ENVIRONMENTAL PROBLEMS IN CENTRIFUGED LATEX MANUFACTURE

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It is the desire of every one to work in a safe environment free from pollution.

Apart from the environment inside the centrifuge factory one must also be concerned with the safety of the environment outside the factory where most of the by products of the factory are discharged.

The necessity for health and safety legislation has been accepted all over the world and it is one of the largest areas of growth in the world today.

When one considers the environmental problems of centrifuged latex manufacture it is necessary to look at the entire system of operations right from the rubber plantations up to the discharge of effluents.

The system of operations in centrifuged latex manufacture can be explained in a flow diagram (Fig 1.)

FIG. 1. SYSTEM OF OPERATIONS IN CENTRIFUGED LATEX MANUFACTURE

Rubber Plantations
↓
Tapping
↓
Collection of latex in cups
↓
Collection of buckets
↓
Collecting centre
(Bulking tank)
↓
Transport — Bowsers, Drums
↓
Factory bulking tank — sludge removal
↓
Centrifuging machine

Centrifuge M/C

↓ Centrifuge latex
Bulking tank
Maturation (Several days collection)
Drums

Transport Tankers.

Flexibags.

↓ Skim latex

Bulking tanks Removel of NH_3
↓
Skim coagulation — Skim serum (High BOD) (effluent)

Skim coagulation
↓
Milling
↓ Fcl
Drying

Skim serum (High BOD) (effluent)
↓ Adjust p^H
treated effluent tanks
↓
treated effluent
(low BOD)
(less small)

The system of operations should be carefully controlled to ensure that;

(1). Raw materials must not present any hazards under the approved conditions of use, handling, storage and transport.

(2). The working environment should not be contaminated during processing and manufacture.

(3). The Products which are manufactured must meet all restrictions on chemical constituents present.

In centrifuged latex manufacture the main source of pollution is from wash water from cleaning bowsers, tanks, centrifuge bowls and other equipment and skim serum after centrifugation and coagulation.

Environmental pollution caused by the direct discharge of untreated rubber factory waste water can be reduced by limiting the sources of pollution in the factories by proper process control, in which raw materials is minimised and by using minimum quantities of process chemicals and water.

Improvement of working conditiohs and occupational health:-

Any release of chemicals in a working area involves the exposure of such chemicals to workers. This is usually through inhalation or skin contact with gases, vapours, fluids, dusts and aerosals. Ventilation of the working area, and personnel protective equipment and clothing reduce the possibility of exposure. At present the factory operations are such that there is frequent physical contact between factory workers and dissolved process chemicals. A hazard evaluation should be made for these situations and protection measures should be developed. In this respect it should be noted that lack of understanding and co-operation on the part of the workers (often due to inadequate training) tend to reduce the effectiveness of protective measures. In addition, in warm climates specially, the use of personnel protective equipment may become an insufferable burden on the worker. He may well prefer facing a risk he scarcely understands to the constraints that would limit it. In the development of protection measures these aspects should be taken into account.

Environmental impact of waste water discharge

During prolonged dry seasons, especially the self purifying capacity of water ways may not be sufficient for an effective biological breakdown of the high organic content of the effluent. Odour caused by the decomposition of rubber and non-rubber constituents in combination with various processing chemicals, can become a serious environmental problem.

Although rubber plantations and rubber processing units have existed in sri Lanka for over 75 years, serious complaints about plantation effluents have only been received during the past two decades due mainly to;

(a). the setting up of centralised production units.
(b). Human settlements have spread into areas near rubber factories.
(c). Increased public awareness on environmental issues.

An island wide survey was carried out by the RRI in 1984 to assess the extent of pollution problem due to the discharge of rubber factory effluents. The total number of estates that responded to the survey was 52. Of the 52 estates 31 estates had pollution problems.

Only 7 estates had some kind of treatment system for their effluent. Most estates discharged their effluent to nearby streams and paddy fields.

A study was completed in 1988 by the Government of Netherlands under the Netherlands Bilateral Development Co-operation Policy by the Ecology and Development Co-operation Commission in collaboration with the State plantation Corporation and the Central Environmental Authority. They got information from 137 factories, out of which 101 factories discharged their waste water into water ways, 14 into fields, 10 into streams and paddy fields, 9 into adjoining plantations and 2 into pits. 38 factories have received complaints in recent years about local environmental pollution. The fact that, in some cases no complaints have been received does not necessarily mean that people are not suffering from the nuisance caused by waste water discharge.

Environmental legislation and effluent discharge standards

In 1980, Parliament inacted the National Environmental Act No. 47, resting authority for environmental policy formulation and co-ordination of various agencies in long range planning or environmental protection and management in the Central Environmental Authority (CEA).

A bill to amend the National Environmental Act has recently been presented to the cabinet. It now covers not only Environmental management but also environmental protection and environmental pollution which are more related to pollution control.

CEA has identified the following branches of industries which have considerable environmental impact.

- Natural Rubber.
- Leather tanning.
- Textiles.
- Pesticide formulation.
- Electroplating.
- Dairy products.
- Coconut oil processing.

Various standards for discharge of waste water into inland surface waters are regularised in Sri Lanka.

A working committee was formed to develop and work out a phased programme for the discharge of rubber industry waste water. This committee is formed of representatives of CEA, RRI, CISIR, SPC and JEDB. The preliminary standards for the discharge of rubber industry waste water developed by this committee is given in Table 3.

Table 3: Preliminary standards for the discharge of rubber industry

Parameter	Maximum concentration
pH	6 - 9
total suspended solids (mg/l)	100
BOD (mg/oz/l)	50
COD (mg/oz/l)	400
NH_3 - N (mg/N/l)	
- general	70
- centrifuged latex	300
total N (mg/N/l)	100
sulphides (mg/S/l)	2

Effluent treatment methods

The choice of waste water treatment system depends on local condition and on a number of selection criteria such as investment costs, operation and maintainance costs, system efficiency and reliability, availability of land and need for skilled personnel.

Before waste water is treated biologically it has to undergo some pretreatment to remove rubber particles, correct the pH and to add any necessary nutrients. The pretreatment systems and a number of waste water treatment alternatives for rubber factories are described below.

Pretreatment consists of an equalisation tank with a one day retention time. There is a constant flow of effluent water from this tank into a rubber trap where rubber particles are removed. After waste water has passed through the rubber trap it is dosed with chemicals to correct the pH and to bring the concentration of materials to an optimum level for biological treatment.

Effluent treatment methods

(1). Overland flow system:

In this system rubber factory waste water is first pretreated and then pumped up to a point from where it can flow down slowly, in a thin layer over the surface of long length slopes. The effluent is then absorbed and filtered by the top soil. Aerobic biodegradation of organic matter which remains takes place in the top soil while the purified water seeps away. For a rubber factory with production capacity of 1 t/day an area of 15 000 sq metres is necessary. Sites for this system have to be same distance away form live. This system has good treatment efficiency and low investment maintenance and operation costs provided that a proper site is available. However the system is relatively labour intensive and needs intensive control and inspection.

Ponding system

In this system the pretreated waste water flows through a series of ponds which usually consists of an anaerobic pond followed by a facultative or aerobic pond (See T 4).

(a). Anaerobic pond

The organic matter in the anaerobic pond is degraded by anaerobic bacteria into gases such as methane, hydrogen, sulphite, ammonia and carbondioxide. Solids settle into a sludge layer at the bottom of the pond which have to be removed periodically.

(b). **Facultative pond**

In the facultative pond which is a shallow pond the organic matter is degraded aerobically in the upper layer of the pond. It is estimated that a land area of approximately 1200 sq meters is needed for a rubber factory with a production capacity of 1 t/day.

(c). **Mechanically aerated pond**

In this system the pond oxygen for aerobic biodegradation is supplied by mechanical aerators. One way is by having a stirring device. Bubbling air using a compressor or a vacuum aerator are two other possibilities.

Activated sludge system

In this system the pretreated waste water is led into an aeration tank where it is mixed with flocs of aerobic micro - organism.

The mixture of activated sludge and waste water is aerated vigorously. Organic substances in the waste water are absorbed by the active microorganism which biodegrades the organic matter. Usually a concentration of dry solids of 4 kg/m^3 is maintained in the aeration tank.

Oxidaton ditch system

This is also a type of activated sludge treatment method described earlier but with a low load activated sludge and a larger aeration time.

Rotating biological contactors

This consists of one or more biorotors, a biorotor being a central horizontal shaft to which a contact surface has been attached.

The biorotor is fitted into the effluent treatment tank and is only partially submerged. The biorotor rotates slowly at about 1 to 2 rotations per minute and a film of sludge containing aerobic microorganism develops on the contact surface of the biorotor. While rotating in the tank the biorotor lifts up a quantity of waste water, causing intensive contact between waste water, microorganism and oxygen from the air.

The excess sludge film of the contact surface is automatically washed off by the flow of water through the system. This system requires little space.