

THE WORLD OF ODOUR

## Sensory analysis to play increasing role in enabling faster growth of consumer-facing businesses

The Odournet Group – the largest specialist consultancy exclusively dedicated to environmental odour management and odour assessment, with over 60 sensory specialists operating from six accredited olfactometry centres, mainly in Europe – is raising its level of engagement in India.

The company, which has its origins in the Netherlands, has ventured into Mexico and set up a subsidiary in Goa, Odournet Holding India P. Ltd., which aims to offer the full range of services to customers in India. These include environmental odour management; product & material testing (for automo-

tive, consumer goods, personal care, hygiene products, textiles etc.); instruments (development, production and distribution of olfactometers and devices for sampling & data collection); and Quality Assurance/Control (QA/QC) services for odour laboratories.

Specialists from the company were recently in Goa to showcase capabilities and learn from Indian companies in a range of industries where odour has come to play a role, including food, personal care, textiles and paints.

### The sense of smell

The perception of smell involves a complex set of interactions that are

initiated when volatile molecules, typically with a molecular weight less than 300, reach the sensitive area in the human nose – the olfactory epithelium. Indeed, the unravelling of the pathway from these receptors in the nose, through the bone and into the olfactory bulb in the brain, ending up in the glomerulus, was awarded a Nobel Prize in Medicine in 2004.

The capacity of the human sense of smell is extraordinary. While 50% of thresholds for important ingredients are significantly below 1-ppm, some molecules can be detected by the human nose at levels bordering on a few parts per trillion – a sensitivity that few instrumentation techniques can match.



Chief Guest Prof. G.D. Yadav (Vice-Chancellor, ICT, Mumbai) addressing the delegates at the inaugural function



Mr. Hansruedi Gyga, Scientific Consultant to Odournet

The sense of smell is also vital for well being. It significantly enhances, for example, the pleasure of eating, and can lead to immediate behavioural changes (e.g. stop immediately when eating spoiled food). It also has an unconscious effect on our emotions, compelling us to accept or reject products – an aspect that has great bearing for consumer-facing companies across diverse industries. If a satisfactory product has a characteristic olfactory cue, this will be a very powerful evocation of the memory of use and hence the re-purchase stimulus. A negative olfactory cue, on the other hand, can lead to a strong and long lasting rejection.

According to Mr. Hansruedi Gyga, Gygrome Consulting (Switzerland), a product might be rejected simply

because its “scent signature” is not as expected. “In food up to 50% of re-purchasing decision and in fragrance industry around 90% are related to smell,” he says. Different cultures and ethnicities can also respond quite differently to a particular olfactory cue because of cultural and genetic preferences. In other words, it is very difficult to define universally pleasant smells.

#### Understanding consumer behaviour

Over the last 30 years, the Odournet Group has developed a portfolio of thousands of studies in all odour relevant sectors of the economy and developed deep insights into consumer behaviour through a combination of naïve panel studies (in a laboratory) or consumer panel studies in a domestic setting, including through the use of

minimally invasive technologies, such as smart phones. “Consumer behaviour testing is essential in understanding the outcomes of sensory product attributes in consumer interaction,” says Mr. Anton van Harreveld, CEO, Odournet Group. “From a product management viewpoint, management of the sensory product identity is key to optimising consumer purchase behaviour,” he adds.

#### Odour measurement

According to Mr. Bjorn Maxeiner, Odournet GmbH (Germany), odour is definitely in focus today. Customers are keen to understand the impacts of a desired odour, be it in ambient conditions (e.g. in hotels), or in products. At the same time, there is recognition of the need to avoid undesirable odours, through a variety of approaches including masking, neutralisation and filtration.

While odour measurement ideally needs to produce objective results, this is not always possible so the focus is on obtaining reproducible though subjective results. Issues such as the measurement method, odour parameters (one number cannot describe an odour); equipment (should not have any negative influence on the final result); and laboratory conditions (comparable conditions of temperature, humidity etc.) need to be factored when doing odour measurements. The odour sensitivity of the panel is also an important criterion and could have an influence on the quality of measurement reported. Odour intensity can be measured by using references or without. A typical odour intensity scale has seven levels from imperceptible to extremely strong. ISO standards – e.g. acetone scale, linking acetone concentration to the perceived intensity of the odour – are also available.

Hedonic parameters describe whether the odour is pleasant (-4) to very

#### Odour parameters

Parameter	Description
Odour concentration	Determination of odour threshold – olfactometer needed [in ou/m <sup>3</sup> ]
Intensity	Strength of the odour with and without reference levels
Hedonic	Pleasant or unpleasant (e.g. -4 to +4)
Acceptance	Unacceptable to acceptable (e.g. -1 to +1)
Odour character	Description
Polarity profile	Description through general adjectives



Mr. Bjorn Maxeiner, Head of Centre of Competence, Germany

pleasant (+4), with zero being neutral. Acceptance parameters – with values ranging from unacceptable to acceptable – are sometimes used to assess odours, mostly with naïve, untrained people, but typically needs a big group to get a clear idea.

### Molecular basis of odour

The composition, the source and the context are all relevant for classification of an odour as a ‘fragrance’ or as ‘malodour.’ The three-dimensional structure and shape of a molecule is also important: D-Carvone and L-Carvone, which are optical isomers (i.e. with chemical structures that are mirror images of one another), are perceived very differently by the human nose. While the former has a peppermint quality, the later is caraway like.

According to Mr. van Harreveld, knowing the molecular basis and the chemistry allows product & process optimisation; identifies the culprits of off-notes and off-flavours; and allows substitution of key ingredients by more economical or sustainable alternatives. Analytical techniques such as GCMS/TOF and GCO/sniffing and sensory

panels provide a unique sensory/molecular perspective and a detailed insight into the molecular basis of complex aromas. “But the glut of results is a challenge for extracting knowledge – identification of 500-800 compounds are not uncommon when using these techniques. The key question is which compounds are aroma relevant?”

### Role of fragrances in FMCG products

Fragrances are a key part of the identity of many brands and, sometimes, even personify it. According to Mr. Roopkumar Kami, International Flavors & Fragrances India P. Ltd., respondents rate fragrance as the second most important factor (after the brand) and is key to brand survival. “Hence, there is a need to deeply understand the fragrance,” he says. But getting a clear perspective on the fragrance perceptions of customers has many challenges. Temporary anosmia (a very weak or no perception of fragrance) and fragrance fatigue are challenges that need to be addressed when formulating testing strategies. “Sometimes a strong fragrance blocks a weaker fragrance. Many Indians are blind to certain heavy notes and pro-

duct designers need to take this into account,” Mr. Kami adds. In an Indian context, fragrance literacy is also an issue. “We have come a long way since the last two generations, but there is a large mass of consumers who have poor olfactory understanding and have a limited vocabulary with inarticulate expressions,” he says. “For example, in a soap, perfumers need to know the importance of fragrance at multiple stages of use – dry smell, lathering on body, wash off, retention after drying etc. – but poor fragrance literacy makes determination a challenge in the Indian context.”

Fragrance companies also need to keep in mind the conservative nature of consumers and their hesitation to explore beyond the known. “How do you push sensorial boundaries to the stage where there is novelty but it has not gone beyond acceptable limits, is crucial,” Mr. Kami adds. Ms. Neeru Nayyar, Unilever India (R&D), agrees that FMCG companies try to deliver a pleasurable sensory experience by leveraging technology and deep consumer understanding.

### Challenges in the food industry

The main challenge for the food industry is to retain/enrich food flavours and avoid the generation of off-flavours during the journey down the supply chain – from the farm to the table. In coffee processing, for example, a big flavour loss takes place in the grinding process and hence this aspect has come for significant research. Nescafe ads, for example, are all about aroma retention. Odours are even the first signal to levels of dietary fat, according to recent studies carried out by researchers at Monell. According to Mr. Jagdeep Marahar, Application Group Manager, Nestle India Ltd., major players in the food industry are working on different ways for increasing aromas. Pepsico, for example, is looking at encapsu-



lation inserted the packaging which bursts open when the packaging is torn.

### Getting the packaging right

Off-flavours are an important issue and unless tackled quickly and adequately can have a bad impact on the brand. Around 50% of off-notes come not from raw materials, but from the packaging – polyethylene, paper, styrene, solvents leaching from the printing inks etc. “Packaging is a complex system and checks are difficult to ensure the integrity and high specifications required by end-use consumers,” says Mr. Marahar.

With packaging no longer seen as an end-of-line activity, but as an end-of-the line solution, there is growing emphasis on ensuring that the contained product reaches the consumer in the desired form with the right odour, taste etc. and with full retention of nutritive value. According to Dr. Jyothi Baliga, Indian Institute of Packaging, companies are increasingly examining the role of packaging in ensuring that odour profiles are not compromised either through ingress of ambient gases into the container or by leaching of solvents (for example, in printing inks) or additives used (as in plastic packaging).

She stresses the need to develop a database of off-flavours and off-odours for commercialised Indian foods and their probable chemistry. “We need to establish structure-activity relationship for off-flavour and odour development in the Indian context,” she notes.

### Odour challenges in the coatings industry

The Rs. 26,040-crore (2011-12) Indian coatings industry has seen several changes in the recent past, with slowly growing demand for heavy metal-free coatings (free of lead, chromium, mercury), low VOC coatings (especially for urban areas), beside a preference for low or zero odour coatings. Many large paint companies have eliminated lead and chromium from their paint formulations, despite the lack of regulation, and water-based systems now account for almost 52% of the total decoratives market (itself representing about 71% of the Indian coatings market in 2011-12).

In the industrial segment – which accounts for 29% of the total market – solvent-based systems still dominate (85% share), although high-solids coatings (10%) and water-based systems (5%) are beginning to make an impact.

The main sources of odours in paints come from:

- Free unreacted monomers (phenol, formaldehyde, acetaldehyde etc.);
- Monomers with unpleasant smells;
- Solvents and co-solvents with high vapour pressure; and
- Neutralisers such as ammonia and low molecular weight amines.

According to Dr. Sudhakar Dantiki, AkzoNobel Coatings, control of odour can be done by ensuring complete cure (not entirely possible), ensuring that there are no free reactants and no entrapped solvent in the cured film. The other approach is to mask the odour by using solvents like xylene, low molecular weight acetates, ketones etc.; use of chemicals with good aroma; or by use metal salts of fatty acids as deodourising agent. “Microencapsulation technologies can also be used to release fragrances over time, but have inherent challenges,” he says.

### Anti-microbial textiles

In humans, the formation of body odours is mainly caused by skin glands excretions and bacterial activity. Often, these odours get transferred to the body wear, leading to unpleasant sensations. Dr. T.V. Sreekumar, Reliance Industries Ltd. (RIL), says one approach to combating odour emanating from textiles is through incorporation of anti-microbials on the fabric and this is becoming popular for sportswear, babywear and innerwear. An alternate, more long-lasting approach, involves the introduction of nanoparticles (e.g. of silver) into the textile. “Dye-free, coloured textile fibres can be generated by using nanoparticles with inherently anti-microbial properties,” he adds. Development work carried out at RIL has shown that with the incorporation of just 1.9% silver nanoparticles in acrylic fibre reduced of bacterial growth by 99.9%, compared to an undoped sample.