Defect type, description, sample preparation, and cause by flavor attribute[1]

Flavor attribute	Type of defect	Defect description	Sample preparation	Cause of defect
Control	_	Sweet fresh flavor, perhaps slightly cooked if newly pasteurized. No aftertaste.	Protected from light and kept cold (< 4.0°C without freezing).	Good farm practices and good manufacturing practices strictly followed during processing.
Flat	Processing	Lacks mouth-feel, flavor fullness, or sweetness of fresh milk. Watery characteristic.	Substitute 400 mL spring water for 400 mL milk out of a 2L container of milk for approximately 20% flat.	Adulteration with water or low milk solids content.
Milk Carton	Processing	Cardboard, stale refrigerated odor/taste.	Alcohol wipe the gabled tops, open, and commingle 8 half pints.	Associated with paper-board packaging. Generally more apparent in half-pints due to increased package surface area to volume ratio.
Cooked	Processing	Varies in intensity from sweet, pleasant, with slight sulfurous note to caramelized or cabbage-like, which may be objectionable.	Use fresh 2% ultra-pasteurized milk for a consistently strongly cooked flavor.	Higher pasteurization temperatures and/or longer holding times.
Feed	Absorbed	Sweet hay aroma and grassy aftertaste	Weigh 30 g alfalfa into a split filter bag. Add 300 mL spring water. Compress by hand 40 times (x2). Hold for 1 hour. Squeeze liquid from bag into a container (filter if necessary). Aliquot 20 mL into screw cap vials and autoclave at 121°C, 15 psi for 30 min. Store at < 4.0°C without freezing. Substitute 3 vials of feed solution for 60 mL milk, carefully pipetting so as to not transfer sediment.	Transferred to cow's blood after absorption through lungs (via inhalation) or rumen (via ingestion) of a particular feed.
Fruity Fermented	Bacterial	Pineapple, apple, or strawberry-like fruity odor, with sometimes a sauerkraut or vinegar note.	Substitute 25 mL of 6:1 pineapple:vinegar for milk.	Growth of psychrotolerant bacteria, e.g. *Pseudomonas fragi.*

Light Oxidized	Chemical Biochemical	Plastic or medicinal odor and taste (or tallowy or like burnt feathers)	Place container directly in front of light box at 2000 lx intensity for approximately16 h at < 4.0°C without freezing.	Exposure of milk to sunlight or fluorescent lights resulting in protein degradation and/or lipid oxidation.
Malty	Bacterial	Malt-like aroma or taste (like Grape-nuts cereal, malted milk).	Add 15 g of Grape Nuts™ cereal to 300 mL milk, swirl, refrigerate at < 4.0°C without freezing for one half h with occasional swirling, strain through cheesecloth back into original refrigerated container.	Growth of *Lactococcus lactis* var. *maltigenes* (or possibly other organisms) due to poor refrigeration.
Acid	Bacterial	Buttermilk odor/taste. Sour, tart, tingling sensation on tip of tongue.	Substitute 300 mL buttermilk (preferably highly acidic, unsalted) for 300 mL of milk.	Growth of lactic acid producing organisms such as *Lactococcus lactis*, due to poor refrigeration, especially when temperatures exceed 70°F (21°C).
Rancid	Bacterial or Biochemical	Pungent cheesy odor that will smell like baby's vomit when rubbed on wrist.	Pour half gallon of milk into clean container. Add small chunks totaling 20 g of strong unsmoked American provolone. Refrigerate at < 4.0°C without freezing for 24 h, with occasional inversion. Strain through cheesecloth into original refrigerated container.	Release of free fatty acids such as butyric from milk fat by natural or microbial enzymes. In raw milk, associated with excessive agitation, temperature abuse, or cow related factors (e.g., health or nutrition, such as low anti-oxidants in feed).
Bitter	Bacterial	Lingering aftertaste as from tonic water (quinine), strong coffee, grapefruit. No odor if the only defect present.	Transfer 300 mL milk to clean 500 mL container. Add 1.0 g caffeine (Sigma Aldrich, St. Louis, MO). Add a stir bar, apply lid, and stir on a stir plate for 30 min. Transfer back to original refrigerated container.	Enzymatic breakdown (by microbial or milk enzymes) of milk proteins to short bitter peptides.

[1]Adapted from: Bandler, D.K. and S.E. Barnard. (1984) Milk Flavor and Quality – from Cow to Consumer, Cornell University, Ithaca, NY ASIN: B00070N0QY