Understanding Aroma & Flavours and Optimizing Sensory Quality of Spirit Beverages

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Contents

• Spirits vs. other beverages
• Categories of spirit beverages
• Origins & development of flavours during spirit production
• Optimizing Sensory Quality of Spirit Beverages
• Sensory Evaluation - Systems & Tools
• Retronasal Tasting using Off notes and positive GMP flavour references
• On-line Proficiency validation & maintenance of sensory panel
• Embedding best sensory practices
Spirits have complex flavours “congeners” derived from hundreds of different compounds fusel alcohols, methanol, acetone, acetaldehyde, esters, medium-chain Fatty Acids sulphur compounds, tannins, and aromatic aldehydes during fermentation, distillation and maturation.

Alcohols and esters acts as strong modifiers of many flavours, affecting their head-space concentration and flavour release.

Some flavours are characteristic of some spirits categories (e.g. smoky from peat, coconut from whisky lactone, woody (Vanilla) from oak.)
Distilled Spirits Beverages

- Whisky or whiskey, Brandy, Rum, Gin and Vodka
- Shochu - Japanese distilled beverage less than 45% ABV
- Tequila - Spirit made in Mexico from the blue agave plant
- Mezcal (or mescal) - Spirit made in Mexico from any type agave plant
- Cachaça - Spirit made in Brazil from fermented sugarcane juice
- Pisco - Brandy produced in winemaking regions of Peru and Chile
- Raki - An anise-flavoured spirit from Turkey which is also known as arak in the Levant countries and ouzo in Greece
- **Craft Spirits** - A Fast Emerging Trendy Spirit Category
Spirit Production Process

Three steps are involved in Spirit production

- **Fermentation:** Conversion of sugar into alcohol using suitable yeast

- **Distillation:** to concentrate alcohol, to leave behind non-volatile compounds, Selectively ‘cut’ fractions having congeners

- **Maturation:** Three fundamentally different effects in casks are:
  - Subtractive maturation (Aldehyde, Acid)
  - Additive maturation (Tannin, Aromatic Aldehydes);
  - Interactive maturation (Esters)

- **Vodka and Gin do not require maturation**
Origins & development of flavours at various stages of spirits production
Sources of Flavours

- Raw Materials
- Fermentation
- Distillation
- Maturation
Raw Materials

Varies with categories:

- Whiskies - Malted Barley, grains
- Brandies - Grapes, Fruits
- Rum - Molasses
- Gin – Grain, Botanicals
- Vodka – Grain
- Tequila & Mezcal – Agave
- Shochu – Rice
- Cachaça – Sugar Cane Juice
Flavour Formation during Fermentation

• Substances other than Ethanol produced during fermentation are known as **congeners**

• **Congeners** are responsible for most of the taste and aroma of distilled alcoholic beverages

• Includes chemicals compounds such as higher alcohols/fusel oils, esters, Fatty/organic acids, aldehydes, ketones (Diacetyl), and sulphur compounds
In ethanol fermentation, (1) one glucose molecule breaks down into two pyruvates. The energy from this exothermic reaction is used to bind the inorganic phosphates to ADP and convert NAD+ to NADH. (2) The two pyruvates are then broken down into two acetaldehydes and give off two CO2 as a by-product. (3) The two acetaldehydes are then converted to two ethanol by using the H- ions from NADH, converting NADH back into NAD+.
Flavour Formation during Fermentation

Yeast Metabolism During Fermentation

- Sugars
- Oxygen
- CO₂
- Ethanol
- Acetaldehyde
- Organic Acids
- Amino Acids
- Membranes
- Unsaturated Fatty Acids
- Sterols
- Esters
- Higher Alcohols
- VDK
- Sulfur Volatiles

Glucose → Pyruvate → TCA Cycle → Amino Acids

Energy
Fermentation congeners – Fusel Oils

• Fusel oils - predominantly amyl alcohol

• Aeration of wort, high temperature and high nitrogen (amino acids) promotes production

• Impart body and pleasant banana, sweetish, aromatic flavours but unpleasant solvent notes at higher level
Fermentation congeners – Esters

Esters are the largest group of aroma compounds, major part formed by the ethyl esters of fatty acids.

Over 90 distinct fermentation esters are identified which imparts diverse fruity and flowery notes:
Notably
• ethyl acetate (fruity/solvent),
• ethyl caproate (apple/aniseed),
• ethyl caprylate (apple-like aroma),
• Ethyl caprate (sweet, waxy, fruity),
• ethyl laurate (apple, sweetish, fruity),
• iso amyl acetate (banana/apple),
• phenyl ethyl acetate (roses/honey).
Fermentation congeners – Acids

The acids formed which impact the aroma profile include:

- **Medium/Long Chain Fatty Acids**: Important medium/long chain fatty acids are caproic, caprylic and capric acids. Described as soapy, goaty, oily, rancid, caprylic flavours.

- **Short Chain Fatty Acids**: Propionic, Butyric, isovaleric acids, with their strong smells, viz., sweaty, vomit, cheesy, contributes to the odour profile of spirit.

- **Organic Acids**: Important weak acids produced by yeast and contaminant microbes are acetic, pyruvic, succinic and lactic acids. Described as sour, acidic, acetic flavours.
Fermentation congeners – Sulphur Compounds

• As a product of sulphate reduction, H2S is an intermediate in the biosynthesis of all sulphur-containing compounds required for cell growth and function.

• All organic sulphur compounds are formed via sulphur containing amino acids

• Sulphur compounds viz., DMS, DMDS, DMTS, CS2, Methanethiol, H2S, etc. are formed from sulphur containing amino acids which have very low odour thresholds and poses large negative effect on the final aroma of the spirit
Fermentation congeners – Others

- **Carbonyl compounds**: Side products of amino acid synthesis
  - acetaldehyde, propionaldehyde, furfural, 2,3-pentandione, iso- & and n- butyraldehyde, iso- & n- valeraldehyde and diacetyl.

  In small portion, but sharp aroma contribute much to the odour intensity.

- **Diacetyl** (buttery, butterscotch, aroma), a by product of yeast nitrogen metabolism and bacterial metabolism.
  - Pleasant in small amount but large amount is regarded as a flavour defect.

- **Phenols** occur in minor amounts in whisky, but the majority of these compounds originate from the raw materials e.g., Peat, rather than being fermentation by-products.
Flavour Development in Pot Distillation

- Two stills are normally used, the wash still and spirit still. Third distillation is also practiced particularly in Ireland. Removes more of flavour volatiles giving “lighter” spirit (in flavour but not alcohol).

- All volatile components, “Congeners” of the wash are collected in LW. Includes three classes of congeners which affects distribution between foresheets, spirits and feints. A. More volatile than ethanol B. Similar volatility to ethanol C. Less volatile than ethanol

- Different congeners of type C (C1 & C2) reach maximum level at different times. Hence “Cut point” between spirit and feint critically influences the flavour. For cut points between 60 – 50 %. Cut point of 50 % has stronger flavours though weaker in ethanol.
Flavour Development in Pot Distillation 2

Typical Cut points

Foreshot / Spirit 68-75 % alcohol
Spirit/Feints 55-65 % alcohol
End Points 0.1 % alcohol

Panek & Boucher 1989
Flavour Development in Pot Distillation

- Reflux in the still also affects the flavours
- Greater the reflux, more the low volatiles but strongly flavoured components condense and return to pot
- With less reflux more of these components pass over condenser and to spirit
- Reflex is affected by shape of the still and affects the flavour strength
- New make spirit quality of each distillery vary and has its own characteristics
Flavour Development in Pot Distillation 4

Pot Still Shapes Pictures

A. Spherical lid; B. Intermediate connection; C. Conical and tall neck; D. bend; E. Lyne arm

Flavour Development in Continuous “Coffey” still Distillation

• Volatiles from wash is stripped by steam and condensed at appropriate level in the temperature gradient of the rectifier.

• Ethanol at ~ 94 % is collected near top of rectifier. Not pure enough for Gin or vodka. But for grain whisky reduced to ~60-70% abv and matured for 3 years.

• Compounds more volatile than ethanol stripped from ethanol stream and compounds less volatile than ethanol condensed in the lower section of analyser column.

• Contains only small amounts of congeners mostly fusel oils which imparts a whisky character.
Flavour Development in Continuous “Coffey” still Distillation 2

Continuous Still Distillation

A: Analyzer
B: Rectifier
Condenser

1. Wash
2. Steam
3. Liquid out
4. Alcohol vapor
5. Less volatile components are recycled
6. Most volatile components
7. Spirit
Development of Flavour: Congeners and Distillation

Relative Volatility of Congeners

\[ K = \frac{\text{Mole fraction in vapour}}{\text{Mole fraction liquid}} \]

- Acetaldehyde (A)
- Ethanol
- i-Amyl alcohol (B)
- Phenol (C)

Source: Science and Technology of Whiskies

Congener profile in rectifier
Typical Craft Spirit Distillation Still
Maturation

- Involves Subtractive, Additive & Productive maturation processes
- Responsible for the non-volatile components of spirits
- Enriches the sensorial characteristics of the product
- Stabilizes colour and improve limpidity
- For Scotch whisky, the minimum maturation period is three years; it may be different for other whiskies
- Maturation uses oak casks, which may be new or used, charred or uncharred (depending on the type of product)
- Increases congeners (constituents of small molecules other than ethanol) during maturation might depress alcohol metabolism to modify alcohol toxicity and reduce unpleasant after-effects.
- Accelerated ageing has also received considerable attention from craft spirits producers – Small casks, oak chips, balls, cubes & spirals, Thea One reactor, etc.
Oak Casks Derived Aroma and Flavours

- **New charred casks**—Typical characteristics are *woody, vanilla, coconut, and resinous*. Wood aromas are mostly heartwood constituents and thermal degradation products.

- **Ex-sherry casks**—Typical characteristics are *vanilla, fruity, and sweet*. Wood aromas are mostly heartwood constituents and thermal degradation products, potentially modified and added to by the period of sherry contact.

- **Ex-bourbon casks**—Typical characteristics are *dry, floral, scented, and vanilla*. Wood aromas are still mostly heartwood constituents and thermal degradation products but possibly augmented by hydrolysis and oxidation of wood polymers.

- **Refill casks**—Typical characteristics are *smooth, vanilla, and sweet*. Wood aromas come mostly from subsurface layers of the stave where they may be formed by hydrolysis and oxidation of wood polymers.

- **Regenerated casks**—Typical characteristics are *woody, vanilla, and sweet*. Wood aromas are mostly thermal degradation products.
Oak cask Maturation

- Taste
- Maturation
- Cask too strong
- Ideal point
- Distillery-Character
- Immaturity
- Cask maturation
- Cask too weak

Reference: www.whisky.com
# Influence of Oak Wood on Maturation
**(Seasoning & Heat treatment)**

<table>
<thead>
<tr>
<th>Component</th>
<th>Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cellulose</td>
<td>No direct effect</td>
</tr>
<tr>
<td>Hemicelllose</td>
<td>Wood Sugars, Caramelised products, Colour</td>
</tr>
<tr>
<td>Lignin</td>
<td>Colour, increased complexity, vanilla, promotes oxidation products</td>
</tr>
<tr>
<td>Oak Tannins</td>
<td>Promotes oxidation products, imparts astringency, removal of off notes</td>
</tr>
<tr>
<td>Charred Layer</td>
<td>Removal of off notes, produces smoky flavours</td>
</tr>
</tbody>
</table>
Lignin Degradation Products

- Lignin degradation products (such as vanillin, syringaldehyde, coniferaldehyde) have been found in all oak-matured spirits
- Lignin degradation products provide floral, spicy, smooth, mellow attributes to flavour and aroma
- Sources of lignin-degradation products are
  - Degradation of lignin by toasting or charring of the cask
  - Ethanol extraction of monomers from lignin
  - Ethanolysis of lignin
Tannins

• Water-soluble polyphenols commonly found in plants

• Hydrolysable tannins
  • gallotannins, ellagitannins, which hydrolyse to form gallic and ellagic acids
  • contribution to flavour remains questionable, but may contribute to bitterness and astringency

• Condensed tannins
  • flavanoids such as quercitin (can be a source of haze)
Lactones in Oak-Matured Spirits

- Important in providing “oak” characteristic to oak-matured spirits
- Amount of each isomer varies with the type of oak (e.g., cis isomer is more abundant than trans isomer in American oak)
- cis isomer has an odour threshold 2.5 to 20 times lower than the trans isomer
- Synthesized oak lactones contain all four possible isomers: adulteration of oak-matured spirits with synthetic mixture can therefore be detected
Craft Spirits  - A Fast Emerging Trendy Spirit Category

• Individualized choices of grains, fruits, yeasts and nutrients; i.e. limitless variables

• Subjective determination of fractions or “cuts”

• Sensorial determination of maturation

• Creative design of brands and labels
Spirit Specific Sensory Evaluation
Critical Sensory Imperatives – Spirit Beverages

- Quality Assurance/Control
- Assessing product shelf life
- Authenticity Analysis
- Product Flavour Profiling & New Product Development
- Product Appreciation
- Sensory Quality during Process (Fermentation, Distillation, Maturation)
- Screening packaging materials for presence of taints
- Address Consumer complaints
- Avoiding expensive recalls
Basic Spirit Beverages Aromas & Flavours

Fruity: apples, pears, bananas

Smoky: peaty, phenolic, medicinal

Cereals: hay, grass, porridge.

Floral: heather, rose, geraniums

Vanilla: toffee, vanilla pods.

Sulphury: rubber, drains.
Off notes & Off flavours

• Sensory attributes that do not belong in the normal flavour profile of a spirit or is in higher concentration compared to the normal flavour specifications (profile) of the spirits

• Off-flavours can be caused by extremely low levels of compounds

• Different compounds can cause similar off-flavours: earthy flavour can be caused by ethylfenchol, 2-methylisoborneol, geosmin, ...

• The taste and aroma of a compound is influenced by:
  Its concentration e.g.. Ethyl hexanoate: Apple - aniseed
  The spirit itself (strong or weak; new make or aged)
## Typical Off-notes in Neutral Spirits

<table>
<thead>
<tr>
<th>Chemical</th>
<th>Description</th>
<th>Formation and Origin</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaldehyde</td>
<td>Green Apple Skin / Leafy / Grassy / Cardboard / Oxidised</td>
<td>Fermentation. Co distilled with alcohol. Also formed on long storage / transportation due to Oxidation</td>
</tr>
<tr>
<td>Diacetyl</td>
<td>Buttery / Butterscotch / Creamy / Toffee</td>
<td>By citrate-metabolising lactic acid bacteria and decarboxylation of a-acetolactic acid during fermentation</td>
</tr>
<tr>
<td>DMS</td>
<td>Sweet corn / cooked cabbage / Tomato / Shellfish / Oyster-like</td>
<td>By products from biosynthesis of sulphur-containing amino acids and from the reduction of sulphate salts in wort. Infection due to poor sanitation</td>
</tr>
<tr>
<td>H2S</td>
<td>Sulphury / Rotten eggs</td>
<td></td>
</tr>
<tr>
<td>Mercaptan</td>
<td>Sulphury / Drain gas / Butane like</td>
<td></td>
</tr>
<tr>
<td>Iso Amyl Alcohol</td>
<td>Impure Spirits / Fruity / Banana, Estery</td>
<td>Formed by yeast during fermentation by amino acid deamination and decarboxylation</td>
</tr>
<tr>
<td>Higher Alcohols / Fusel oils</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ethyl Acetate</td>
<td>Fruity / Nail Enamel / Solvent / Acetone / Paint / Glue / Fruity / Banana</td>
<td>Formed during primary fermentation by enzymatic chemical condensation of organic acids and alcohols.</td>
</tr>
<tr>
<td>Isoamyl Acetate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4-Ethyl Phenol</td>
<td>Band aid Medicinal / Barnyard, Sweaty Horses</td>
<td>Brettanomyces contamination, Decarboxylation of p-coumaric acid from grain by yeasts and bacteria</td>
</tr>
<tr>
<td>Plastics</td>
<td>Plastics / Styrene / Acrylic / Solvent</td>
<td>Storage in recycled plastic containers</td>
</tr>
</tbody>
</table>
Sensory methods & procedures

Analytical (Objective) - Product Oriented
- Quality /quantity of a Characteristic
- Similarity /Differences between products
- Standardisation
- Fewer People, selected, trained

Affective (subjective) - People /Consumer Oriented
- Acceptance/preference of a product
- First impressions
- Personal reaction
- Larger number of panellists, representative of population

Discriminative
Descriptive

Hedonic (Liking)
Acceptability
Preference
Sensory Evaluation

ANALYTICAL SENSORY ANALYSIS

Sensitivity
- Threshold
- Discrimination (Difference)
  - Duo-trio
  - Triangle

Quantitative
- Scaling
  - Ranking
  - Interval
- Duration
  - Time-Intensity (TI)
  - Temporal Dominance of Sensations (TDS)

Qualitative
- Descriptive Analysis
Critical Sensory Evaluation Practices in Spirit Industry

• Neutral Spirit /Alcohol or ENA (Extra Neutral Alcohol)

• Spirit Products

• New Make & Matured Spirits

• Raw Materials – Grains/Malts, Molasses, Grapes/Fruits/Wines

• Ingredients

• Flavours

• Raw Water/DM Water
Sensory Evaluation Methods for QA/QC & NPD

- Scoring (Ratio Scale 0 -10)
- Category scaling (0-5, 0-Poor, 5-Very Good)
- Test (no off Smell /Taste)
- Difference Tastes – Duo Trio, Triangle, Tetrad etc.
- Difference from Control (DFC) – “Not different” to “Extremely different”
- Ranking
- Threshold or Sensitivity Tests
- Flavour profiling
- Descriptive Sensory Analysis
Spider-web chart - product's sensory profile

Spider Web Chart - Whisky

Attributes
- Blue: Nose
- Red: Taste
- Black: Finish

* Demonstration data only
Sensory Systems & Tools

for

Best Spirit Sensory Practices
• Definition of Sensory Evaluation
• Why Sensory Evaluation is Needed
• Sensory Evaluation Practices
• Senses Used to Evaluate Products
What is Sensory Evaluation?

“ A scientific discipline used to evoke, measure, analyze and interpret those responses to products that are perceived by the senses of sight, smell, touch, taste and hearing”


All senses are important when eating or drinking but of all the five senses, sense of smell that is plumbed into our memory through the limbic system in our brain and has direct access to our world of feelings...
Interaction of the Senses

- Appearance
- Sound
- Aroma
- Flavor
- Mouthfeel
- Vision
- Hearing
- Touch
- Smell
- Taste
- Retronasal aroma
- Chemical irritation

Why is Sensory Quality important?

- It is a measure of product quality significant to consumer acceptance.
- Like physical and chemical analysis, sensory properties need to be ‘objectively’ evaluated.
- Is the last gate before your product reach the consumer:
  - Meet consumers expectations
  - Trouble shooting tool - complaints
  - May avoid product failure & recall
- Until today this cannot be done analytically: Electronic nose & tongue – Yet not perfected to match human sensory.
Sensory Evaluation Practices

Sensory Culture changed from past with more robust systems incorporating:

- Increased awareness
- Screened trained and standardised panel
- Standardised methods
- Dedicated rooms with least distractions
- Panel of at least 5 panellists
- Monitoring of panel through efficient proficiency schemes
Elements of Sensory Evaluation

- Appearance – Colour, clarity, Fizz
- Consistency and Texture - Body
- Flavours

- **Basic Tastes**: sweet, salty, sour, bitter, umami
- **Sensation**: Cooling, astringency, temperature, spice heat
- **Mouthfeel**: Crunchy, sticky, slimy, grainy, mouth coating
- **Aroma**: Volatiles above threshold levels in contact with receptor
Five Taste Sensations

- **Sweet** - sugars, saccharine, some amino acids
- **Bitter** - caffeine, quinine, iso alpha acids
- **Salty** - sodium chloride
- **Sour** - Acidic
- **Umami** - (Japanese - Pleasant to Taste) glutamate and MSG

We recognise ONLY 5 BASIC TASTES everything else is a combination of these 5 tastes, aromas and mouthfeel, but we often think it is taste.
Mechanisms of perception

- Vision: appearance
- Touch: consistency & texture
- Olfaction: odour, aroma, fragrance, smell
  - Trigeminal: pain, irritation, pungency [mouthfeel]
  - Gustation: taste, [mouthfeel]
- Hearing: sound
- Temperature: cool - heat

Chemical senses
Basic Concepts - Taste

Tongue

- Palatine tonsil
- Lingual tonsil
- Foliculate papillae
- Circumvallate papillae
- Filiform papillae
- Fungiform papillae

Circumvallate Papilla

- Filiform papillae
- Circumvallate papilla
- Connective tissue
- Salivary glands
- Muscle layer

- Taste buds
The sensation is perceived by the use of the olfactory epithelium.

Humans can perceive many thousands of different aromas.

We remember aroma in a completely different way from the way we remember other things.
Olfaction and Gustation

Reference: http://www.distillerytrail.com/blog/10-steps-the-fundamentals-of-how-to-taste-whisky/#at_pco=tst-1.0&at_si=5a9c3ec97ad1316c&at_ab=per-2&at_pos=0&at_tot=2
Basic concepts - Trigeminal Nerve

Responds to:
- Carbonic acid (dissolved CO2)
- Menthol
- Acids
- Alcohol
- Ginger, chilli, mustard, horseradish

Contributes to the appreciation of many beverages like:
Beer, CSD, RTD, Champagne, Spirits..
Sensory Analysis - Basic concepts

What is more important: Taste or Smell?
Molecules released into the air inside our mouths as we chew and swallow travel up through the retronasal passage into the nose, then move up and contact the olfactory epithelium. Flavor is the combination of true taste (sweet, salty, sour, bitter) and retronasal olfaction and mouthfeel.
Salivary mechanisms involved in aroma release

Reference: S. Ployon et al. / Food Chemistry 226 (2017) 212–220
Flavour release and transport in the mouth and nose

Reference: Vol. 1, 2002 — COMPREHENSIVE REVIEWS IN FOOD SCIENCE AND FOOD SAFETY, 45 - 57
Perception and aroma compound releases during brandy consumption

Effective Sensory Management
Effective Sensory Quality Management

- Final Product QC
- R&D centre
- Marketing NPD
- Sensory Panel
- Incoming Raw Materials
- In Process

Plant level
Plant level
Plant Level
Difficulty of Sensory Analysis

- Consumer description often vague & unreliable
- May present at extremely low concentrations
- Multiple origins: All steps of manufacturing & supply chain
- Analytically = looking for a needle in a hay stack

Human senses are a very sensitive equipment to measure flavours - for some compounds humans are more sensitive than the most advanced analytical equipment.
Taster Management

- Screening and Selection
- Taster Training
- Taster Validation
- Maintenance
How to best establish a sensory taste panel

- Effective selection and screening processes
- Defined training systems
- Standardised training materials including reference standards
- Systematic and objective proficiency assessments
Selection - Why?

To identify potential trainees that:

• Have an interest in tasting, and the tasting function
• Are available to participate in training
• Are available to participate in regular tasting
• Are in good health
• Have no product aversions
• Are intelligent
Selection – How?

Standardised Questionnaire

- Health
- Motivation
- Likely aptitude
- Confidence
Screening - Why?

- Identify potential trainees most likely to benefit from training
- Eliminate unsuitable trainees as early as possible
- Evaluate candidates’ discrimination and descriptive skills
- Determine whether candidates can detect differences between similar products
- Screen for the ability to learn new terminology and procedures
Screening - How?

1) Matching test in water (basic tastes)
2) Triangle tests
3) Recognition test

Advantages

- Evaluation of the response to methods that will be used in training
- Matching test removes the possible effect of spirit
- Triangular test removes the effect of the trainer
Taster Training – Why?

• A better taster provides more repeatable and reliable results on which costly decisions can be based.

• A larger number of average tasters is required to produce reliable results, and therefore costs more.

• The results derived from a small group of expert tasters does not require extensive data analysis.

• A good taster will take significantly less time to taste each sample.
Taster Training – How?

- Provide the skills for Sensory Assessment
- Standardise tasting techniques and terminology
- Standardise use of a global ‘flavour language’
- Detection and description of flavours at low levels with right procedure
- Reinforce taste panel’s objectives and responsibilities
A structured approach in developing sensory skills

Taster Training - How?

Level of training

Sensory Skills

Basic Training
- e.g. plant level

Intermediate Training
- e.g. bigger plant level

Advanced Training
- e.g. regional or corporate panels

Expert Training
- e.g. innovation

Detection

Recognition & Identification

Scaling

Quality Ratings / Brand Specifications

Detailed Profiling / True to Type
Critical Sensory Training sessions

- **Matching test**: Developing ability to differentiate and identify different Category of spirit and their characteristic attributes.

- **Recognition test**: Develop ability to recognise and identify a wide range of positive flavours and off-flavours / taints in spirits.

- **In/Out test**: Develop their ability to judge whether a spirit is acceptable to be released to the market, *i.e.* to decide whether the product is free from defects. This exercise will also help to build up the trainees’ confidence.
Sustaining the Investment in Training

- Sensory Performance
- Training
- Maintenance Training and Proficiency
Proficiency / Validation - Why

- To demonstrate the reliability of tasters, and therefore of the sensory quality system
- To allow initiation of corrective actions; refresher training / focussed training, removal from the panel, etc.
- To assure that you are measuring what you think you are measuring
- Monitor trends in sensory assessments over time
- Monitor individual capabilities as part of the training programme
- Demonstrate competence to third parties such as accreditation bodies or customers

Validated trained panel = Calibrated Instruments (Objective Results)

Ultimately Improve Quality, Taste and Consistency of your global brands
Taster Validation – How?

**On-line**
- Treated samples or control samples in between regular samples

**Off-line**
- Independent Taster Validation or Sensory Proficiency Schemes
Methods of Sensory Proficiency

**Flavour Identification:**
Individual flavour identification using standard terminology

**Rank Rating:**
Discrimination of different flavour intensities and scale them accordingly

**In Profile:**
Primary focus on **IN** or **OUT** / meeting the brand's sensory profile – used by spirits customers
Proficiency - Taste

Produced to GMP Quality Standards

Colour coded format for easy use

Provided in Pharmaceutical blister packs – protected from air and moisture and easy to use

Documentation and labels provided

Test to results takes 30 mins
Proficiency - Answer

Assessor Forms for easy result capture

Easy to use and available in many languages

Relates to flavour lexicon with images and text
Proficiency - Answer

Online data entry via internet browsers

Matches paper data capture for 1:1 direct input

Easy and quick to use

Multiple languages supported
Proficiency - Process

Correct Answers:

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<tr>
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</thead>
<tbody>
<tr>
<td>Color</td>
<td>IN</td>
<td>IN</td>
<td>IN</td>
<td>Musty</td>
</tr>
</tbody>
</table>

Taster Responses:

<table>
<thead>
<tr>
<th>Taster Name</th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Panellist 1</td>
<td>✓</td>
<td>✓</td>
<td>X Metallic</td>
<td>X IN</td>
</tr>
<tr>
<td>Panellist 2</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>X IN</td>
</tr>
<tr>
<td>Panellist 3</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
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Immediate feedback for your sensory panel

Review and re-taste samples to enhance the training process

Continuous performance review, identification of training opportunities
Sensory Proficiency Scheme - Methods of Validation

**Flavour Identification Validation:**
Individual flavour identification using standard terminology

**Rank Rating Validation:**
Discrimination of different flavour intensities and scale them accordingly

**In Profile Validation:**
Primary focus on **IN** or **OUT** meeting the brand’s sensory profile - used by spirits customers
Flavours in WSPS (IN-OUT) 
(Whisky Sensory Proficiency Scheme)

1. Acetaldehyde – Green Apple Skin/ Cardboard / Oxidised
2. Butyric – baby sick, rancid
3. Diacetyl - Buttery
4. Geraniol - Floral / Rose water
5. Isoamyl Acetate - Fruity Banana
6. Leather - Leathery
7. Malty-Biscuity - Toasted grain / Malt
8. Medicinal - Peaty, phenolic
9. Musty - Musty/Mouldy
10. Rotten Vegetables - Sulphury
11. Smoky - Peaty
12. Spicy - Spicy /Clove
13. Vanilla - Wood Maturation
14. Whisky lactone - Coconut
**Flavours in the RSPS (IN-OUT)**
(Rum Sensory Proficiency Scheme)

1. Acetaldehyde – Green Apple
2. Barnyard – Band Aid, Medicinal
3. Butyric - Cheesy, Rancid
4. Coconut – Sweet Vanilllin
5. Cooked Vegetable - Cauliflower
6. Diacetyl - Buttery
7. Dry Hay – Hay like
8. Ethyl Hexanoate – Fruity Apple
9. Ethyl Butyrate - Tropical Fruit
10. Isoamyl Acetate - Fruity Banana
11. Isoamyl Alcohol - Fusel Alcohol
12. Isovaleric – Cheesy
13. H2S – Rotten Egg
14. Mercaptan - Sulphury
15. Musty - Musty/Mouldy
16. Rotten Vegetable - Sulphury
17. Spicy - Spicy /Clove
18. Plastic
19. Phenolic - 4-vinyl guaiacol
20. Vanilla - Wood Maturation
Flavours in the NSSPS (IN-OUT) (Neutral Spirit Sensory Proficiency Scheme)

1. Acetaldehyde – Green Apple
2. Acetic – Vinegar
3. Barnyard – Band Aid, Medicinal
4. Butyric - Cheesy, Rancid
5. Diacetyl - Buttery
6. DMS – Sweet corn
7. Ethyl Butyrate – Tropical fruits
8. Isoamyl Acetate - Fruity Banana
9. Isoamyl Alcohol - Fusel Alcohol
10. Isovaleric – Cheesy
11. H2S – Rotten Egg
12. Mercaptan – Sulphury
13. Metallic – rust, blood like
14. Musty - Musty/Mouldy
15. Plastic
Key Benefits

- Understand aroma & flavours and off notes in spirit beverages
- Implement Best Sensory Practices with trained sensory Panel
- Monitor and validate proficiency of sensory panel & panelists
- Retronasal Tasting with GMP flavour references for discerning sensory
- QDA for Flavour Profiling and New Product Development
- Continuous Improvement & Innovation for Craft Spirits
- Consistent Sensory Quality and shelf life of products
- Third party sensory accreditation status
Thank You
Questions?