7.13 Offensive Odor Control Measures

7.13.1 Planning for Controlling Offensive Odor · Deodrization Method

The basis for planning the odor control measure is to understand the source of the odor, the process of generation, and the conditions surrounding its output accurately. In the event of odor, in most cases it can not be anticipated as to where the odor is generated from. The number of sources and the amount being generated must be thoroughly investigated. And the final step of reducing these amounts are the basis of establishing control measures. In order to determine the amount of odor being emitted, the Odor Emission Rate (OER) is tested. The major sources of the odor are checked and in general, counter measures for sources with large OERs are established initially. The OER is indicated by taking the product of the odor concentration by exhaust gas volume (m^3/min). The first step of the odor control measure is to investigate the cause of the odor from the source. Then, methods, including ideas on changing current procedures, are looked at to find a way to reduce the amount of the odor. At the same time, in order to lessen the volume of processed gas as much as possible, covers and suitable hood work are done to close off openings. Countermeasures are implemented for stopping leakage from such areas as the facilities. Reduction of the volume of processed gas is a necessity in cutting cost for deodorization units. Following this, deodorization control measures are performed for the odor that is generated. First, the major components of the odor and their concentrations must be comprehended. Then the most appropriate method for deodorization must be selected. In addition to this, should there exist numerous sources, the concentration level of the odor must first be clarified. The odors are then separated based on their concentration level and processed. In this case, it is not enough just to send the odor into a newly set up deodorization device. Treatment methods such as the use of high concentrate odor as auxiliary air for the furnace of the existing facility or for use as aeration gas in water treatment, are being implemented. Fig.7.13.1 gives an example of deodorization method at a raw sewage treatment facility [1].

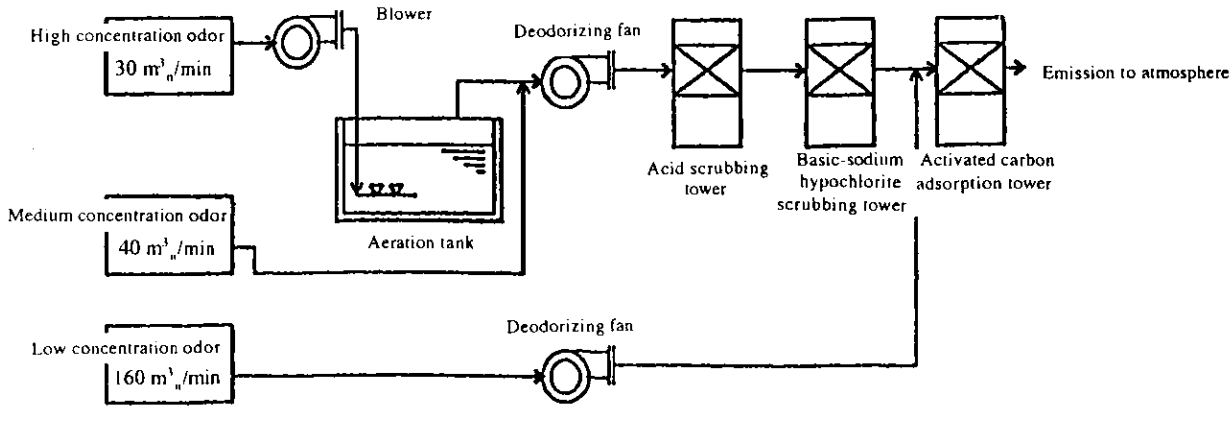

Fig.7.13.1 Examples of Deodorization Method at Night Soil Treatment Facility [1]

7.13.2 Deodorizing technologies [2) 3)]

Methods used for the removal of offensive odor include the thermal combustion method, adsorption method,

wetscrubber method, biological deodorization method, ozone oxidation method, and the use of deodorants [4]. These methods and their respective devices are selected based upon the physico-chemical qualities of the substance to the deodorized and the conditions of the facilities exuding the odor. The following covers the characteristics of each device and their range of application.

(1) Combustion method

① Direct Burning Method

The offensive odor substance is decomposed via combustion at a high temperature (650-800℃, 0.3-0.5 second retention time) and deodorised. For the combustion process, auxiliary fuels such as city gas and kerosene are used. This is the most dependable method as long as the substance is completely eliminated by combustion. However for those substances which can not be completely oxidized, the method only results in creating toxic substances in addition to the unpleasant odor. This method can be applied for use treating a wide range of odors. As this method utilizes high temperatures, the running cost is high and it is necessary to install a heat recovery unit. It is also effective as a control measure for sources which emit high concentration odors continuously. However, it is difficult to reduce the odor concentration level of the exhaust gas to below 100 after deodorization.

② Catalytic Combustion Method

The method deodorizes by decomposing the odorous substances via catalytic combustion. Catalysts such as platinum, vanadium, and manganese are used. Oxidation takes place at fairly low temperatures (300-350℃). For this reason, running costs are low in comparison with the direct combustion method as less heat is used. Preliminary treatment such as with a filter, is necessary as catalyst poison such as heavy metal, silica, halogen, dust, mist, and nicotine effect performance.

③ Regenerative Thermal Oxidation Method [5) 6)]

In the regenerative thermal oxidation method, the temperature of the processed gas is maintained at high levels (800-900℃). The offensive odor substances within the processed gas are oxidized and emitted as carbon dioxide or water. The basic mechanism of this method and the direct burning method are the same. This device, after deodorization, passes the high temperature exhaust gas through the accumulator (packed with metal or ceramic thermal storage material). The heat contained by the gas is transferred to the accumulator as it passes through. This heat is used to increase the temperature of unprocessed gas. Deodorization takes place in the combustion chamber. In this case, as the reception of heat is taken directly from the accumulator and due to the fact that there is a sufficient area of contact, more than 90～95% of the heat is recovered. This method is used to deodorize solutions. In cases where the odor is of low concentration and there is a long operating time, the running cost is low.

(2) Adsorption method

This method utilizes an adsorbent such as activated carbon to adsorb the offensive odor substance. It is a suitable method for situations where the flow of processed gas is relatively large and the concentration of the offensive odor substance is low. It is used as the last step of the deodorizing device as a processing method. The scale of the processing device changes vastly depending on the concentration, humidity, and amount of gas. Also, it is

necessary to select the proper adsorbent for the offensive odor substance. In most cases the adsorption method device is used in conjunction with other devices such as absorption method. High concentrate offensive odors are handled by a separate device, while this device treats relatively low concentrate odors. Units currently being used are ones which exchange the whole adsorbent, recycle the adsorbent it using steam, or the new honeycomb-type method.

(3) Wet Scrubbing Method

Easily dissolvable substances in the exhaust gas are dissolved using such solutions as water, acid, alkaline, or acidic solution. These substances are absorbed in the solution in order to remove odors. In general, the absorbent solution for acid gas (hydrogen sulfide, etc.) is alkaline solution (sodium hydroxide), that for alkali gas (ammonia, amine, etc.) is acidic solution (sulfuric acid, etc.), and that for aldehyde and ketone is sodium thiosulfate. Basic sodium hypochlorite is used as a oxidizing agent for general organic substances. This method is also adaptable for use in dealing with relatively large flows of processed gas. The initial costs for setting up this system are relatively low but the running costs are effected by liquid waste disposal. Recently, activated sludge has been used as the absorbent liquid. A method is being developed where this is used in combination with the biological deodorization method.

(4) Ozone Oxidation Method

Ozone, which is a tough oxidizing agent, is used and the offensive odor substances are decomposed by oxidation. In some cases it is used in conjunction with the absorption method or the absorption method.

(5) Biological Deodorization Method [7) 8)]

Microbes found in black soil, activated sludge, and peat moss are used to decompose the odor substance through a biochemical reaction. This method is used in treating sewage, raw sewage, and organic solvents. This method has a low running cost (0.2-0.8 times that of other methods), is easy to run and manage, and there is no fear of secondary pollution. In order to increase the amount of microbes, it is necessary to obtain a nutritional source and water. For this reason the removal of hydrophilic substances is high. The biological deodorization method is categorized as shown in Fig.7.13.2.

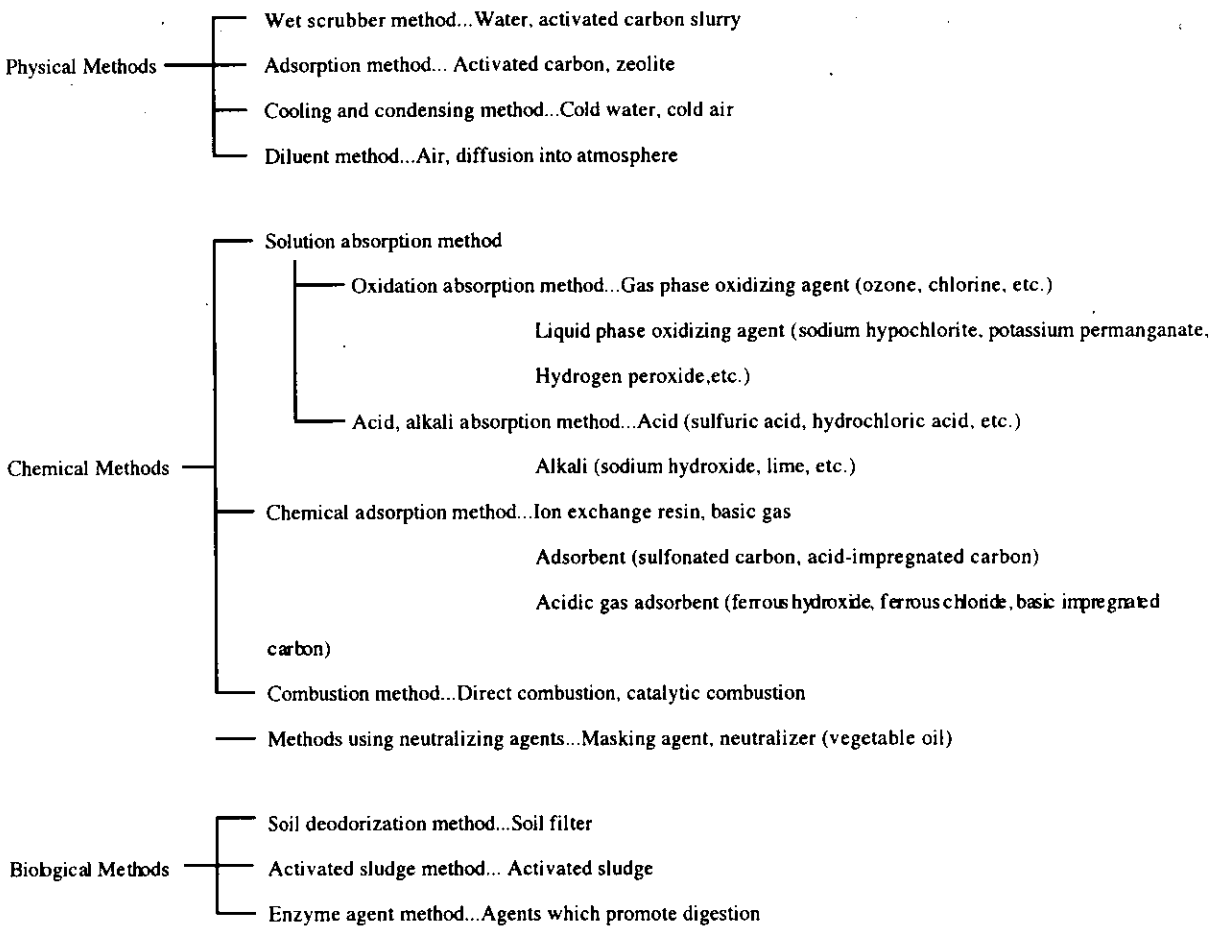

Fig.7.13.2 Categories of Deodorization Methods [4)]