Evaluation of Odour Emissions at ABP Processors

Fact sheet FABRA-FS-0012

ODOURS FROM PROCESSING ABP

Overview

Odour is one of the most significant environmental impacts from processing Animal By Products (ABPs).

Decomposition of the proteins and enzymes in ABPs over time produces a mixture of odorous compounds such as:

- sulphurous, e.g., hydrogen sulphide, mercaptans and organic sulphides
- nitrogenous, e.g., ammonia, amines and amides
- oxygenated, e.g., ketones, esters, alcohols, aldehydes and acids
- aliphatic and aromatic, e.g., oils and fats

Many of these compounds have very low odour thresholds and exposure to them for just a short time may cause nuisance / annoyance, even at very low environmental concentrations. However, the fact that an odour is perceptible at a given location does not necessarily mean it will cause nuisance.

The degradation of ABPs varies by season and prolonged periods of high ambient temperatures cause higher intensity odour, placing maximum loading on odour abatement plant. The odour impact also depends on several other factors such as the proximity to the receptor, wind direction, dispersion, individual perception, hedonic tone, other odour sources, the odour emission rate and odour intensity.

Given the inherent properties of ABP materials, odours will always be present but the offsite odour impact can be minimised by effective odour management, minimisation, containment and treatment techniques. ABP processors also interact with their local communities to minimise odour impact.

Common Odour Sources from ABP Processing Sites

Descriptions of ABP processing odours are usually:

- "rotten or foul, dead animal"
- "meaty, burnt meat or fat"
- "pet food"
- "sewage or cabbage"
- "earthy or compost"

The main sources of odour at an ABP processing plant and the odour intensity are listed in Figure 1. See a schematic of a typical rendering process in the factsheet *Rendering – Process and Benefits*[1].

Odour Source	Process area
ABP Raw material	Incoming raw material vehicles Fugitive releases from raw material buildings Transfer and bulk storage of blood
ABP Processing	Cooker exhausts Fugitive releases from process buildings
ABP Products	Separation plant Meal processing & handling Fat refining & handling
Waste and wastewater	Cleaning of plant and vehicles Wastewater treatment plant Wastewater sludge storage & handling
Abatement	Exhausts from odour abatement units

Odour intensity key			
High	Medium	Medium/low	Low

Figure 1 – ABP processing odour sources

Odour Abatement Methods

Odour is contained by extracting air from odour sources and abating the odour before release to atmosphere. Low volumes of high intensity odour are treated separate to large volumes of low intensity odour.

At UK sites, high intensity cooker exhaust gases are treated by thermal oxidation to destroy odour. The gases are extracted into the combustion chamber of either a thermal oxidiser, boiler or incinerator. Odour destruction efficiencies of over 99% are achieved. Thermal oxidation is usually effective at >750 °C and the optimum temperature depends on the residence time in the unit and odour compounds present.

Biofilters are mostly used for abating lower-intensity odours such as extracted building air. This biological treatment is achieved by bacterial metabolism of organic compounds into non-odorous products.

Chemical scrubbers are an alternative or addition to biofilters and are useful where space is limited. Carbon filters are suitable for treating passive odours from tank vents and tanker offloading operations.

The typical performance of these odour abatement techniques at ABP processors is given in Figure 2:

Technique	Odour Concentration (OU_E/m^3)	
	Inlet	Outlet
Combustion	Up to 3,600,000	5,000
Biofilters	7,500 - 50,000	250 - 2,500
Chemical scrubbers	7,500 - 50,000	250 - 2,500

Figure 2 – Performance of Abatement Techniques

MEASUREMENT OF ODOUR

Monitoring Methods

Odour monitoring is carried out using physical or chemical analytical methods or sensorial approaches.

An air sample is taken from the odour source by drawing the air into a Nalophan bag (see Figure 3).

Figure 3 - Odour sampling

Gas chromatography-mass spectrometry (GCMS) is used to speciate the individual compounds in the odour sample. Compound specific monitoring methods can be used for some odour compounds such as ammonia and hydrogen sulphide.

For odour concentration determination (expressed in OUE/m^3) dynamic olfactometry is undertaken according to BS: EN 13725:2003. This uses trained assessor panels who sniff prediluted samples to judge intensity (see Figure 4).

Figure 4 - Olfactometry measurement

An odour unit is defined as the point at which 50% of the panellists cannot smell the odour but 50% can. This perception threshold = 1 odour unit per m^3.

Interpretation of Results

Olfactometry is a useful tool but is only a perception of odour, not an actual concentration. Odour perception is unique to everyone and depends on both inherent and environmental factors affecting one's ability to detect odour. Sensorial analyses, assigned to 'human sensors' are therefore subject to significant uncertainties, despite using expert trained panels.

Olfactometry measures the odour intensity in a sample but cannot quantitatively itemise odour units associated with partly treated process gases and less offensive odours, characteristic of the abatement technique. Acrid combustion gases, chlorine and earthy biofilter smells contribute to the total odour units measured. The laboratory often gives a qualitative description of the sample odour which helps judge the efficiency of the abatement plant.

ABP processing odours are assigned to the most offensive category and ambient odour levels > 1.5 odour units (OUE/m^3) are considered undesirable at the sensitive receptor location. Air dispersion modelling can ascertain the likely ambient odour levels at the nearest human receptors and accounts for the other factors that influence the offsite odour impact. Olfactometry and speciation analysis can identify process changes, abatement technique, design and benchmarking. Monitoring data should also be used to devise an effective odour management plan (OMP).

REGULATORY LANDSCAPE

Odour from ABP processors is regulated by environmental permits issued under the Environmental Permitting Regulations (EPR). See factsheet *Animal By-products – Regulatory Controls*[3].

Environmental permits state that "*emissions from the activities shall be free from odour at levels likely to cause pollution outside the site, as perceived by an authorised officer, unless the operator has used appropriate measures, including, but not limited to, those specified in any approved odour management plan, to prevent or where that is not practicable to minimise the odour.*"

Permits do not specify odour emission limits on abatement plant. Olfactometry is not reliable enough for this purpose in FABRA's opinion, but it is an effective tool for process control, in combination with an OMP.

REFERENCES

1. Rendering – Process and Benefits - Factsheet FABRA-FS-002.
2. Animal By-products – Regulatory Controls – Factsheet FABRA-FS-006