



# Development of a Sensory Lexicon for Almonds



## Abstract

Although the sensory characteristics of peanuts are well documented, to date, no attempt had been made to qualify and quantify the appearance, aroma, flavor and textural characteristics of almonds. Creation of a standard lexicon provides researchers with a tool to understand the range and importance of each sensory characteristic. The objective of this study was to develop a comprehensive sensory lexicon that encompasses attributes relating to appearance, aroma, flavor and texture of untreated and treated almonds.

Commissioned by the Almond Board of California, Sensory Spectrum evaluated thirty-six samples of raw almonds, representing 20 different almond varieties, procured from sources across California. Nine staff members of Sensory Spectrum, trained and experienced in detailed appearance, flavor and texture analysis, evaluated fifteen randomly selected samples in April 2005 over two sessions.

Lexicons for Appearance, Aroma, Flavor, and Texture attributes of almonds were developed. The terminology and definitions yielded a formal lexicon and evaluation ballot. Six almond samples were selected from the fifteen previously tasted to validate the lexicon. The six samples selected showed differences in perceived appearance, flavor or texture attributes during the initial screening. A total of 14 appearance, 1 aroma, 33 flavor aromatics, 3 basic taste and 2 chemical feeling factor attributes, and 19 texture attributes with corresponding definitions were initially developed. After later evaluation of roasted and pasteurized almonds, additional terms and definitions were added as new characteristics were uncovered. The current almond lexicon as presented contains 15 appearance terms; 9 aroma terms; 36 flavor aromatics, 3 basic taste and 4 chemical feeling factor terms, and 19 textural terms, all with definitions.

Creation of a detailed, working lexicon provides almond researchers, producers, and retailers a better platform to communicate observations in the quality grading of almonds.

## Methodology

Thirty six samples of almonds were sent to Sensory Spectrum for evaluation. These samples were representative of 20 different almond varieties. Nine Sensory Spectrum staff members, trained in detailed appearance, aroma, flavor and texture descriptive analysis participated in the evaluations.

Fifteen randomly selected almond samples were chosen for screening. Samples were qualitatively evaluated for appearance, flavor and texture for the purpose of terminology generation. Attributes were discussed and refined, and definitions were generated.

Six of the initial 15 screening samples were selected for lexicon validation based on screening differences for one or more evaluation modality. Samples were presented blindly to the evaluation panel. Samples were evaluated for appearance, aroma, flavor and texture attributes with profiles generated for each sample.

## Results

The initial lexicon contained a total of 72 terms with definitions. These included 14 appearance, 1 aroma, 33 flavor aromatics, 3 basic taste, 2 chemical feeling factor and 19 textural terms. Subsequent evaluation of roasted almonds and pasteurized almonds allowed for further development of the lexicon to its present state. The present almond lexicon contains 86 attributes divided as follows: 15 appearance terms; 9 aroma terms; 36 flavor aromatics, 3 basic taste and 4 chemical feeling factor terms; and 19 textural terms and definitions. Lexicon creation is dynamic; as new attributes are uncovered and/or understanding of given terms is expanded (i.e., to be more specific), this lexicon may grow and change.

APPEARANCE	
<b>Color Hue</b>	The actual color name, such as red, blue, etc. (see-brown).
<b>Color Intensity</b>	The intensity or strength of the color from light to dark.
<b>Chroma</b>	The brightness or purity of the color from dull/muted to pure/bright.
<b>Visual Roughness</b>	The amount of hills and valleys visible on the surface of the sample.
<b>Evenness of Color Within a Sample</b>	The degree to which the sample color is the same throughout the product.
<b>Evenness of Color Within a Seed</b>	The degree to which the sample color is the same across each seed, not blotchy.
<b>Size of Almond * Thickness</b>	The visual height of the nut from end to end.
<b>Width</b>	The visual width of the product from side to side.
<b>Roundness</b>	The degree to which the nut is rounded in shape and not flat.
<b>Uniformity of Nuts (within a sample)</b>	The degree to which the nut size and shape are uniform throughout the sample.
<b>Macro Roughness</b>	The amount of hills and valleys visible on the surface of the sample.
<b>Micro Roughness</b>	The amount of small cracks and crevices visible on the surface of the sample. Includes perceivable particulates (grits and granes).
<b>Wholeness</b>	The degree to which the nuts are whole and not broken into pieces.
<b>Skin Lifting</b>	The incidence of almonds in a sample, in which the skin has adhered to the nut meat in an uneven, wrinkled and lifted fashion.

AROMA	
<b>Total Aroma Impact</b>	Total intensity of all odors of a product when its volatiles enter the nasal passages and are perceived by the olfactory system.
<b>Almond Nut Meat</b>	The aroma compounds associated with the meat of almonds.
<b>Dark Roast</b>	The aroma compounds associated with cocoa beans and/or nuts that have been dark roasted but not burnt with the general category of wood and/or dried tea leaves with fermented fruit character.
<b>Woody/tea/fruit</b>	The aroma compounds of fresh vegetable oil, uncooked beans or squash.
<b>Vegetable Oil/Beany/Squash</b>	The aroma compounds associated with nuts also smell sweet and which was an aromatic of browned sugar.
<b>Sweet Aromatic/ Caramelized</b>	The aroma compounds associated with partially oxidized oil; it is reminiscent color of cardboard boxes.
<b>Cardboard</b>	The aroma compounds associated with benzaldehyde; is reminiscent of cherry candy or almonds.
<b>Benzaldehyde</b>	The aroma compounds associated with dried red fruits, specifically cranberries.
<b>Dried Red Fruit (Cranberry)</b>	

FLAVOR – BASIC TASTES	
<b>Sweet</b>	The taste on the tongue stimulated by sucrose and other sugars, such as fructose, glucose, etc., and by other substances, such as Aspartame, Aspartame-K, Aspartame and Asulfame-K.
<b>Sour</b>	The taste on the tongue stimulated by acid, such as citric, malic, phosphoric, etc.
<b>Bitter</b>	The taste on the tongue associated with caffeine and other bitter substances, such as quinine and hop biters.

FLAVOR – AROMATICS	
<b>Total Impact</b>	The total portion of flavor that is perceived by the sense of smell from a substance inside the mouth of almonds.
<b>Almond Nut Meat</b>	The aromatics associated with the meat of almonds.
<b>Raw</b>	The aromatics associated with uncooked beans or legumes.
<b>Cooked</b>	The aromatics associated with nuts, beans or legumes which have been gently heated or boiled.
<b>Roasted</b>	The aromatics associated with nuts which have been roasted.
<b>Dark Roast</b>	The aromatics associated with cocoa beans and/or nuts that have been dark roasted but not burnt.
<b>Other Nut Meat</b>	The aromatics associated with nuts other than almond.
<b>Walnut</b>	The aromatics associated with walnuts.
<b>Coconut/Lactone</b>	The aromatics associated with shredded coconut or coconut milk and dried coconut, including lactones.
<b>Sweet Aromatics</b>	The aromatics associated with products which also smell sweet (e.g., maple syrup, brown sugar, and vanilla).
<b>Benzaldehyde</b>	The aromatics associated with benzaldehyde, reminiscent of cherry candy or some almonds.
<b>Fruity</b>	The total aromatics associated with fruit.
<b>Red Fruit</b>	The total aromatics associated with red berries including the synthesized, raw and cooked notes of berries including strawberries, raspberries, and berries.
<b>Brown Fruit</b>	The aromatics associated with the general category of brown fruit including raisins, prunes and figs.
<b>Floral</b>	The aromatic character associated with the general category of flowers and fruit blossoms.
<b>Woody</b>	The aromatics associated with the general category of wood.
<b>Sawdust/ Pencil Shavings</b>	The aromatics associated with sawdust or pencil shavings.
<b>Fresh Cut Lumber</b>	The aromatics associated with fresh cut lumber including raw wood, green, and resin notes.
<b>Hulls/Skins/Cellulose</b>	The aromatics associated with nutlegume hulls and skins.
<b>Vegetable</b>	The aromatics associated with the vegetable category of products, including the aromatics of winter or summer squash varieties.
<b>Squash</b>	The aromatics associated with raw zucchini or other similar summer squash varieties.
<b>Zucchini</b>	The aromatics associated with raw pumpkin meat or seeds.
<b>Pumpkin</b>	The aromatics associated with uncooked beans (soy beans, green beans, navy beans, etc.).
<b>Raw Beany</b>	The aromatics associated with uncooked soy beans.
<b>Soy Beans</b>	The aromatics associated with uncooked green beans.
<b>Green Beans</b>	The aromatics associated with beans, grass, leaves and green peas (e.g., 3-bean-1-cd, GS-3-bean-1-cd).
<b>Green</b>	The aromatics associated with dried grass or hay, may be reminiscent of tea leaves.
<b>Grassy/Hay</b>	

FLAVOR – AROMATICS	
<b>Fruity Fermented</b>	The aromatics associated with fermented fruits, reminiscent of ethanol and rotting vegetation such as corn husks.
<b>Plastic/Waxy</b>	The general term used to describe the aromatics of plastics or wax.
<b>Cardboard/Paper</b>	The aromatics associated with a combination of wet paper and wet cardboard boxes.
<b>Painty</b>	The aromatics associated with lined oil or oil based paint.
<b>Earthy/Dry Dirt</b>	The aromatics associated with clean dry earth or potting soil.
<b>Ham</b>	The aromatics associated with cured meat such as ham.
<b>Tea/Tobacco</b>	The aromatics associated with dried tobacco and tea leaves.
<b>Solvent</b>	The flavor aromatics associated with a solvent or flavor carrier, reminiscent of ethyl alcohol or vodka.

TEXTURE SURFACE	
<b>Powdery/Fuzzy</b>	The amount of small fine particles detected by running the sample gently over the lips, with particles feeling reminiscent of velvet.
<b>Macro-roughness</b>	The amount of irregular structure in the surface evaluated by rubbing the sample over the lips. These may be small (grainy) or large (lumpy).
<b>Loose Particles</b>	The amount of loose particles on the surface evaluated by rubbing the sample over the lips.
<b>Moistness</b>	The degree of moistness on the surface of the sample evaluated by rubbing the sample over the lips.
<b>FIRST CHEW</b>	
<b>Hardness to Split/Crack</b>	The force required to bite into and crack the sample using the molars.
<b>Hardness to Grind Pieces</b>	The force required to bite through the fractured pieces of the sample after the first chew using the molars to crack.
<b>Crunch/Snap</b>	The force with which the sample breaks or fractures (rather than deforms) when placing the nuts between the molars and chewing down at an even rate.
<b>Cohesiveness of Chew</b>	The amount the sample deforms rather than breaks when placed between the molars with molars (Toughness).
<b>Moistness at 3 Chews</b>	The amount of wetness/oiliness/moisture in the mass after 3 chews.
<b>Number of Pieces</b>	The number of pieces the almond fractures into after first chew (Fracturability).
<b>Persistence of Crunch</b>	The number of chews that the sample still has a crunchiness sound.
<b>CHEWDOWN</b>	
<b>Number of Chews to Bolus</b>	The number of chews required to form a mass.
<b>Moistness of Mass</b>	The amount of wetness/oiliness/moisture in the chewed mass.
<b>Cohesiveness of Mass</b>	The degree to which the mass holds together in the mouth.
<b>Particulate Mass</b>	The amount of particles in the mass.
<b>Fibers Between Teeth</b>	The amount of fibers or fibrous material to grind between the molars after 10 chews.
<b>RESIDUAL</b>	
<b>Footpack</b>	The amount of product left in the teeth after 10 chews.
<b>Loose Particles</b>	The amount of chafed/granular particles remaining in the mouth after expectoration.
<b>Fatty/Oily Film</b>	The amount of fat/oily residue felt by the tongue when moved over the surface of the mouth.