Odour Control Systems Limited

TECHNICAL DATA

Persnickety® Countervailants™
Additive Solutions for Odour Control

Odour Perception, Odour Qualities and Chemical Control Methods

persnickety®; n.
- Showing extremely careful treatment
- Fussy, fastidious

coun'ter•vail, v.
- to have or use equal force against
- to make up for; compensate
- to be successful, useful, etc

Analysis of available data and experiments leads to the conclusion that there are two senses of odour detection. One is controlled by the olfactory nerves and is responsible for odour perception and recognition. Its performance is a function of molecular structure, configuration of odour receptor sites, signal generation at these sites as a result of a reaction between the odorant and an enzyme, and relative concentrations of the reactants. A change in anyone of these factors can change the perception of the odour.

The process whereby we perceive odours follows these steps;

1) the odorant molecule travels along nasal air passages to the olfactory cleft where it fits into an odour receptor site;

2) a chemical reaction occurs between the resident enzyme (most probably ATP) and the odorant;

3) this reaction causes production of a specific coded electric signal which is transmitted to the brain where it causes perception and recognition of the odorant characterised by that particular signal.

Therefore an odour can be perceived only if all of several criteria are available: There must be an available odour site. There must be sufficient enzyme to react With the odorant. There must be no interference with pattern of the signal generated by the reaction, and the concentration of the odorant must be high enough to create a signal strong enough to be perceived.

The second odour perception system has nothing to do with odour recognition. It is controlled by the trigeminal nerve and serves primarily as a warning system against substances which could be harmful. This system does not recognise odours. It perceives them but does not define them.

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Pungent Malodorous Substances

According to one classification, there are seven odor qualities: 1) Etheral, 2) Samphoraceous, 3) Floral, 4) Musky, 5) Minty, 6) Pungent and 7) Putrid. Odour problems occur in and control methods lows on the latter two qualities almost exclusively. Individual reaction to odours varies widely. Consequently. categorisation and description of odours is necessarily subjective. The following tables list and describe odour characteristics in commonly accepted terms.

PUNGENT MALODOROUS SUBSTANCES

Substance	Formula	Characteristic Odor	Odor Threshold (ppm)
Allyl Mercaptan	$CH_2 \bullet CH \bullet CH_2 \bullet SH$	strong garlic, coffee	0.00005
Ammonia	NH_3	sharp, pungent	0.037
Benzyl Mercaptan	$C_6H_5 \bullet CH_2 \bullet SH$	unpleasant, strong	0.00019
Butylamine	$C_2H_5 \bullet CH_2 \bullet CH_2 \bullet NH_2$	sour, ammonia-like	-
Chlorine	Cl_2	pungent, suffocating	0.01
Chlorophenol	ClC_6H_5O	medicinal, phenolic	0.00018
Crotyl Mercaptan	$CH_3 \bullet CH : CH \bullet CH_2 \bullet SH$	skunk-like	0.000029
Dibutylamine	$(C_4H_9)_2$ NH	fishy	0.016
Diisopropylamine	$(C_3H_7)_2$ NH	fishy	0.0035
Dipheny Sulfide	$(C_6H_5)_2$ S	unpleasant	0.000048
Ethylamine	$C_2H_5 \bullet NH_2$	ammoniacal	0.83
Propyl Mercaptan	$CH_3 \bullet CH_2 \bullet CH_2 \bullet SH$	unpleasant	0.000075
Pyridine	C_6H_5 N	disagreeable, irritating	0.0037
Sulfur Dioxide	SO_2	pungent, irritating	0.009
Tert-Butyl Mercaptan	$(CH_3)_3C \bullet SH$	skunk, unpleasant	0.00008
Trietylamine	$(C_2H_5)_3$ N	ammoniacal, fishy	0.08

PUTRID MALODOROUS SUBSTANCES

Substance	Formula	Characteristic Odor	Odor Threshold (ppm)
Amyl Mercaptan	$CH_3 \bullet (CH_2)_3 \bullet CH_2 \bullet SH$	unpleasant, putrid	0.0003
Cadaverine	$H_2N \bullet (CH_2)5 \bullet NH_2$	putrid, decaying flesh	-
Dimethylamine	$(CH_3)_2$ NH	putrid, fishy	0.047
Dimethyl sulifide	$(CH_3)_2$ S	decayed vegetables	0.001
Ethyl Mercaptan	C_2H_5 align="middle" SH	decayed cabbage	0.00019
Hydrogen Sulfide	H_2S	rotten eggs	0.00047
Indole	C_2H_6 NH	fecal, nauseating	-
Methylamine	CH_3 NH_2	putrid, fishy	0.021
Methyl Mercaptan	CH_3 SH	decayed cabbage	0.0011
Putrescine	NH_2 $(CH_2)4$ NH_2	putrid, nauseating	-
Skatole	C_9H_9	fecal, nauseating	0.0012
Thiocresol	$CH_3 \bullet C_6H_4 \bullet SH$	skunk, rancid	0.0001
Thiophenol	C_6H_5 SH	putrid, garlic-like	0.000062

(Tabular information courtesy of the Water Pollution Control Federation.)

Control

Deodorising by Odour Fatigue:

If a voracious consumer of the signal producing enzyme is introduced into the environment it can prevent the chemical reaction that produces the code signal characteristic of the malodor. It will consume the enzyme leaving none available for reaction with the malodor. It may also cause a secondary signal to be generated thereby altering the overall odour perception and recognition. These compounds are generally non-specific. They block all perception Ionones, some ketones and aldehydes have been used for this purpose.

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Deodorising by Blocking:
This can be accomplished either by closing of the receptor sites via mechanical means such as masks, filters or nostril plugs, or by chemically blocking or damaging the sites. While the former technique is cumbersome, transitory and uncomfortable it is preferable to the latter which could be dangerous. The result of harsh chemicals such as formaldehyde can be more than transitory. Substances powerful enough to cause a radical physiological change can have severe and harmful long range effects upon the body.

Masking by Reodorising:
Perfumes and fragrances function in this manner. Products of this type do little to alter either the basic perception of the odor character or the intensity of the malodor. The intent of their use is to cause so many signals to be sent to the brain, most of which are pleasant, that the impact of the malodor is relatively weak in relation to the overall impact. This approach can be effective with low levels of malodor. Effectiveness is debatable with high levels of malodor. Most often both fragrance and malodor are perceived, and the potential for exacerbating a problem exists.

Devalorising by Chemical Reaction:
If a malodor can be made to react chemically with an introduced substance, it will become something else and will smell differently. This reaction is primarily oxidation-reduction. Oxidation involves a donation of electrons by one molecule, and reduction involves acceptance of electrons by another. Both oxidation and reduction occur simultaneously and in equivalent amounts during any reaction involving either process.

Oxidising agents include chlorine, (chlorine/caustic) sodium and calcium hypochlorite, chlorine dioxide, potassium permanganate and hydrogen peroxide. All are effective, but non-specific. Thus, they react with non-malodorous organics and nitrogen-based compounds which increases the cost of their use. As a group, these products generally pose safety problems - toxicity, the production of toxic by-products, inherent corrosive and explosive characteristics. Temperature and pH influence the effectiveness of most. Stabilized chlorine dioxide is an exception. Unwanted reaction with nitrogen-based compounds can not occur, it is much safer to handle and does not form chlorinated by-products.

Metal salts are also used for deodorising. They bind and precipitate. Their effectiveness is restricted to addressing sulfides in solution. They do not react with malodorous organics such as amines and mercaptans. Those most commonly in use are ferrous and ferric chloride; ferrous and ferric sulfate.

Deodorising by Counteraction/Neutralisation:
Defined as the mutual diminution of two odours, counteraction or neutralisation is achieved by the application of a second odorous substance to the original malodor so that the combination of odours becomes inoffensive. The simultaneous reaction at receptor sites in the olfactory cleft causes the generation of a signal other than that characteristic of the malodor. The combined signal may either overpower the malodor signal or cause the brain to recognize a different pattern which results in perception and recognition of a pleasant odor or no odor at all.

In order to achieve practical success with this approach, a balance must be achieved between the relative concentration of the malodor and counteractant, and their respective rates of reaction with stoichiometric concentrations of enzymes at receptor sites. This technology represents a clear advancement in odor control.

Deodorising with odor *Countervailant™ products: Nuisance odours are rarely single-dimensional. Rather, they are a combination of malodors. As such, any product which is to be successfully used against them must provide multi-interventional capabilities.

The chemistry of Persnickety™ Odour Countervailant™ products is specialised and complex, and provides the most advanced and broadly useful technology currently available. It incorporates the principles of counteraction and neutralisation technology, but expands considerably beyond it. Polymeric adsorption is a facet of Countervailant™ product technology. This involves the building up of malodor molecules via electrostatic attractions and Van der Waals forces to form macro-molecules. The resulting macromolecules become unrecognisable at receptor sites, thus a signal code is not produced.

The process of esterification is also incorporated. Esters are the product of intermolecular dehydration involving an alcohol and an acid. Literally thousands of esters can be formed because of the extraordinarily large numbers of acids and alcohols available for reaction in waste substrates. This reaction ability is particularly useful in dealing with food processing odours - such as fatty acid and butyric acid odours. Signal codes for the resulting esters are normally recognised and described as odours of natural herbs, fruit and nuts. Essential oils are used sparingly as well. They are of plant origin, and principal constituents are terpenes. In diluted form, essential oils are only faintly perceived, and are included largely as olfactory guides for application rates.

All Persnickety™ Odour Countervailant™ products are effective for both gaseous malodors via spray atomisation and malodorous liquids via direct addition. They function in a broad range of pH and temperature. Very importantly, they are safe to use for operators, equipment and the environment.

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OCS Odour Countervailant Application

To list here the complete number of malodor sources which OCS compounds cover would be impractical but some major examples where OCS formulations have solved major odour control problems include:

- Manufacturing and Processing Industries
- Sewage and Effluent Treatment
- Food Processing Companies
- Chemical Processing Plants
- Re-Use Disposal
- Crematoria
- Intensive Agriculture *(NB Specific references are available an request)*

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OCS Application Equipment Trial and Engineering Services

The company designs, manufactures and installs an extensive range of odoor Countervailant application systems to suit almost any odour control problem.

Ranging from simple manually operated units, to highly sophisticated fully programmable, extensive automatic systems, OCS equipment is available on both a hire/trial basis as well as for outright purchase.

OCS Trial Facilities

Where direct references relating to specific odour control problems cannot be cited, the Company offers on-site, practical trial facilities. This means that potential clients and interested parties have the opportunity to monitor and assess the effidency of a proposed OCS odour Countervailant system on a practical assessment basis, prior to there being a firm commitment to purchase.

Work on this includes:-

- Initial consultation of the type of system required.
- Provision of detailed proposals covering the capital outlay and ongoing chemical usage costs of the proposed system.
- Agreement of type and condition of tria! necessary together with proposed trial costings.

The trial system employed would very nearly consist of the final, fully installed equipment covered by our proposals and therefore an excellent overall assessment of it's applicability and efficiency can be made.

All OCS equipment installations are backed by the Company's comprehensive on-site and in-house engineering after sales service.

Full details of these products and services are given in the relevant technical brochures.

preserving the environment

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