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### **Background History to the Chemiphase Biosure systems and products:**

Some form of anaerobic biological activity, which produces and releases gases to the ambient environment, usually causes odours generated on waste water facilities. Factors favouring anaerobic conditions are well documented in literature and a wide variety of gaseous compounds are known to be emitted during the handling and treatment of waste effluent waters.

With increasing public awareness and demand for a better living environment sewage authorities throughout the world are placing increasing emphasis on the control of the obnoxious emissions from wastewater facilities.

Many types of treatment to eradicate or mask are being applied. On the chemical front basic reagents like Hypochlorite, Ferric, Oxygen or Ozone are being added to either breakdown, or oxidise the predominant sulphurous molecules that are causing most of the odours emanating from effluent treatment processes. In conjunction with these reagents, masking agents are aiding odour abatement to a degree but public awareness is growing and they are quickly realising that masking agents i.e. coconut, orange, pear drop fragrances are only masking the odorous smell.

### **Development of New Products for Controlling Odours.**

We at Chemiphase have for the past 4 - 5 years been supplying masking agents to several large sewerage plants and have realised that this is only a temporary solution. Masking agents are expensive to formulate and there is no real benefit from spraying these products around effluent processing sites since they do not knock out the real cause of the odour emission. Consequently we have been carrying out a series of lengthy projects to find a better treatment for controlling odours. The criteria we are looking for is a product that will basically be more cost effective for the end user and is either seen or measured as a true arrester of unwanted odour emissions.

Most odours are caused by a wide variance of chemicals that have been produced by the decay of organic material by anaerobic bacteria. Some of the better known is H<sub>2</sub>S, Mercaptans, Methylamines, Ammonia and Skatole.

From our research we looked initially at chemical products and found a unique chemical molecule that would actually neutralise rich odours by reacting with the odour to form a stable non-odorous molecule. This product, in two versions - **Chemiphase Checkmate** and **Chemiphase CP 80/10**, is fully environmental and has all the correct safety data requirements to meet all major body approvals. The actual reaction when our chemical molecule reacts with known odour chemistry is a non-stoichiometric reaction. This means when an odour chemical is present, say at 20 ppm we would have to add 1 - 2 ppm only of our product in order to remove all traces of the odour. With ordinary masking agents who are stoichiometric in reaction a far higher dosage would be required. Therefore in comparison our product will show a very cost-effective route for chemically controlling odours either by dosing or fogging.

### The next stage.

Chemiphase has been developing bacteria products for controlling these and other odours for over 4 years. We have been applying specific bacteria formulations to oil wells as a means of reducing their wax deposition and corrosion problems caused by H<sub>2</sub>S gas and anaerobic bacteria. i.e. SRB's sulphate reducing bacteria. Throughout this period we have continually shown that our bacteria products have reduced the presence of H<sub>2</sub>S gas and SRB's to the extent we have been able to extend the life of a well from corrosion and blockages due to wax deposition.

### Overcoming Grease Problems

Two to three years ago we formulated bacterial products designed to control fats and grease build-ups in all sorts of industrial and commercial applications. i.e. Restaurants, hotels, kitchens, poultry farms, fish farms, food processing factories and bakeries. The product is added daily to either grease traps or effluent plants as a means of dramatically reducing the occurrence of blocked grease traps or pumps, or specific parts of an effluent plant or pumping station.

Chemiphase has also developed strains of bacteria, which can be utilised for combating algae, phenols, aromatics, waxes, solids and many other problems.

### Land Treatment.

Chemiphase has been involved with land treatment projects such as Derby Pride, Tyne Tees University, Birmingham Council and others including several Department of Environment projects relating to waste water on contaminated land. The degree and type of contamination varies from site to site but through our ability to design, build and formulate treatment systems capable of meeting rigorous specifications we are able to meet the most stringent of Environmental standards.

We are also working with British Steel Chemicals Co. (Bitmac) using our bacterial products and nutrients to digest the effluent stream contaminants down to consent limits. Before our involvement the plant could not be made to work and as was to be expected was not meeting consent limits for discharge. Our system is currently taking 4 - 14000 ppm of phenols and thiocyanates and 1 - 5 ppm cyanide in a flow of 250 tonnes a day. We then treat this mixture with our bacteria which is reducing the contaminants to less than 2 ppm of phenol thus meeting all consent levels on discharge into the River Tees.

We are now working with several water companies using our bacterial products as a means of controlling odour emissions. The initial work concentrated on treating specific parts of the plant that appear to be producing most of the odours emanating from the whole of the plant, these areas being:

- (a) Primary treatment tanks.
- (b) Sludge settlement tanks.
- (c) Sludge holding tanks and centrifuge press area.
- (d) Filter cake / pressings.
- (e) Fat / grease build-ups (pumping pits and overflow areas.)

We have moved on from the concept of treating individual areas to the present mode of operation, which is effectively the installation of a **BIOREACTOR** on site and then feed the incoming effluent water with an effective inoculation of the bacterial product. Once the stream has been inoculated the specific bacterial strains will quickly alter the actual metabolism of the water to essentially stop the anaerobic bacteria reducing sulphur compounds to sulphides. Instead, our

facultative bacteria will either use aerobic conditions if they are prevalent or if there is no presence of oxygen they utilise the anoxic conditions in order to oxidise the sulphur compounds to sulphates, which are non-odorous. A more technical appraisal of what actually is occurring is included.

### **The Chemiphase treatments format.**

The method of bacterial treatment for each individual site will vary in accordance to the specific problem prevailing on the site but generally sewage plants fall into the following categories:

- a) The plant is principally run to treat human wastage.
- b) The plant is designed to treat a combination of human wastage and industrial effluent.
- c) The plant is purely for an industrial effluent purpose.

The plants in 1 & 2 are generally classed together for we normally observe the same odour emulating conditions in both all be it at varying concentrations.

Plants as in 3 are usually very specifically designed and managed. The effluent waters are from chemical, animal or brewery wastes and sometimes more than one of these is combined. In these situations the odour emulating chemicals may be very specific or numerous. We are able to supply the correct strain(s) of bacteria and equipment for all applications.

### **How the Chemiphase Biosure System controls unwanted odours.**

There are many strains of bacteria present within the earth's Eco-system. Our research and development has isolated pertinent strains of bacteria and prepared them for specific functions. These are facultative species which can live, breed and carry out their normal functions either in aerobic or anaerobic conditions (in the presence or absence of oxygen). Thus if there is oxygen present they will utilise the situation but in the absence of oxygen they will grow by utilising organic compounds or CO<sub>2</sub> as a carbon source in order to survive. They can also use nitrates as a source of oxygen.

Bad odours will emanate from decaying matter under anaerobic conditions usually caused by low flow conditions, very high closed circuit throughputs or where there is no or very little movement (i.e. tank sludges). So odour producing compounds fall into two broad categories:

- (a) Those based on organic carbon.
- (b) Those based on sulphur (the most important being hydrogen sulphide).

By using facultative bacteria we are able to alter the metabolism of the system away from the anaerobic conditions and hence oxidise the hydrogen sulphide to sulphate ions.

The bacteria's mode of operation (the metabolic terminal electron acceptors) use either oxygen or nitrogen oxides, ideally nitrate ions, as a means of oxidising reduced sulphur compounds. This route is an energy source for growth provided it is in the presence of a suitable carbon source.

### **Chemiphase Biosure Bioreactor Service Scheme.**

The service scheme concept has been designed to meet customer requirements. Essentially the customers have a particular odour / grease problem on their site and by paying a specific monthly fee for our Biosure system we will ensure that the treatment will work uninterrupted as designed.

**The Scheme** consists of:

- (i) Supply and maintenance of the Chemiphase Biosure Bioreactor and all ancillary equipment.
- (ii) Supply of all Biosure biological cultures.
- (iii) Supply of nutrient package.
- (iv) Regular Biosure service to check the health of the biomass and carry out other essential checks. (See parameters set out below).
- (v) Provide an emergency call out system to ensure the Biosure Programme is not interrupted unduly.
- (vi) Quote installation costs and then a monthly price for each site. These prices will include the purchase of the equipment, the supply and maintenance of the bio-culture and the supply of nutrients. The servicing and maintenance of the equipment will be free of charge whilst the bio-culture and nutrients are purchased.

**The Biosure Service Programme** will include the following “health checks”:

- 1. pH
- 2. Dissolved oxygen
- 3. NH<sub>4</sub> ions
- 4. Phosphate ions
- 5. Glucose / sugar levels
- 6. D O U R - Respiration rate of biomass
- 7. Sulphides
- 8. Suspended solids