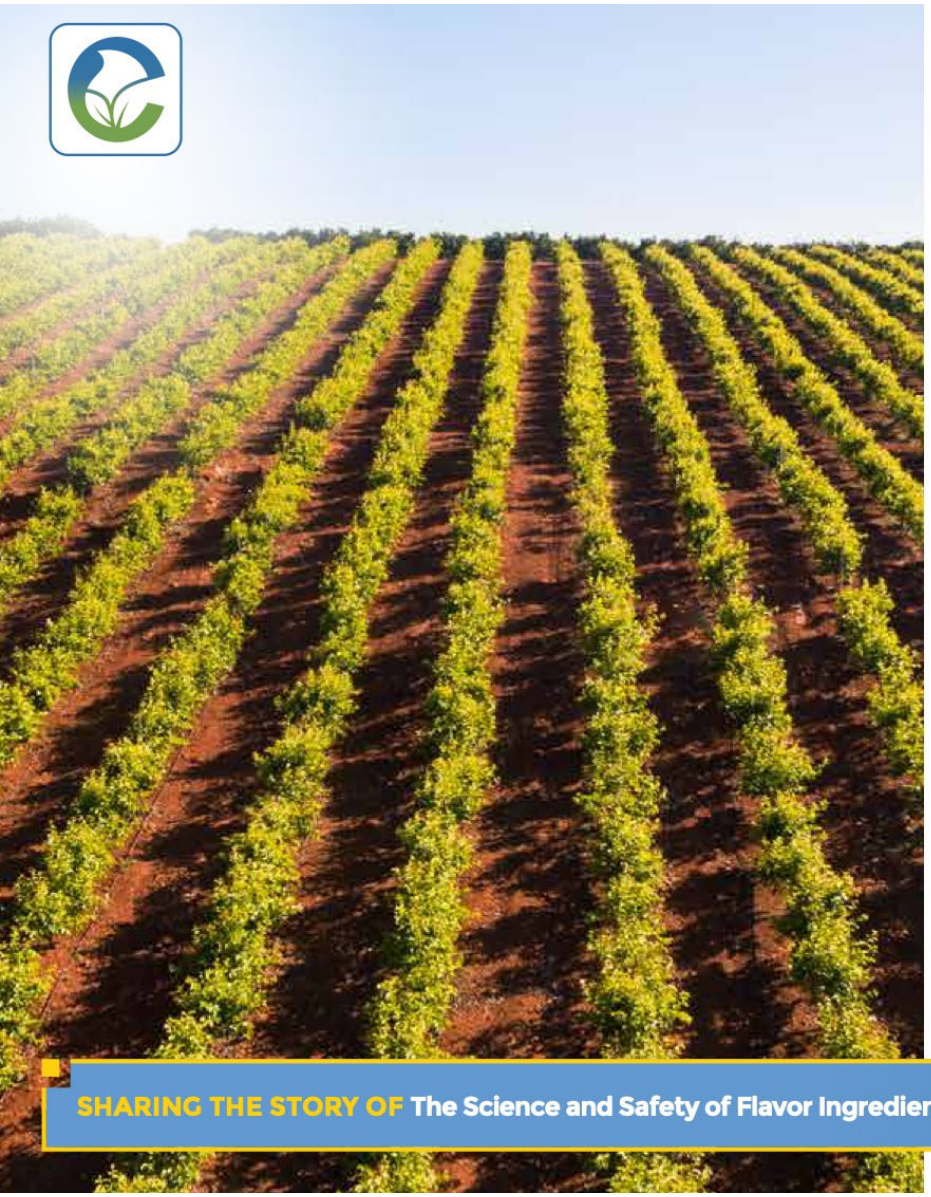
Terpenes: *Fractions of essential oils consisting mainly of hydrocarbons, obtained as by-products from either concentration or distillation of the oils.*

Terpeneless: *Complete or partial removal of monoterpenic hydrocarbons in an essential oil to:*

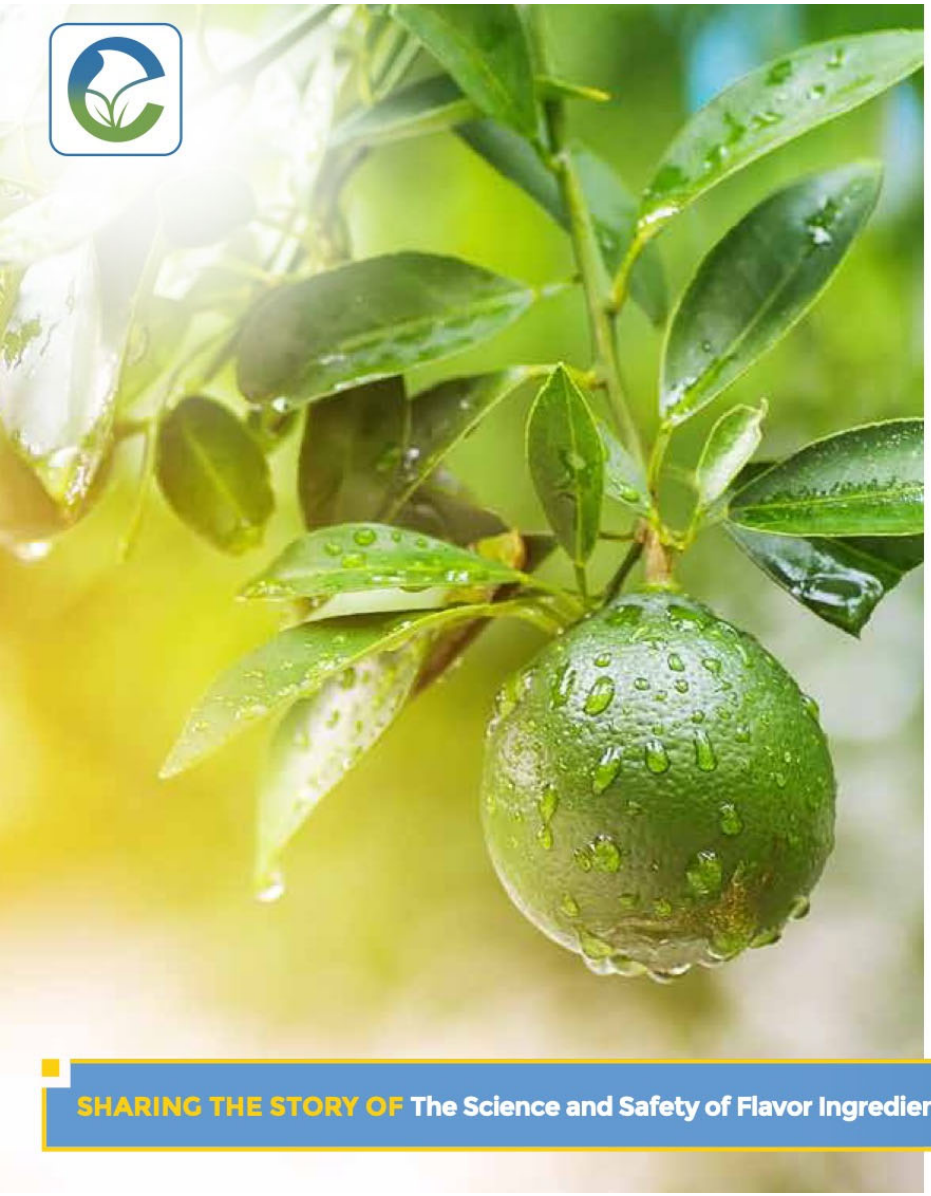
- *Improve solubility in diluted alcohol or food grade solvents;*
- *Increase stability of the oil and to prevent the appearance of rancid notes;*

Tinctures: *They are alcoholic or hydro-alcoholic solutions usually containing the active principles of botanicals in comparatively low concentrations. They are generally prepared either by maceration or percolation or by dilution of their corresponding fluid extracts or native extracts.*

3 HISTORY



Federal Food, Drug, & Cosmetic Act, 1938



The Food Additives Amendment Changed Everything

- This amendment required that food additives be demonstrated to be safe and FDA approved before going to market

- [4] The FDA defined “safe” as a reasonable certainty that a food additive will cause no harm in the opinion of competent scientists. It is not an absolute standard. A set of exempt additives was created including those that qualified scientists deemed Generally Recognized as Safe (GRAS) under conditions of intended use.

(See (21 U.S.C. Sec 321 (s) 1988 for details)

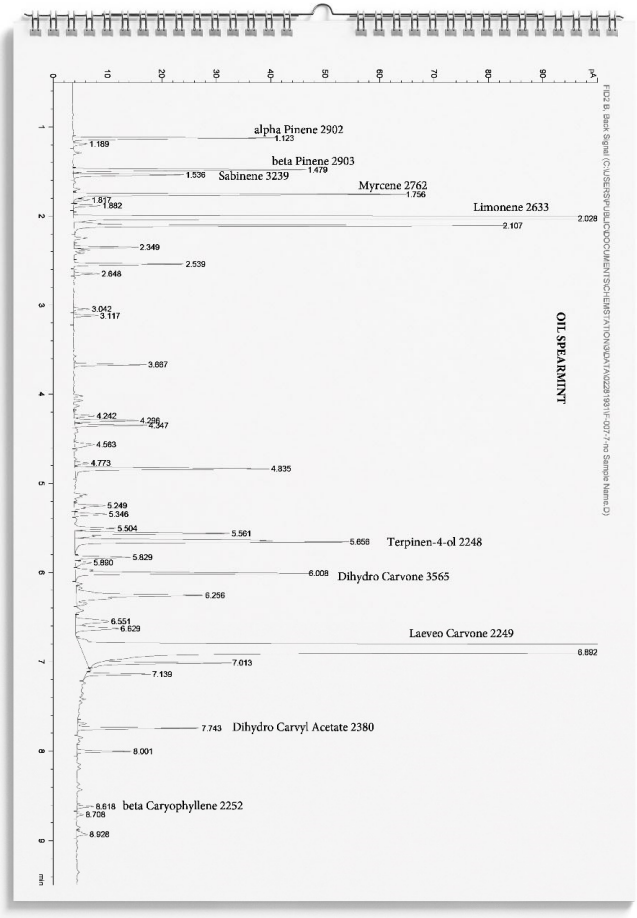
Original Criteria for GRAS Status

1. There must be general recognition of safety by qualified experts
2. The experts must be qualified by training and experience to evaluate the substance's safety
3. The experts must base their determination of safety on scientific procedures or on common use in food prior to 1958
4. The determination of general recognition for safety must take into account the conditions of intended use for the substance

Paracelsus Residence

4 STEAM DISTILLATION PROCESS

Spearmint Oil



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Area Percent Report

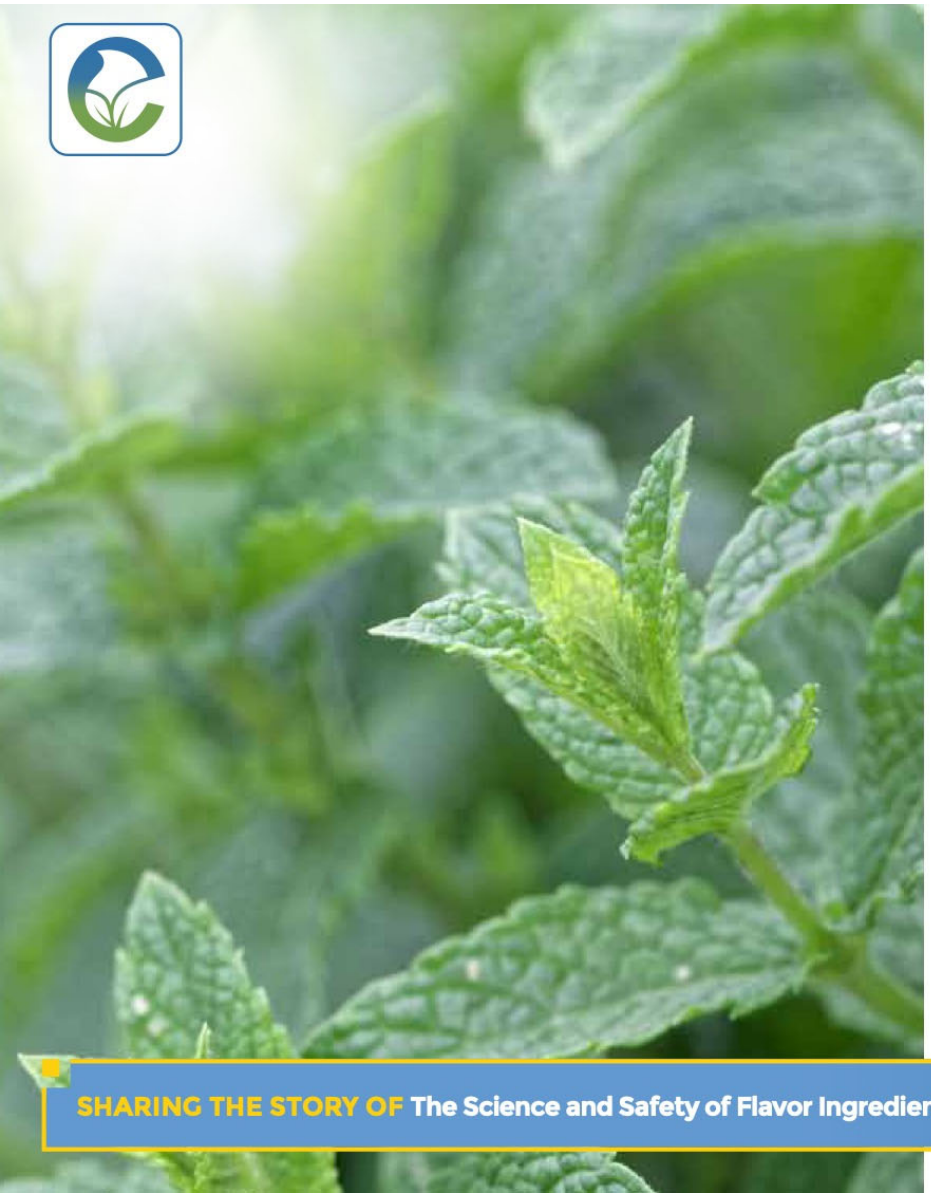
Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A, Front Signal

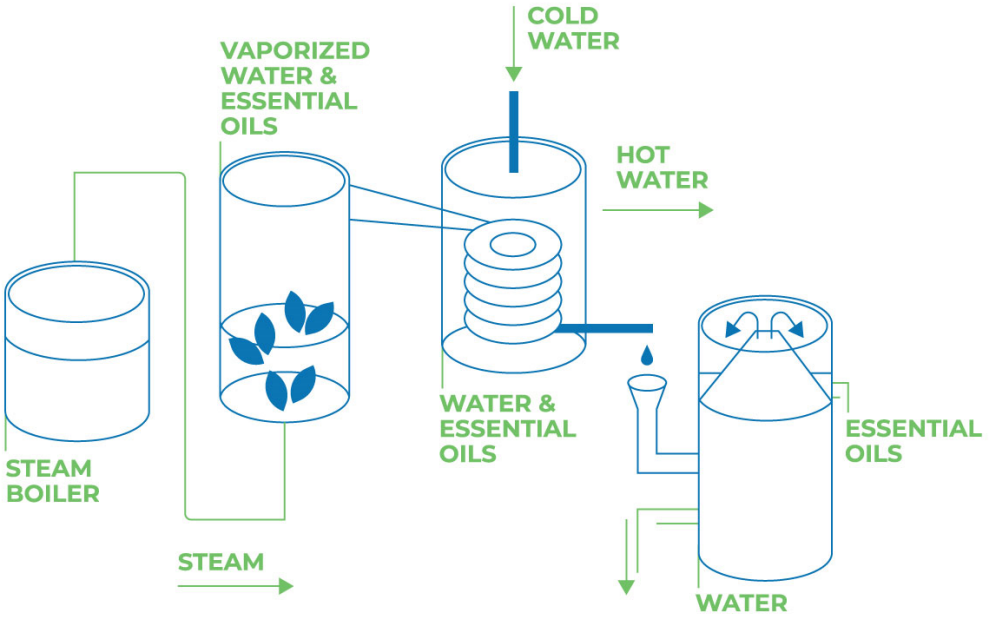
Signal 2: FID2 B, Back Signal

Peak #	RetTime [min]	Type	Width [min]	Area [pA*s]	Height [pA]	Area %	
1	1.123	BV R	0.0196	44.00447	36.57800	0.62832	alpha pinene 2902
2	1.189	VB E	0.0204	3.42652	2.56551	0.04893	
3	1.479	BV	0.0189	51.56891	42.71414	0.73633	beta pinene 2903
4	1.536	VB	0.0190	24.61838	20.26808	0.35152	sabinene 3239
5	1.756	BV R	0.0189	73.26389	60.69324	1.04610	myrcene 2762
6	1.817	VV E	0.0195	3.34448	2.65872	0.04775	
7	1.882	VB	0.0210	6.49518	4.91139	0.09274	
8	2.028	BV	0.0201	1146.16321	876.22345	16.36557	limonene 2633
9	2.107	VB	0.0179	88.00203	78.36741	1.25654	
10	2.349	BV	0.0176	12.81553	11.69378	0.18299	
11	2.539	BB	0.0177	22.33629	20.16737	0.31893	
12	2.648	BB	0.0186	5.54469	4.68136	0.07917	
13	3.042	BB	0.0185	3.49861	2.97592	0.04996	
14	3.117	BB	0.0188	5.44773	4.52794	0.07779	
15	3.667	BB	0.0175	14.42764	13.22324	0.20601	
16	4.242	BV	0.0217	5.22586	3.77596	0.07462	
17	4.296	VV	0.0196	14.85602	11.70418	0.21212	
18	4.347	VB	0.0178	14.68088	13.18233	0.20962	
19	4.563	BB	0.0306	7.91565	3.58290	0.11302	
20	4.773	BV E	0.0227	3.75719	2.56163	0.05365	
21	4.835	VB R	0.0217	51.57607	35.62983	0.73643	
22	5.249	BB	0.0270	10.40496	5.68464	0.14857	
23	5.346	BB	0.0223	8.33385	5.80788	0.11900	
24	5.504	BV	0.0259	12.49156	7.48356	0.17836	
25	5.561	VV	0.0254	46.30579	28.42811	0.66118	
26	5.658	VB	0.0275	100.93954	50.12072	1.44127	terpinen-4-ol
27	5.829	BV	0.0199	13.16637	10.15588	0.18800	
28	5.890	VV E	0.0273	5.53628	2.97619	0.07905	
29	6.008	VB R	0.0212	59.88619	42.48226	0.85509	dihydro carvone 3565
30	6.256	BV R	0.0367	62.22186	23.26853	0.88844	
31	6.551	BV	0.0471	17.98803	6.12032	0.25684	
32	6.629	VB	0.0342	17.75464	7.91627	0.25351	
33	6.892	BV R	0.0409	4944.92773	1565.33179	70.60650	laevo carvone 2249
34	7.013	VB E	0.0200	33.47202	24.36222	0.47793	
35	7.139	BB	0.0199	15.19265	11.75062	0.21693	
36	7.743	VB R	0.0176	28.27919	22.43641	0.40379	
37	8.001	BB	0.0176	11.61837	9.94119	0.16589	
38	8.618	BB	0.0209	3.98990	3.04801	0.05697	beta caryophyllene 2252
39	8.708	BB	0.0217	1.68873	1.21995	0.02411	

GC #3 2/28/2019 11:14:24 AM SYSTEM



Steam Distillation Process

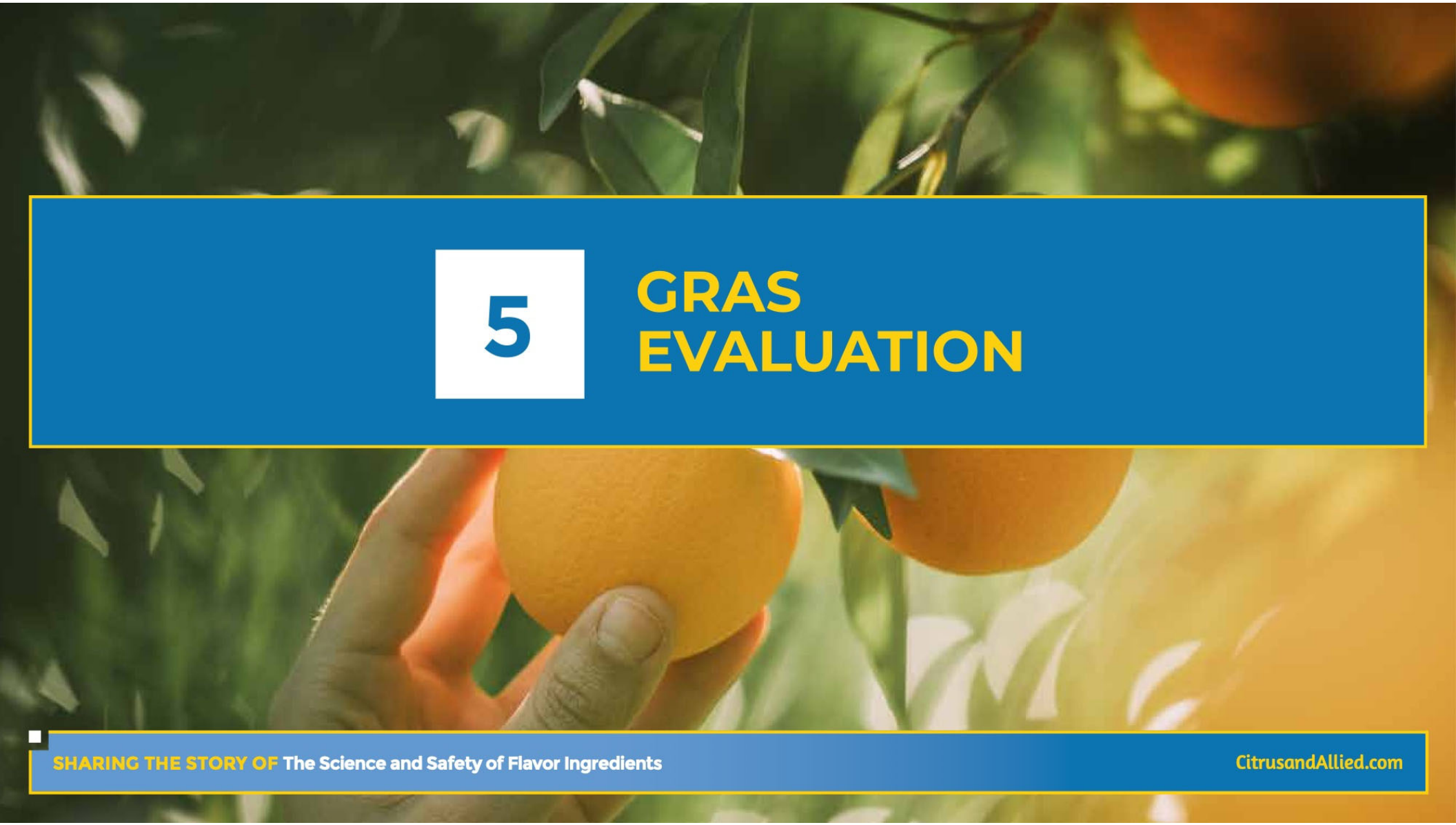


Peppermint Distillation Process

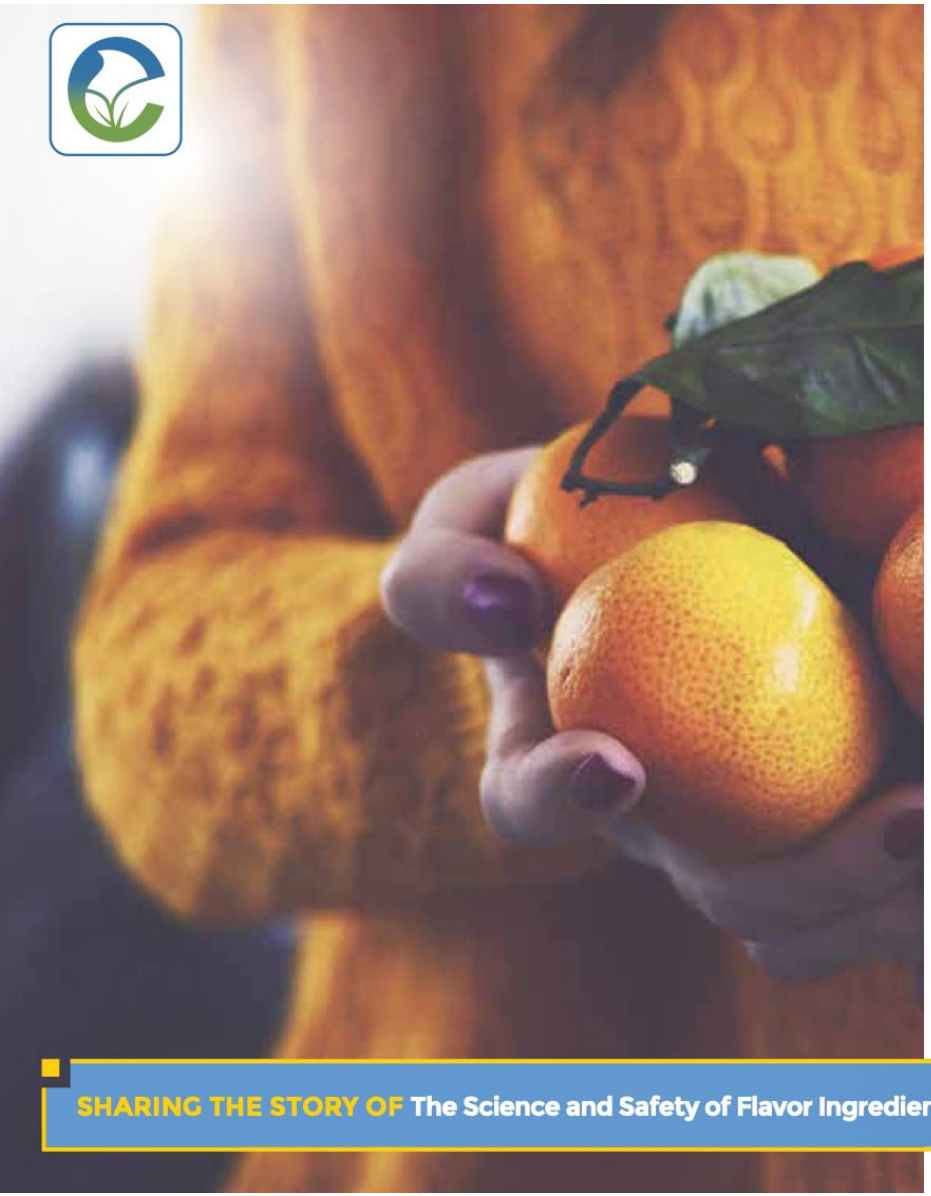
Peppermint Distillation Process

Peppermint Distillation Process

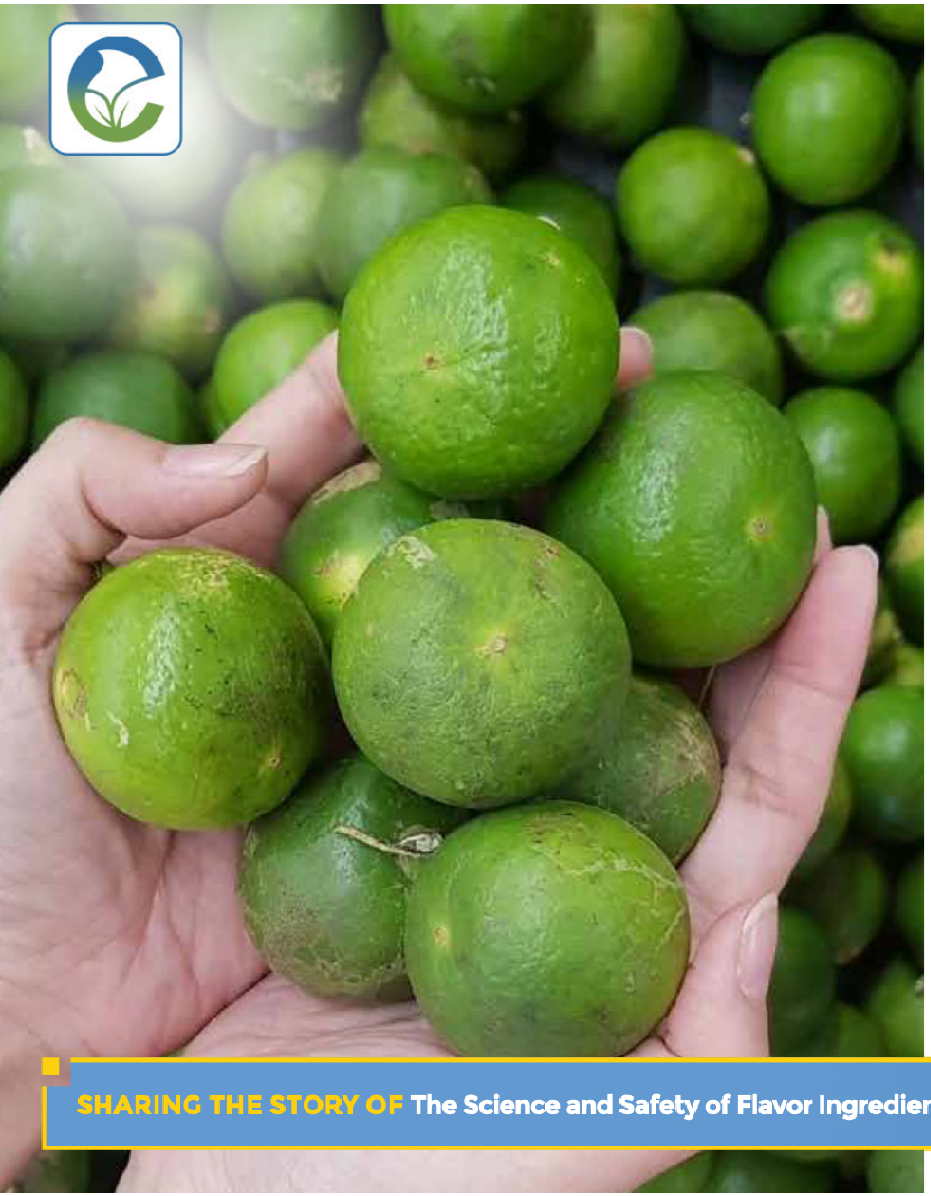
Peppermint Distillation Process



5 GRAS EVALUATION



FEMA Independent Expert Panel

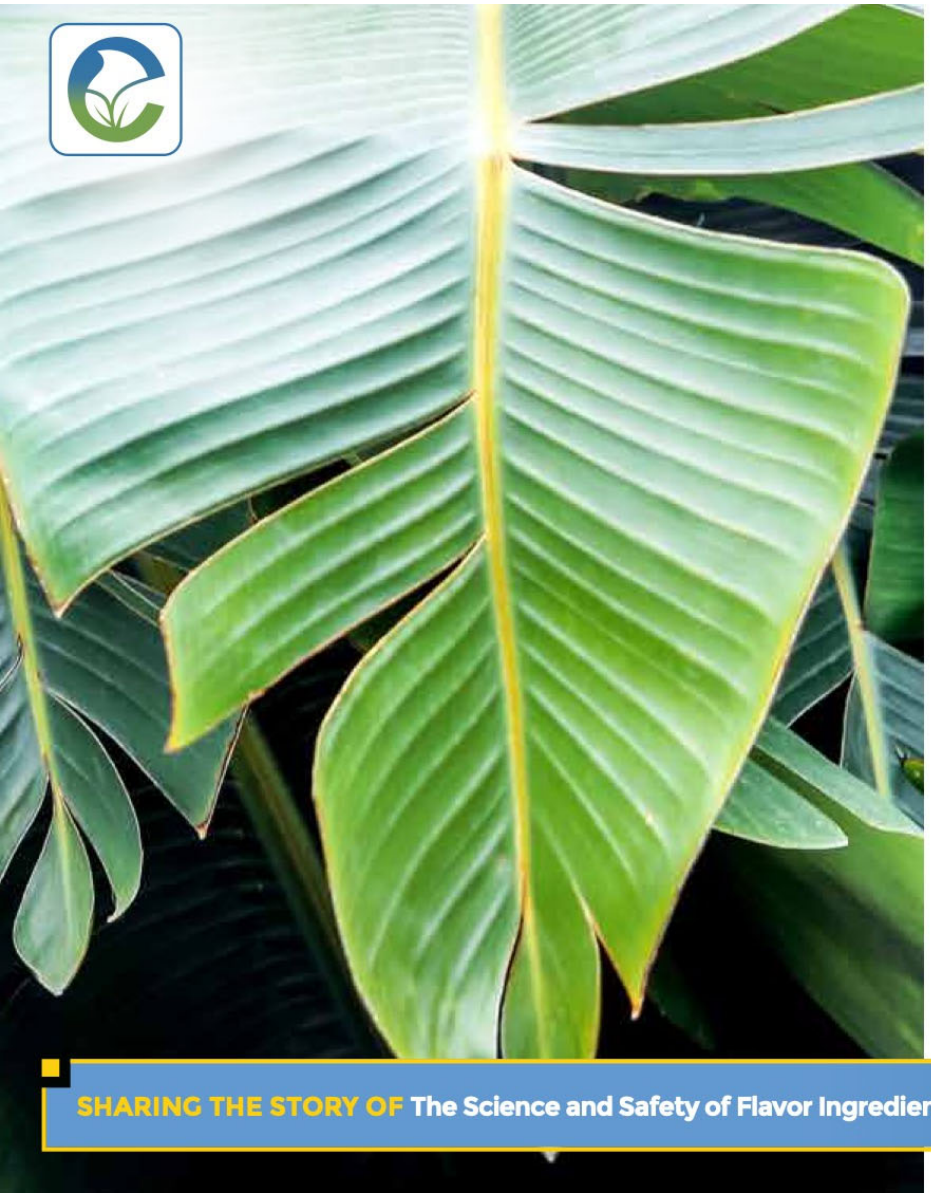


Criteria for Determining GRAS Status Ingredients

1. Exposure – to the substance in specific foods the total amount in the diet and the total poundage
2. Natural occurrence in food
3. Chemical identity – including purity, method of preparation and specific chemical structure
5. Metabolic and pharmacokinetic characteristics
6. Animal toxicity

The “Consumption Ratio” compares the quantity of a flavor ingredient consumed as a natural constituent of food with the quantity of the flavor ingredient consumed as an added flavor.

It essentially asks – is this flavor consumed in greater amounts from its source? Or from its presence in packaged foods?



Would You Eat This?

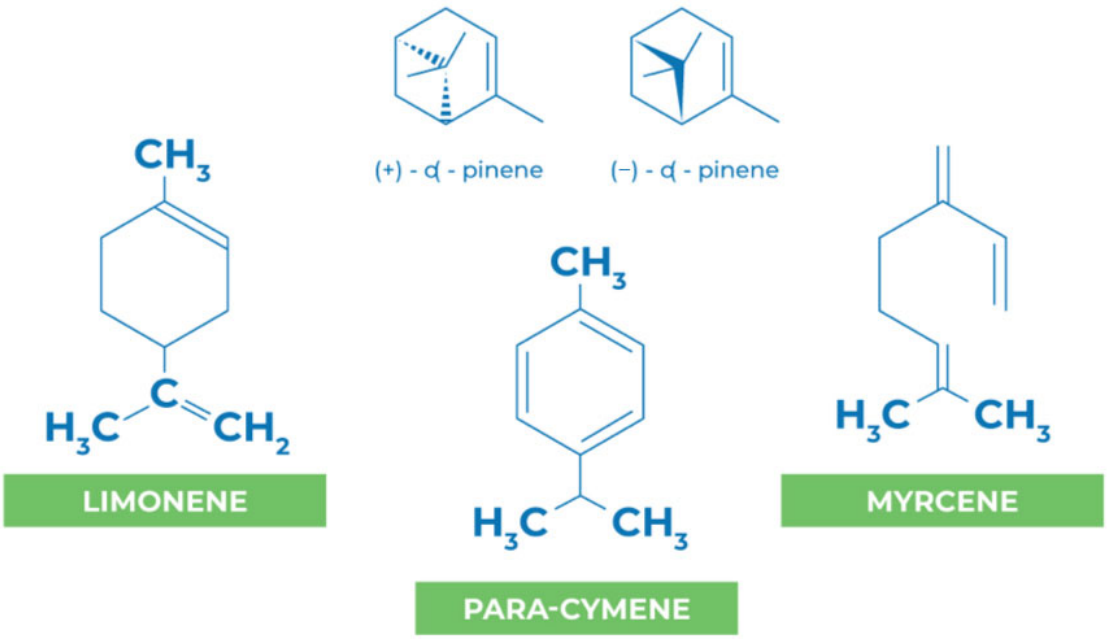
INGREDIENTS: WATER (75%), **SUGARS (12%)** (GLUCOSE (48%), FRUCTOSE (40%), SUCROSE (2%), MALTOSE (<1%), STARCH (5%), FIBRE E460 (3%), **AMINO ACIDS (<10%),** (GLUTAMIC ACID (19%), ASPARTIC ACID (16%), HISTIDINE (11%), LEUCINE (7%), LYSINE (5%), PHENYLALANINE (4%), ARGININE (4%), VALINE (4%), ALANINE (4%), SERINE (4%), GLYCINE (3%), THREONINE (3%), ISOLEUCINE (3%), PROLINE (3%), TRYPTOPHAN (1%), CYSTINE (1%), TYROSINE (1%), METHIONINE (1%)), **FATTY ACIDS (1%)** (PALMITIC ACID (30%), OMEGA-6 FATTY ACID: LINOLEIC ACID (14%), OMEGA-3 FATTY ACID: LINOLENIC ACID (8%), OLEIC ACID (7%), PALMITOLEIC ACID (3%), STEARIC ACID (2%), LAURIC ACID (1%), MYRISTIC ACID (1%), CAPRIC ACID (<1%)), ASH (<1%), PHYTOSTEROLS, E515, OXALIC ACID, E300, E306 (TOCOPHEROL), PHYLLOQUINONE, THIAMIN, **COLOURS** (YELLOW-ORANGE E101 (RIBOFLAVIN), YELLOW-BROWN E160A), **FLAVOURS** (3-METHYLBUT-1-YL ETHANOATE, 2-METHYLBUTYL ETHANOATE, 2-METHYLPROPAN-1-OL, 3-METHYLBUTYL-1-OL, 2-HYDROXY-3-METHYLETHYL BUTANOATE, 3-METHYLBUTANAL, ETHYL HEXANOATE, ETHYL BUTANOATE, PENTYL ACETATE), 1510, NATURAL RIPENING AGENT (ETHENE GAS).

With Permission of James Kennedy

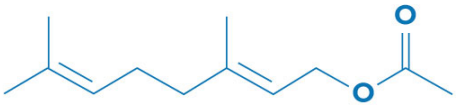
All Natural Banana

With Permission of James Kennedy

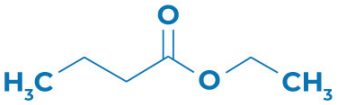
Terpene Hydrocarbons



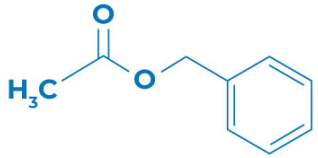
Esters



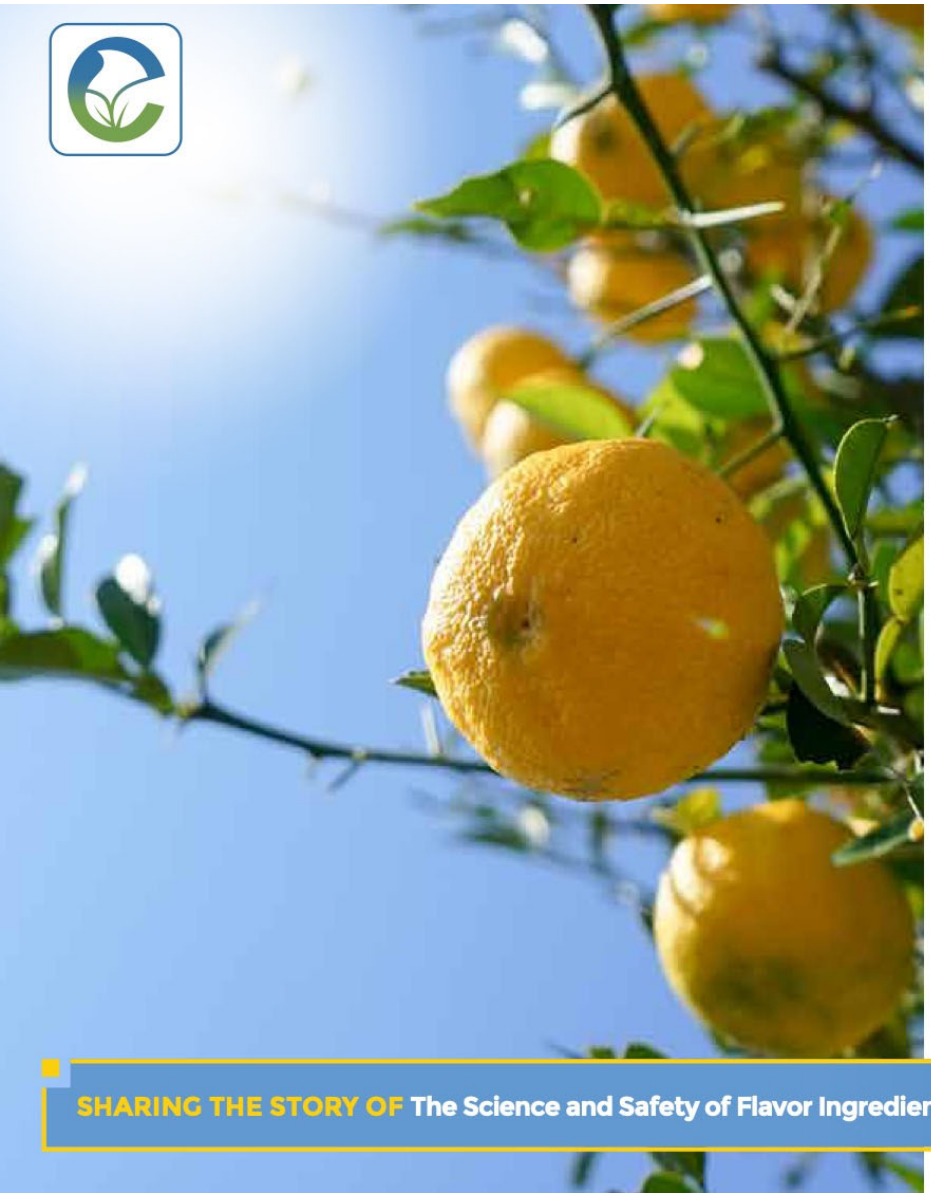
GERANYL ACETATE



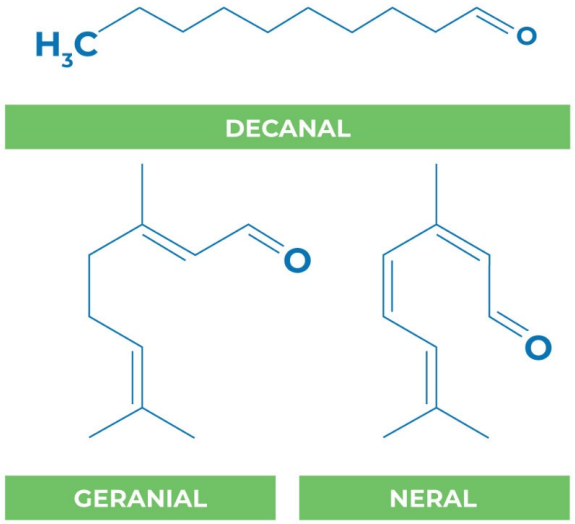
ETHYL BUTYRATE

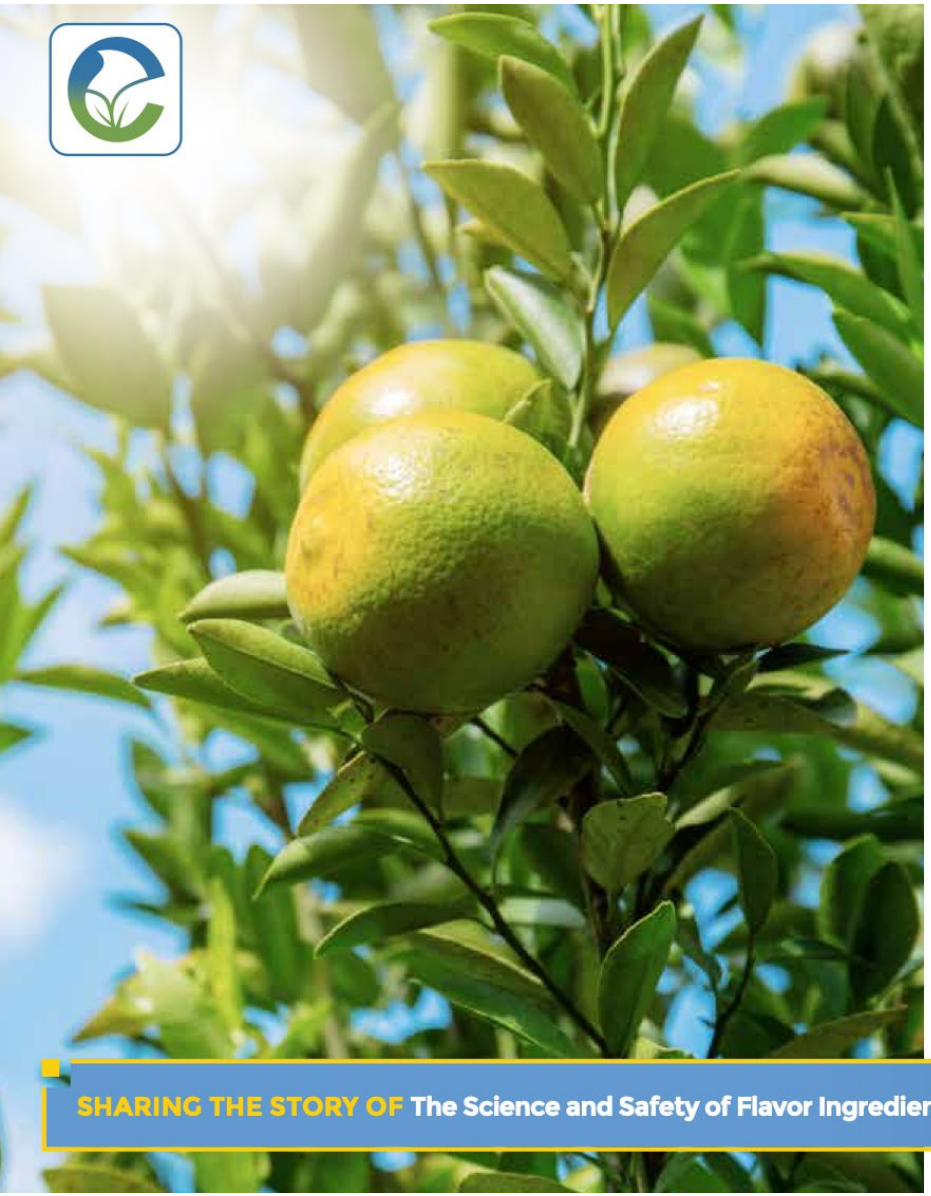


BENZYL ACETATE

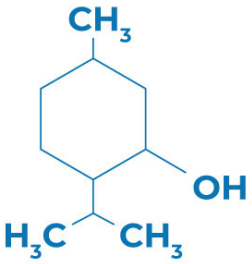


Aldehydes

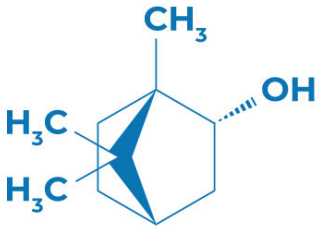




Alcohols

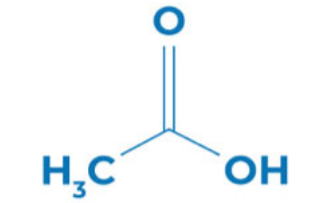


MENTHOL

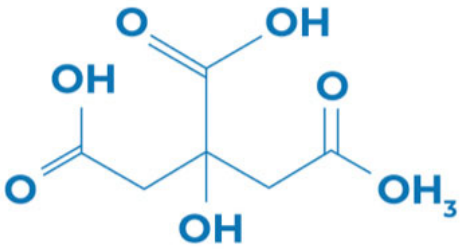


BORNEOL

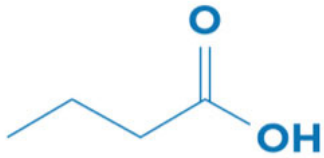
Acids



ACETIC ACID

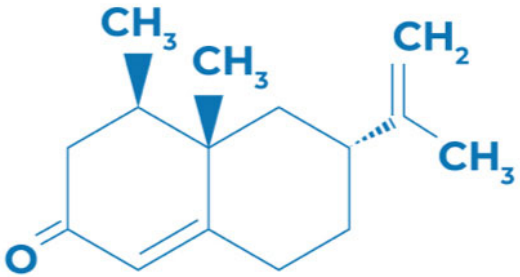


CITRIC ACID

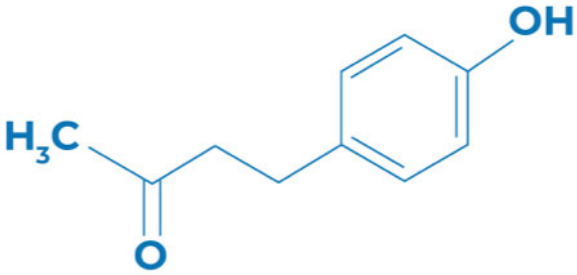


BUTYRIC ACID

Ketones

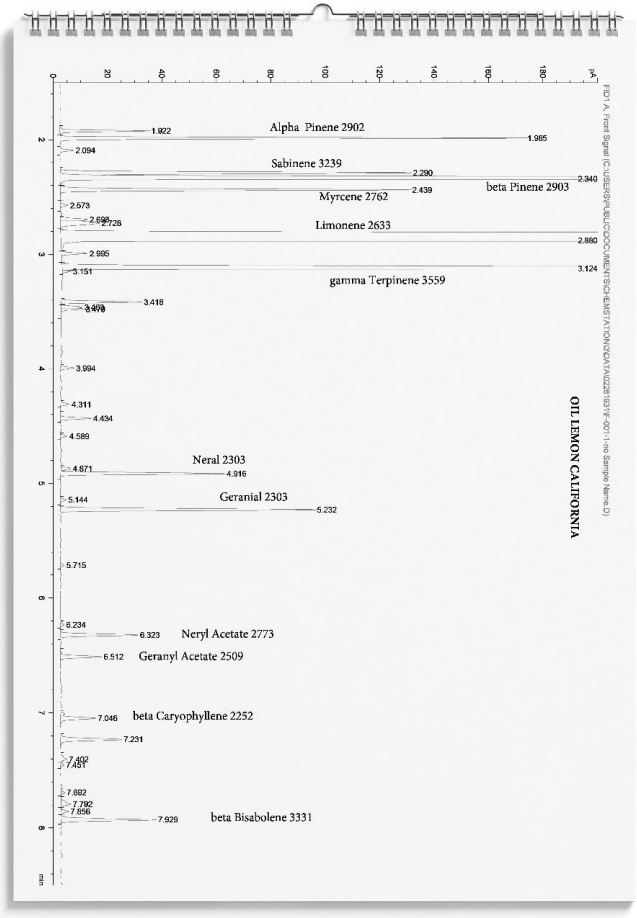


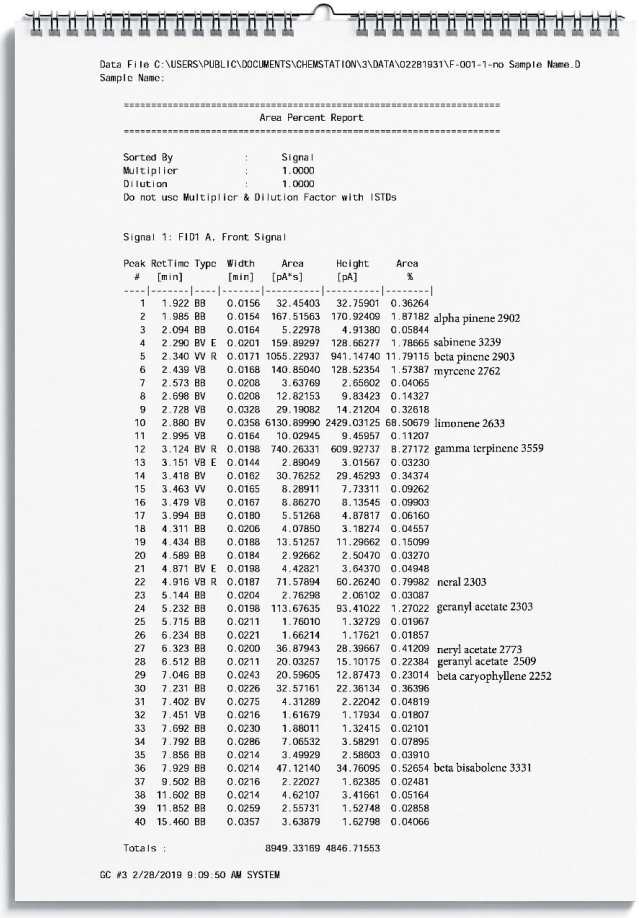
NOOTKETONE



RASPBERRY KETONE

Lemon Oil





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Area Percent Report

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A, Front Signal

Peak #	RetTime [min]	Type	Width [min]	Area [pA*s]	Height [pA]	Area %	
1	1.922	BB	0.0156	32.45403	32.75901	0.36264	
2	1.985	BB	0.0154	167.51563	170.92409	1.87182	alpha pinene 2902
3	2.094	BB	0.0164	5.22978	4.91380	0.05844	
4	2.290	BV E	0.0201	159.89297	128.66277	1.78665	sabinene 3239
5	2.340	VV R	0.0171	1055.22937	941.14740	11.79115	beta pinene 2903
6	2.439	VB	0.0168	140.85040	128.52354	1.57387	myrcene 2762
7	2.573	BB	0.0208	3.63769	2.65602	0.04065	
8	2.698	BV	0.0208	12.82153	9.83423	0.14327	
9	2.728	VB	0.0328	29.19082	14.21204	0.32618	
10	2.880	BV	0.0358	6130.89990	2429.03125	68.50679	limonene 2633
11	2.995	VB	0.0164	10.02945	9.45957	0.11207	
12	3.124	BV R	0.0198	740.26331	609.92737	8.27172	gamma terpinene 3559
13	3.151	VB E	0.0144	2.89049	3.01567	0.03230	
14	3.418	BV	0.0162	30.76252	29.45293	0.34374	
15	3.463	VV	0.0165	8.28911	7.73311	0.09262	
16	3.479	VB	0.0167	8.86270	8.13545	0.09903	
17	3.994	BB	0.0180	5.51268	4.87817	0.06160	
18	4.311	BB	0.0206	4.07850	3.18274	0.04557	
19	4.434	BB	0.0188	13.51257	11.29662	0.15099	
20	4.589	BB	0.0184	2.92662	2.50470	0.03270	
21	4.871	BV E	0.0198	4.42821	3.64370	0.04948	
22	4.916	VB R	0.0187	71.57894	60.26240	0.79982	neral 2303
23	5.144	BB	0.0204	2.76298	2.06102	0.03087	
24	5.232	BB	0.0198	113.67635	93.41022	1.27022	geranyl acetate 2303
25	5.715	BB	0.0211	1.76010	1.32729	0.01967	
26	6.234	BB	0.0221	1.66214	1.17621	0.01857	
27	6.323	BB	0.0200	36.87943	28.39667	0.41209	neryl acetate 2773
28	6.512	BB	0.0211	20.03257	15.10175	0.22384	geranyl acetate 2509
29	7.046	BB	0.0243	20.59605	12.87473	0.23014	beta caryophyllene 2252
30	7.231	BB	0.0226	32.57161	22.36134	0.36396	
31	7.402	BV	0.0275	4.31289	2.22042	0.04819	
32	7.451	VB	0.0216	1.61679	1.17934	0.01807	
33	7.692	BB	0.0230	1.88011	1.32415	0.02101	
34	7.792	BB	0.0286	7.06532	3.58291	0.07895	
35	7.856	BB	0.0214	3.49929	2.58603	0.03910	
36	7.929	BB	0.0214	47.12140	34.76095	0.52654	beta bisabolene 3331
37	9.502	BB	0.0216	2.22027	1.62385	0.02481	
38	11.602	BB	0.0214	4.62107	3.41661	0.05164	
39	11.852	BB	0.0259	2.55731	1.52748	0.02858	
40	15.460	BB	0.0357	3.63879	1.62798	0.04066	
Totals :				8949.33169	4846.71553		

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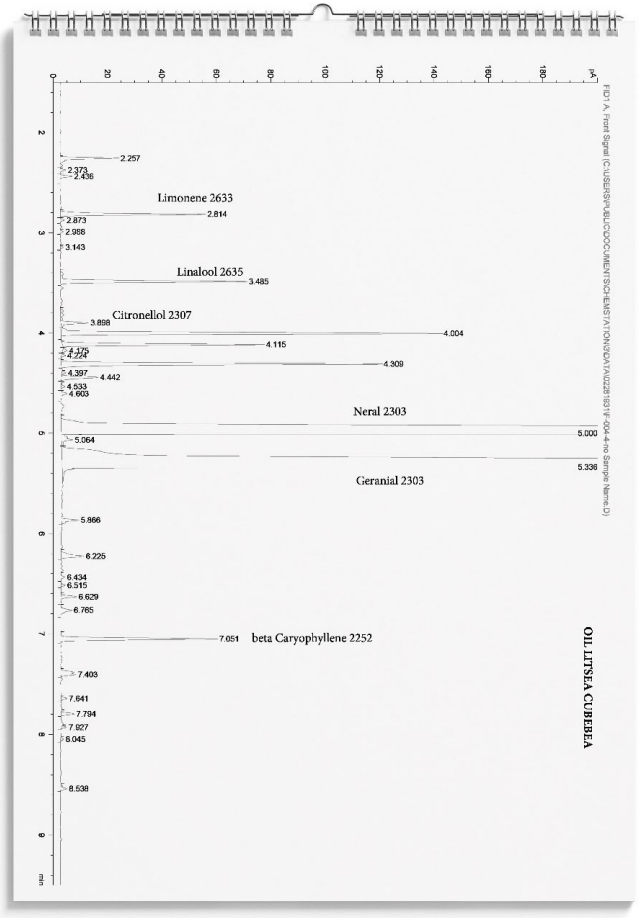
6 NATURAL VS. SYNTHETIC

“Natural” Definition
21 CFR 101.22 (3)

The term **Natural Flavor** or **Natural Flavoring** means the essential oil, oleoresin, essence or extractive, protein hydrolysate, distillate, or any product of roasting, heating or enzymolysis, which contains the flavoring constituents derived from a spice, fruit, or fruit plant material, meat, seafood, poultry, eggs, dairy products, or fermentation products thereof, whose significant function in food is flavoring rather than nutritional. Natural flavors include the natural essence or extractive obtained from plants listed in 182.10, 182.20, 182.40, and 182.50 and part 184 of this chapter and the substances listed in 172.510 of this chapter.

Litsea Oil



Data File C:\USERS\PUBLIC\DOCUMENTS\CHEMSTATION\3\DATA\02281931\F-004-4-no Sample Name.D
Sample Name:

Area Percent Report

Sorted By : Signal
Multiplier : 1.0000
Dilution : 1.0000
Do not use Multiplier & Dilution Factor with ISTDs

Signal 1: FID1 A, Front Signal

Peak #	RetTime [min]	Type	Width [min]	Area [pA*s]	Height [pA]	Area %	
1	0.578	BB	0.0141	6.93308	8.18496	0.09138	
2	2.257	BV R	0.0195	27.17232	21.50942	0.35816	limonene 2633
3	2.373	BV	0.0195	2.51522	1.98979	0.03315	
4	2.436	VB	0.0171	4.94313	4.38852	0.06516	
5	2.814	BV	0.0182	64.72318	53.32258	0.85312	
6	2.873	VB	0.0177	1.81024	1.53678	0.02386	
7	2.988	BB	0.0170	1.25068	1.12144	0.01649	
8	3.143	BB	0.0189	1.34259	1.10973	0.01770	
9	3.485	BB	0.0204	91.26104	68.36997	1.20291	linalool 2635
10	3.898	BV E	0.0274	18.78169	10.04779	0.24756	citronellol 2307
11	4.004	VB R	0.0200	181.87796	139.87164	2.39733	
12	4.115	BB	0.0194	92.32468	74.01085	1.21693	
13	4.175	BB	0.0246	2.64991	1.62860	0.03493	
14	4.224	BB	0.0196	1.89179	1.48887	0.02494	
15	4.309	BB	0.0216	161.01529	117.58627	2.12234	
16	4.397	BV E	0.0205	1.82071	1.42523	0.02400	
17	4.442	VB R	0.0242	20.42129	13.40154	0.26917	
18	4.533	BB	0.0277	2.55939	1.39968	0.03374	
19	4.603	BB	0.0266	4.10769	2.36847	0.05414	
20	5.000	BV R	0.0432	2965.32983	900.85791	39.08599	neral 2303
21	5.064	VV E	0.0331	10.14549	4.08548	0.13373	
22	5.336	VB	0.0474	3768.68945	1012.56854	49.67506	geranial 2303
23	5.866	BB	0.0217	9.08374	6.25527	0.11973	
24	6.225	BB	0.0274	15.55443	8.32983	0.20502	
25	6.434	BB	0.0191	1.83237	1.49157	0.02415	
26	6.515	BB	0.0209	2.02410	1.54557	0.02668	
27	6.629	BB	0.0212	8.09665	5.75375	0.10672	
28	6.765	BB	0.0283	7.90295	4.07053	0.10417	
29	7.051	BB	0.0217	79.13291	57.40941	1.04305	beta caryophyllene 2252
30	7.403	BB	0.0335	13.35877	5.42280	0.17608	
31	7.641	BB	0.0213	2.85554	2.11880	0.03764	
32	7.794	BB	0.0208	6.18102	4.73289	0.08147	
33	7.927	BB	0.0180	1.89024	1.67303	0.02492	
34	8.045	BB	0.0239	1.58389	1.05553	0.02088	
35	8.538	BB	0.0247	3.61956	2.21286	0.04771	
Totals :				7586.68278	2544.32594		

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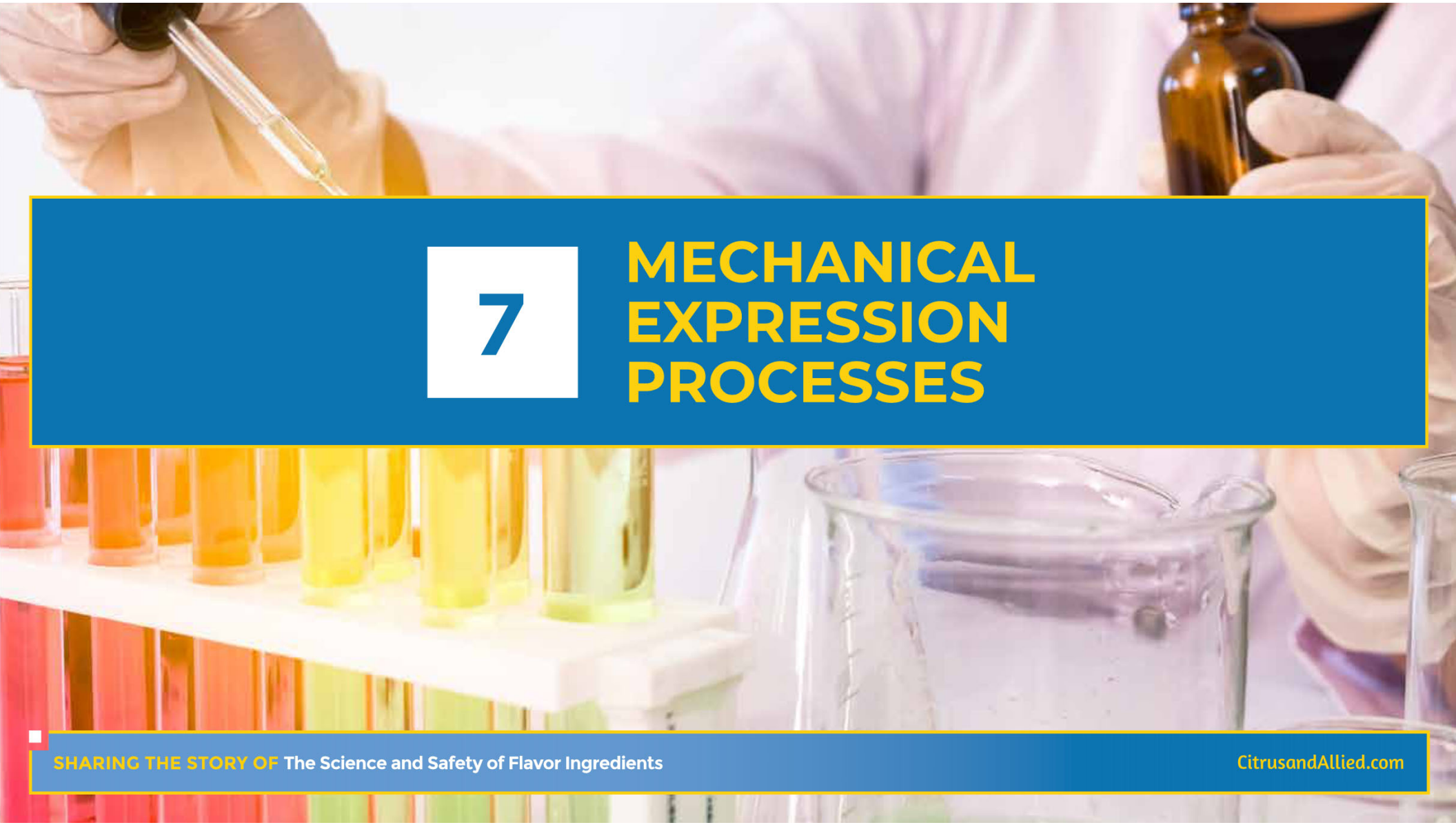


7 MECHANICAL EXPRESSION PROCESSES

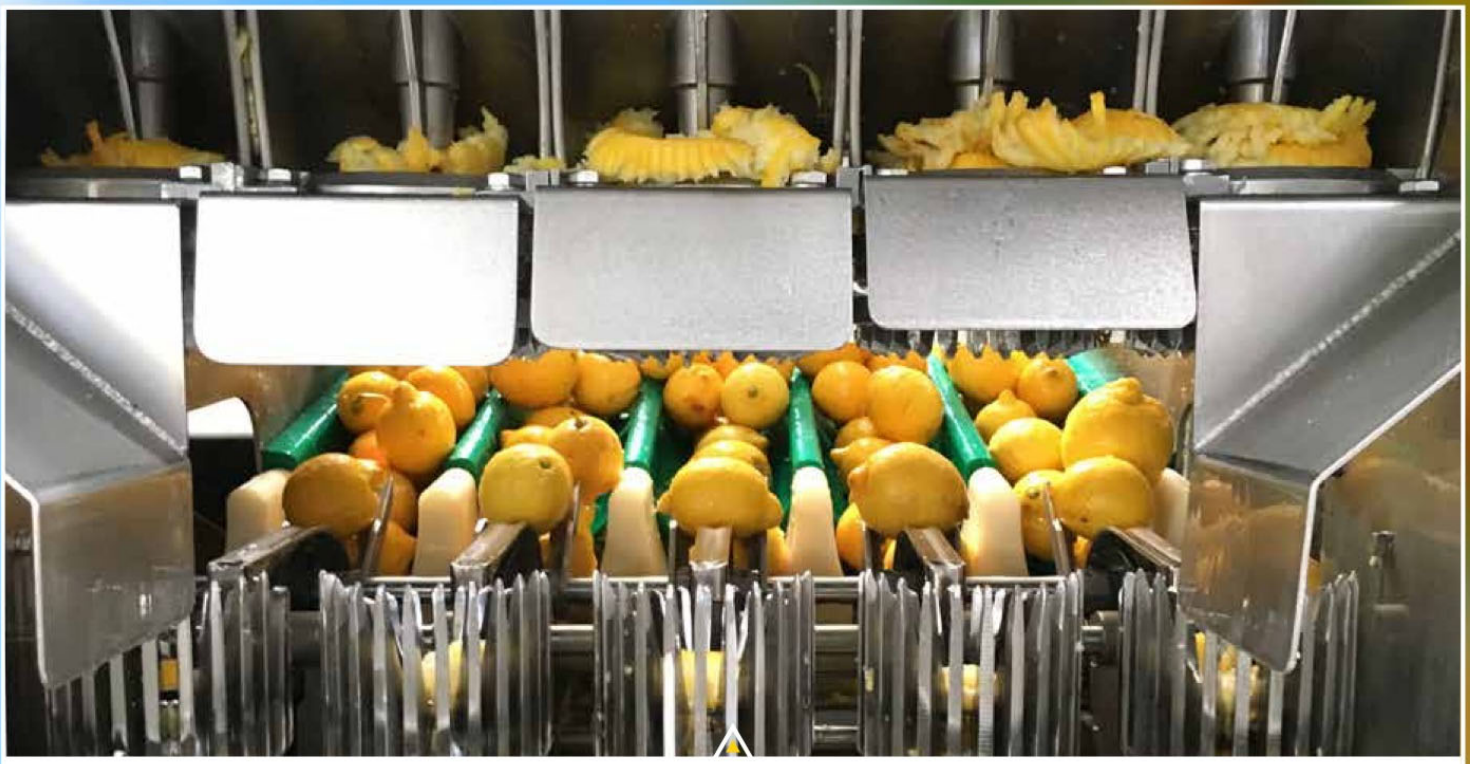
Cunculina

- Original apparatus for expressing citrus oils
- Tools are called Rasteddi

Lemons for Processing

Lemon Groves

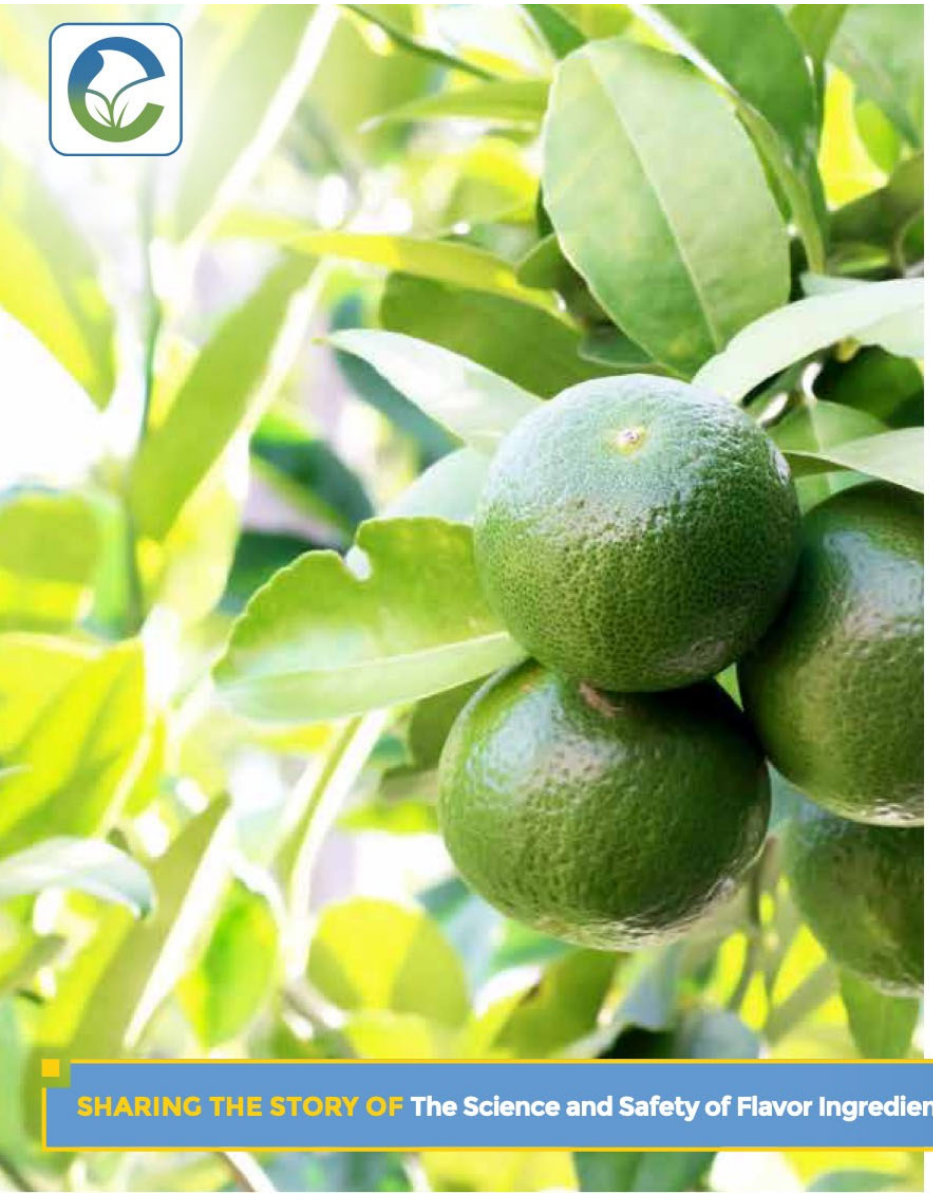
Citrus Juice and Oil Extractor



Citrus Juice and Oil Extractor

Citrus Peel After Extraction

6 NATURAL VS. SYNTHETIC



Fractional Distillation

In Japan, where the population is particularly well educated, there is no legal distinction in consumer product labeling between a food or beverage product that is flavored with natural ingredients and one flavored with synthetic ingredients.

The label simply indicates, “Flavored”.

Raspberry Prototype – Natural vs. Artificial

RASPBERRY - NATURAL SAMPLE A		RASPBERRY - ARTIFICIAL SAMPLE B
% BY WEIGHT	INGREDIENTS	% BY WEIGHT
97.70	Ethy Alcohol	97.70
1.00	Maltol	1.00
0.10	Propionic Acid	0.10
0.40	Ethyl Acetate	0.40
0.10	Ethyl Butyrate	0.10
0.30	Ethyl-2-Mthyl-Butryate	0.30
0.02	Isovaleric Acid	0.02
0.02	Benzaldehyde 10% ETOH	0.02
0.02	CIS-3-Hexenyl Acetate	0.02
0.30	Beta Ionone 10% in ETOH	0.30
0.04	Dimethyl Sulfide	0.04
TOTAL = 100%	*Formula Creation by Peter Wasko*	TOTAL = 100%

8 CLOSING REMARKS

Do you think that enjoying foods from different cultures fosters global understanding?

Want to have fun with chemistry?

Become a Flavor Chemist!

Thank You

Please Inquire by Emailing,
Rpisanojr@citrusandallied.com

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Citrus and Allied Essences Ltd

Scan the QR Code
to download the paper,
The History of the Safety Evaluation of Flavor Ingredients,
from which this presentation is derived