

## **INDUSTRIAL WASTE TREATMENT DISTILLERY WINERY EFFLUENT**

### **WASTE FROM FERMENTATION**

- Every fermentation process utilizes raw materials which are converted to product.
- Waste materials are produced during or at the end of the process.
- The typical fermentation waste contains- Unconsumed inorganic and organic media components Microbial cells and other suspended solids.
  
- Other effluent components generated from the overall operations are Wash water from rinsing operations.
- Wash water with traces of acid and/or alkali agents as a result of cleaning and sanitizing activities.
- In many cases wash water contains suspended solids like filter aid fining agents and carbon
- Normally, fermentation effluents do not contain toxic materials which directly affect the aquatic flora or fauna. The effluent, however, contains high level of organic matter which are readily oxidized by microorganisms and thus drastically deplete the dissolved oxygen concentration.

### **DISSOLVED OXYGEN**

- Oxygen concentration should be at least 90 of the saturation concentration at the ambient temperature and salinity of the water .Dissolved oxygen is critical for the sustainment and of aquatic life

### **DISPOSITION OF EFFLUENT**

- If the effluent is not utilized by the manufacturer, it is usually disposed using one or more of several common methods-
- Discharged to land, river or sea in an untreated state
- Disposed in a landfill site or it is incinerated
- Partially treated on site (eg. lagooning) prior to further treatment or disposal
- Part treated, part untreated
- All the effluent treated by a biodegrading process on or offsite.

### **LAGOON (OXIDATION POND)**

- This technology for effluent treatment is usually employed by seasonal industries like distilleries. The design usually involves an enclosed water-tight embankment about 1-2m deep. The system can be left as is, without mechanized aeration. However, for

rapid processing (as done at Appleton Estate) a mechanized aerator is installed in the lagoon to provide continuous aeration for the effluent

## **SPRAY IRRIGATION**

In some cases, liquid waste can be applied directly to land as irrigation water. They are considered to be fertilizers if they provide a net increase of nutrient level (macro/trace element) in the soil. If this method of disposal is to be used, then it is necessary to have large area of land near the manufacturing plant, in an area of low to medium rainfall. This is the synergy between the sugar cane agronomic activity and the rum distillery/fermentation operation. In the case of Appleton Estate, the liquid waste is pre-treated by the lagoon system prior to spraying on the land.

## **DISPOSAL VIA SEWAGE PLANT**

- Factors to consider before sending industrial effluent to a sewage plant.
- The capacity of the plant to cope with the estimated effluent volume.
- Possible interruption of the normal function of the plant.
- Ensure there are no compounds present that will pass through the plant unchanged, then cause problems when discharged into a watercourse.
- Determine whether pre-treatment is required to minimize negative effect on the sewage plant.

## **TREATMENT PROCESS FOR EFFLUENT DERIVED FROM RUM AND WINE INDUSTRIES**

- Fermentation waste may be treated by the following methods-
- Physical Treatment
- Chemical Treatment
- Biological Treatment

## **PHYSICAL TREATMENT**

This treatment can be independent, but the result is amplified when it occurs in conjunction with chemical or biological treatment. The common physical processes are sedimentation, filtration and centrifugation. The major benefits are reduction in organic matter level thus BOD level increased ease to process liquid waste and increased ability to recover components of the fermentation waste for recycling purpose.

## **CHEMICAL TREATMENT**

- The most common chemical processing for treating fermented liquid waste are coagulation and flocculation. The former is instantaneous, while the latter requires more time and gentle agitation to achieve aggregation of the particles.

- Some coagulating agents are Fe(II) or Fe(III)sulphate,aluminium sulphate (alum) and calcium hydroxide(lime). The coagulant is added to the effluent in a mixing tank, that is designed to remove the supernatant and the sludge independently.

## **BIOLOGICAL TREATMENT**

Most organic waste material may be degraded biologically. This process may be achieved aerobically or an aerobically, in a number of ways. Locally, Wray Nephew has adopted aerobic processes for treating fermented liquid waste. The distilleries utilizes aerated lagoon system described early, while the Winery utilizes aerobic digesters and sewage treatment system. The digesters are reactor chambers equipped with perforated airlines. Air is supplied continuously by mechanized blowers. The organic matter is degraded by aerobic microorganisms found in the activated sludge, as well as by the action of commercial inoculate. At this pre-treatment process takes approximately seven (7) days, and thereafter the waste is sent to the sewage plant for further oxidation and degradation. The pretreated waste is Sent to the sewage plant at a pre-determined rate.

## **SEWAGE PLANT OPERATIONS**

- Modern sewage plant has the following chambers and components-
- Receiving chamber with skimmer
- Oxidation chambers
- Clarifying chamber for settling flocs.
- Chlorination chamber designed to give appropriate retention time
- Return sludge chamber (to collect and remove sludge)
- Perforated airlines in oxidation, receiving and return sludge chambers
- Surface skimmers to remove floating flocs in clarifying chamber
- Eductor to remove settled solids from clarifying chamber
- Filter (sand bed) optional

## **MONITORING EFFLUENT QUALITY**

Effluent quality is monitored by determining its level of chemical and biological composition. Some of the major parameters monitored are pH, Sulphate ,Copper ,BOD ,Zinc,Lead, COD , Iron.

## **OTHER WASTE TREATMENT SYSTEMS**

### **ANAEROBIC TREATMENT**

- Benefits
- No air required, hence very low/no energy input

- One of the principal by-product is methane, which is a major energy source A wide range of waste can be treated via this process
- Disadvantages
- High initial capital input
- Slow process that does not readily kill pathogens
- Large amount of waste to dispose when cleaning system