Summary

Odours are mixture of light and small molecules that, coming in contact with various human sensory system, also at very low concentrations of inhaled air, are able to stimulate an anatomical response. The human olfactory system is still regarded as the most important and effective analytical instrument for odour evalution, the demand for objective methods still exist. Many a time, the comparison of subjective and objective methods of odour evaluation has been researched to arraive at a more confident, realistic picture of the odours and the compounds responsible for the sensing of odours. The odour measurement is essential for odour regulation and control. Odour emission often consists of a complex mixture of many odourous compounds. Analysis of individual chemical compounds present is usually not practical. More often, complexity of odour involves psychological and physiological response, perceives the odour as pungent, ethereal, aromatic, pepperminty, musky, camphorous, putrid and so on referring to the source. Therefore, the analytical methods can reflect chemical compound responsible for these perceptions. As a result, odour sensory methods, instead of instrumental methods are normally used to measure such odours.

Sensory measurements employ the human nose as the odour detector and human odour is directly experienced which is related to properties. Sensory methods are available to monitor odour both from source emissions and in the ambient air. These two diverse circumstances require different approaches for measuring odour.

Instrumental sensory measurements employ the human nose in conjunction with the instrument, called olfactometer. This dilutes the odour sample with odour-free-air according to precise ratios, to determine odour concentrations. Odour concentration is an odour’s pervasiveness. To measure odour sensation, an odour is diluted to certain amount to reach a detection or recognition threshold. The detection threshold is the concentration of an odour in air when 50% of a population can distinguish between the odour sample and odour free blank. The recognition threshold is the concentration of an odour in air in which 50% of a population can discern from an odourous sample and odour free blank. To establish the odour concentration, an olfactometer is used which employs a group of panelists. An ascending order of strong samples is preferred so that the panelists can detect higher dilutor samples followed by lower dilution that means to say stronger samples. Single port used method is simpler than the forced choice multiple ports method. Sampling odour mixtures at different dilutions are presented to a group of selected panelists for sniffing and their responses are recorded. The process continues until each panelist positively detects an odour in the diluted mixture. At this stage the panelist responses has reached the detection threshold for that odour. This threshold is expressed as threshold odour numbers and used to calculate the concentration of the odour in terms of European odour units (ou_E/m^3).

Panelists are qualified examiners used as sensors in olfactometric analyses and their olfactive response (odour threshold) is the measured parameter for calculating odour concentrations. These panelists are selected according to standardized procedure to minimize the difference among their detection. The panelists should be the individuals with average olfactive sensitivity, who constitute a representative sample of human population. The screening is usually performed using reference gases and normally n-butanol odour threshold in a range of 20-80ppb is the accepted limit with 40ppb+2.3. Panelists must be continuously screened and trained. Panelists with illness, cough, cold, allergy etc. are eliminated. In order to present the odour sample to the panelists, samples must be collected using specialized sample bags. The most accepted technique for collecting odour samples is the lung technique. The statistical analysis of the data specifically ANOVA which reflects the variance between group and within group has to be adopted.

The other instrumental based quantification of odour samples is studied using Gas chromatography- olfactometer (Gc-o). The second approach for odour evalution by parametric sensory measurements has the advantage of being quick to obtain at relatively low cost, as no particular equipment is required. The subjective measurement of parameters of odour perception by the well trained panel. The parameters include odour character, odour intensity and hedonic tone.

Though human perception of odour is desirable and regarded as most important and effective analytical instrument for odour evaluation, still there are problems in comparing different persons experience in quantifying the odour. olfactometer called the dilution instrument has been coupled with the sensory method to provide to the panel of human assessors. Electronic sensing equipment called e -nose or electronic - nose is capable of reproducing human senses using sensor arrays and pattern recognition systems. E-nose can detect and recognize odours and flavours. The stages of recognition process are similar to human olfaction and are performed for identification including data storage and retrieval. Further, the development of a new olfaction system, called electronic_mucosa is based on advanced pattern recognition algorithms for space and time classification of odourants. The electronic nose consists of head space sampling, sensor array and pattern recognition modules to generate signal pattern that are used for characterizing odours in terms of perception as a global fingerprint. The major parts of E-nose are a sample delivery system, a detection system and a computing system. The sample delivery system enables the generation of the headspace ie. volatile compounds of a sample. The system then injects this headspace into the detection system. The sample delivery system is essential to guarantee constant operating conditions. The detecting system consists of a sensor set, a reactive component of the instrument. When volatile compounds come in contact, the sensors react through the interfaced transducer electrical signal. A specific response is recorded. A specific response is recorded by the electronic interface transforming the signal into digital value. Recorded data are then computed based on statistical models. In most E-noses, each sensor is sensitive to all volatile molecules, but each in their specific way. However in bio-E-nose receptor proteins cloned from biological organisms eg. humans respond to specific odour molecules through binding. The more commonly used sensors are metal-oxide semiconductors devices. Beside this, the sensors are conducting polymers, polymer composites, quartz crystal resonators, and surface acoustic wave. Some devices combine multiple sensor types in a single device. In recent years, other types of E-noses have been developed that utilize mass spectrometry or ultra gas chromatography as detection system. Several studies concerning the use of nanomaterials as gas sensor materials have been reported.

The Computing System combines the responses of all of the sensors which represent the input data. This instrument performs global fingerprint analysis and provide results that can be easily interpreted. E-nose results can be correlated to those obtained from sensory panel, GC, GC/MS results. E-noses are mainly used in R&D labs and process and production departments. E-noses can be used in quality control mechanisms of conformity of raw materials, origin of vendor selection, and detection of contamination spoilage, adulteration and monitoring of storage conditions. In the processing, it can be applied for managing raw material variability, comparison with a reference product to narrow down the batch variation, scaling-up of process and monitoring the place safety.

Considering the different techniques of odour evaluation, no one of the described techniques alone is able to exhaustive information about the odours emissions from different food systems as well from different kinds of human activities that cause olfactory picture. Therefore, a comparison or an integration of the olfactory methods with the methods of sensorial analysis makes the tasks complete to get a realistic picture of odours.

Besides these, clinical test approach for detecting the odour identification ability of the panelists can be followed. However, the clinical testing can be time consuming and difficult to perform precisely. The major goal of sensory testing is to assess the chemosensory property. In this direction, simplified and standardized commercial kits are available. These can provide a reliable measure of olfactory ability. Tests of olfactory function can evaluate the threshold of odour detection, identification and quantification. These tests include butanol threshold test, the university of Penssylvania smell identification test (UPSIT) and the sniffin stick test.