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Development of odour monitoring and control in Malaysia

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The odour or odor complaints receive by Department of Environment of Malaysia in 2006 is about 1082 cases. The trend shows that odor problem became more and more acute every years. The sources of odor complaint are come from many types of industries such as animal raring industry, Chemical industries, rubber processing industries, Municipal solid waste, sewage treatment plant, palm oil industries, petroleum industries and ect. The types of odour control technology use to solve the odor problem still cannot reach the standard need by the people. Some of the problem became more problematic because the sources is located in the place of populated area. At the same time, there is no regulation concerning the specific odor parameter stated in the Environment Quality Acts 1974. Just recently the Department Of Environment is drafting the regulation in order to monitor the problem, relating the nuisance come from odor. This paper is aim to give some information regarding odour issue in Malaysia because so far there is not many paper is written about the odor problem in the country.

1. Introduction

Odorous gases are a special kind of air pollutants. Fish mills, MSW, industrial plants for livestock and, poultry production, sewage treatment, petrochemical and solvent plants are common sources of odorous emissions. Odour released in the atmosphere from various form cause a serious nuisances and environmental contamination. Several odour substances are very harmful to human health because of carcinogenic effects and also produce toxic substances by photo chemical oxidation in the atmosphere. (Othman, 2007).

For most people, the process of smelling gives little information concerning the ingredients of a substance. It only offers information related to the emotional impact. However, experienced people, such as flavorists and perfumers can pick out individual chemicals in complex mixes through smell alone. There are a general agreement on which odour are experienced as unpleasent eg. Odour that are pungent (ammonia), rotten eggs, stinking garbage wastes, and rancid odour. Odour that are sweet (flower), fresh outdoor odours and appetizing food, are mostly experienced as pleasant odour. A provisional conclusion can be drawn stating that if an odour is regarded as an environmental nuisance, it means that the odour is unplesant one. ." Othman (2007)

1.1 How our brain funtion?

Even extremely small amounts of odorant gases can be perceived by humans. The human olfactory system can detect many thousands of scents based on only very minute airborne concentrations of a chemical. The sense of smell of many animals is even better. It is estimated that only 10^8 or 10^9 molecules of odorant vapour in the nose is enough to trigger detection.The odor molecules send messages to the limbic system, the area of the brain that governs emotional responses. Some believe that these messages have the power to alter moods, evoke distant memories, raise their spirits, and boost self-confidence. This belief has led to the concept of "aromatherapy" wherein fragrances are claimed to cure a wide range of psychological and physical problems. Aromatherapy claims fragrances can positively affect sleep, stress, alertness, social interaction, and general feelings of well-being. However, the evidence for the effectiveness of aromatherapy consists mostly of anecdotes and lacks controlled scientific studies to back up its claims. ." Othman (2007)

1.2 The study of odors

The study of odors is a growing field but is a complex and difficult one. Some fragrant flowers give off odor plumes that move downwind and are detectable by bees more than a kilometer away. In Malaysia this types of study also very new, we have only one olfactometry laboratory in Malaysian Rubber Board (MRB), All the testing and analysing is done by these Institute. `` Othman (2007)

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2. Background odour complaints in Malaysia

2.1 Complaints Regarding Odorous Emissions in 2006 (DOE)

No	CLASSIFICATION	TOTAL	remarks
1	Animal base	141	Chicken, pig, slaughter houses
2	Chemical base industry	114	Petrochemicals and solvent
3	Rubber base industry	101	Rubber processing and waste treatment
4	MSW relate	96	Dumping side and leachate
5.	Waste water treatment	89	Sewerage local authorities
6.	Palm oil factory relate	26	Waste water treatment
7.	Plastic industry	22	Recycle industry
8.	Metal industry	17	Scrap industry
9	Fish industry	11	Fish mill
10.	Food industry	10	Coco, cocking oil
11	Wood base industry	7	Solvent painting
12.	Housing	8	sewerage
13	Small shop	4	painting
14	Printer	2	solvent
15.	Other	424	
	TOTAL	1082	

2.2 Types of odour release during decomposition

Sauce	Odorous subtances
Carbohydrates	Alcohols, volatile organic asids (low melecolar weights), aldehydes, ketones
Proteins	Ammonia, amines, volatile organic asid, hydrogen sulfide, amino asid, mercaptans
Lipids	Volatile organic asid, alcohols, hydrogen sulfide, mercaptans

2.3 Odorous compounds associated with industrial , municipal and agricultural sources

Source	Odorous compounds
Livestock operations	Hydrogen sulfide, ammonia, dimethyl sulfide, dimethyl trisulfide, carboxylic acids, indoles, skatole, phenols
Rubber base industry	Ammonia, aldehydes, sulfur dioxide, mercaptans, organic acid, phenols, alcohols
Wastewater treatment	Hydrogen sulfide, acetaldehyde, mercaptans, amminia, indole, sketole, butylamine, ethylamine, metylamine, trimethylamine
Municipal solid waste	Reduce sulfur compounds, ammonia, dimethylamine, trimethylamine, organic acids (acetic, butyric, velaric), 2-pentanone, terpenes (pinene,carene, limonene)
Petroleum and chemicals	Mercaptans, organic sulfides, aldehydes, phenolic compounds, hydrogen sulfide, ammonia

3. Material and methode

3.1 Sampling Technique

Principally every sampling has to meet the logically requirements, has to be defined, standardized, meaningful and reproducible. This is needed to make different measurements comparable. Odorant concentrations scaled in OU/m³ are very convincing while comparing different emissions of different plants and condition.

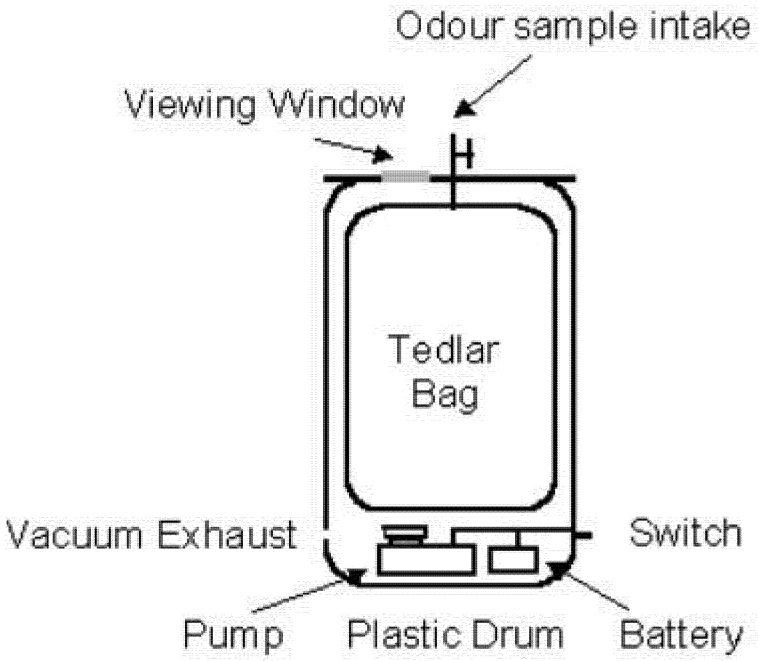

Figure 1 Odor sampling technique used in Malaysia

3.2 Odour reference standard

In the proposed national standard of Malaysia, the regulation will follow new European Standards EN 13725: 2003. In this connection it's about the standard method to define the sense barrier of odors on basis the thinner of concentrated odor loaded assays. Following parameters are defined: odor substance concentration, intensity of odor and hedonism assessment, measurement of odor, performance, quality requirement, materials, gases and panel members, issues of odor sampling, presentation of the odorants to the assessors, data recording and reporting.

3.2.1 Analytical Technique

During the emission measurement the odor concentration in the air is so high, that the so called "Olfaktometer" is needed to thinner the assay. Because of this all measurement methods based on thinning assays are called "olfaktometrical methods". An "Olfaktormeter" is seldom used during the immission measurement. The same measure principals are used but the judgment of the air assay happens without thinning the assay.

3.3 Measurement

The measurement of emission, handles with different measure sizes, for example:

3.3.1 Odorant concentration

To define the odoront concentration, it is necessary to thinner the air essay to the odour barrier with the help of the "Olfaktormeter", and the thinner number Z at the odor barrier, is the same number like the odor substance concentration. The European odor

unit (OU_E) is expressed as the amount of odorants and it is equal to EROM (European Reference Odor Mass), or a mass that is just detectable when evaporated in to 1 m^3 of neutral gas. For n-butanol one EROM is 123ug. When evaporated in 1 cubic meter of natural gas at standard condition, this procedure a concentration of 0.04 umol/mol eqivalent to 40 ppb. During panel selection procedures, n-butanol is used as a reference odour.

3.4 Odour intensity

This size scales a special air array according to the intensity scale. The scale is differentiated into the following steps:

0 no odor
1 very weak (odor barrier)
2 weak
3 obvious
4 strong
5 very strong
6 intolerable

If it is an emission measurement (thinned by the olfaktometer) than the evaluation of odor intensity got to be ranked to the olfactometry methods. A direct evaluation is used, when the array is measured from the immission side.

3.5 Hedonic assessment

The hedonic assessment is the process of scaling odors beginning with extremely unpleasant followed by neutral up to extremely pleasant. There is no difference between this process and the method of measuring the odor intensity. But the method of emission measurement is seldom used and that of immission measurement is not used.

4. Odour treatment

4.1 Irradiation technique

The emission of Volatile Organic compounds (VOCs) and sometime we called it odour substances to the atmosphere has been strictly controlled in the USA and EU countries, because of the toxicity of the odour to the environment and human beings. In contrast, the emission of most odour that contains difference odour for example benzene, had not controlled in Malaysia. At a moment, the large factories and plants are discharging high concentrated of odour especially hydrocarbons, to the atmosphere without proper treatment.

The electron beam treatment is suitable for the oxidation process of dilute odour in air, because of its less pressure drop of air in the process than adsorption and oxidation with solid materials, such as an activated carbon and catalyst. The energetic electron, accelerated with an electric field in vacuum chamber and extracted to the atmosphere through thin metal window foil expose the air containing dilute ions through the ionization and dissociation of air components. The free radical react with dilute VOCs in the gas phase to produce alkyl radical. The alkyl radicals subsequently react with oxygen and form primary irradiation products, such as organic acid and aldehyde, at lower doses, finally resulted to produce CO2 as a non toxic substances through further oxidation of primary irradiation products. (see figure 1)

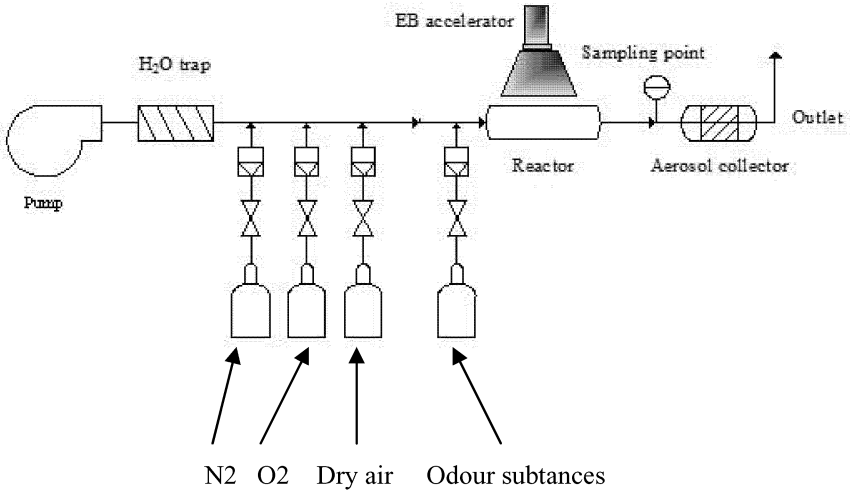

Figure 1. Apparatus for preparation EB irradiation of odour samples

4.2 Chemicals

Nitrogen (N_2, 99.995 %) Taiyo Nippon Sanso Coporation and oxygen (O_2) 99.79 % were used as base gas components of sample gases in distilled water at 288 K.

4.3 Preparation of samples gases

Humid N_2 was prepared by bubbling dry N_2 in the distilled water ai 288 K. Gaseous TML was vaporized by bubbling it gas in the distilled water at 281 K. The sample gases at a flow rate of 10 L/min were prepared by mixing the above mentioned gases with dry N_2 and O_2. The absolute humidity of the sample gases, 1 % was controlled by changing the ratio of the flow rate of dry N_2 to that of humid N_2 with monitoring absolute humidity by a moisture analyzer (Hygro-M3 with D-2 detector, General Eastern Co.Ltd) ‘’Hakoda (1998)

4.4 Electron Beam irradiation

The sample gases were irradiated with 1-MeV electrons provided by an electron beam generator (2 MV and 30 mA max. beam window is 5 cm X 60 cm with the Ti film window of 50 u m in thickness. Cockroft-Walton type, Nissin Electric Co> Ltd). The rectangular parallel piped irradiation vessel made of stainless steel was designed having 5 cm x 72 cm X 10 cm (depth) with 50 um thick stainless steel film window, considering the size of the beam area.’’ Hakoda (1998)

Averaged absorbed dose in sample gases was concentration of N_2 produced from TML (99.99% Syowadenko Co. Ltd) under EB irradiation based on a G-value (molecules produce per 100 eV). The TML gas at a flow rate of 10 L/min was introduce to the irradiation vessel and irradiated at different current with an acceleration voltage of 1 MeV. The concentration of produced TML was measured by a gas chromatograph (GC) with a thermal conductivity detector (TCD) (Shimadzu Co., GC-8A) using a packed column (molecular sieve % A, 3 mm I.D., 1.5 m, GL. Science inc.). The value 15 kGy/mA was obtained as the value of dose per unit beam current at a flow rate of 10

L/min. The temperature of the sample gases was kept constant at 298 K+- 2 K during irradiation by the circulation of cooling water outside the vessel. ‘’Hakoda (1998)

5. Legislative provisions

In the beginning of legislating the environmental protection in Malaysia under Environment Quality Acts 1974, Clean Air Regulation, the question of evaluating different odors, volatiles organic compounds (VOC) appeared. Since that time there is no laws had been made regarding odor nuisence.

The choice of the location for a new development such in Environment Impact Acessement (EIA) is the most important sanction, that means to keep an adequate distance to the next development and to take care of the meteorology terms, like the main wind directions. The reduction of the immission, in cases of big air flow volumes with a small emission concentration, could be a effective and economic alternative, instead of reducing the emission with different sanctions.

6. Conclusions and recommendations

Odour problem in Malaysia, is very old problem but the people solve the problem using very conventional way such as using charcoal ect. For most of the industries where their discharge at point sources they uses the ease way such as water scrubber to eliminate the odour problem, But for the open spaces such waste water treatment so far there no technology to solve this problem except using deodorant spray.

Just recently the DOE is drafting the regulation in order solve the problem, relating the nuisance come from odor but the process may take a long time because some industries still cannot except odor as a big problem compare to economic value.

6.1 Recomendations

6.1.1 Build a barriers

The presence of barriers changes the wind flow patterns around facilities, that is the source of odour pollution, the adage of out of sight, out of mind may occur when a good tree cover is present around the facilities. Some reports show that how their facilities operated two years with no odour complaints till major road construction project removed much of the tree cover around the area. Thereafter odour became a significant part of their facility problem. Although there is not much quantitative data to prove the effect of significant tree cover, it is strongly recommended to have a cover that keeps the sites from view of neighbors. Trees also have the ability to capture some of the dust particulates that are carriers of odour for long distances. In addition, tree provide noise suppression and an aesthetic appeal that would benefit the operation.

7. Good housekeeping , operational and contingency plans

Every facility should have a written plan that describes how to operates the process, what to monitor, how often and when the product is ready. In addition to an operating plan, each facility should have written document that outlines what to do when contingency occur. Sometimes the worst incidents occur, that results in major loss of

public confidence and great amount of resources being spent in working with the community. In order to avoid such situations, a contingency plan was put in place, which ensured that all potentially out of specification odour problem will take action within 72 hours. This does not occur often, however when it does, the operators are now in a position to respond to contingency quickly and effectively.

7.1 Department of Environment

The Law concerning this issues must be make true many input from various groups including researchers otherwise in future, when it come to enforcement the law there will be a great problem, such as the odor unit, odor index and odor concentration because of different industries have different odor.

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