

❖ Pollution Control Implementation Division - III

A HANDBOOK ON APPLICATION OF ROOT ZONE TECHNOLOGY FOR TREATMENT OF DOMESTIC & INDUSTRIAL WASTE WATER

Background

Root Zone Treatment System are planted filter-beds consisting of sand/gravel/soil. The Root Zone Treatment System uses a natural way to effectively treat domestic & industrial effluents. This Technology was developed in 1970's in **Germany** and is successfully running in different countries, mainly in **Europe, India and America**. The process incorporates the self-regulating dynamics of an artificial soil eco-system. **RZTS** are well known in temperate climates and are easy to operate on-site treatment facilities, which have less installation and low maintenance & operational costs.

WHAT IS ROOT ZONE TREATMENT SYSTEM (RZTS)

The term 'Root Zone' encompasses the life interactions of various species of bacteria, the roots of reed plants, soil, sun and water. They are also known as constructed wetlands or sub-surface flow systems (Fig.1) In this system, these plants conduct oxygen through their stems into their root systems and create favorable conditions for the growth of bacteria. The wastewater flow through the root zone in a horizontal or vertical way where the organic pollutants are decomposed biochemically by the bacteria present in the rhizosphere of root plants (Fig.2). The filter media are selected carefully to provide favorable conditions for both plants & bacterial growth and to avoid clogging. Organic pollutants are removed drastically from wastewater and are reduced to their elemental forms.

GENERAL DESIGN CRITERIA

The Root Zone Treatment installations are constructed according to the desired level of purification, the concentration of pollutants and hydraulic & organic loadings. The RZTS plants can be set-up as secondary or tertiary treatment for domestic and industrial wastewater treatment systems.

TABLE-1

S.No.	Type	Horizontal Bed (M ² /day)	Vertical Bed (M ² /day)
1.	Organic loading	10-30 gm BOD	20-40 gm BOD
2.	Hydraulic loading	40-100 litre	50-130 litre

For cold climates the design criteria are shown at **Table-1** & this criteria has been used while designing Mother Dairy Pilot Project. For tropical/subtropical condition, however, the design criteria concerning to performance are still not available. It is expected that area requirement should be less in tropical climate because of enhanced microbial degradation process. On the other hand, there are some indications that in warm climates the filter media have to be selected differently to avoid clogging problems.

GUIDELINES ON ROOT ZONE TREATMENT SYSTEM

On the basis of performance data of RZTS located in India & elsewhere, the work related to development of Guidelines for construction, use, operation & maintenance of Root Zone Treatment System has been prepared and like to be published soon by Central Pollution Control Board (CPCB). However, the detailed information related to Root Zone System can be obtained from CPCB. Besides this an experiment (pilot project) for optimization of efficiency parameters under Indian climatic conditions such as void ratio, evaporation rate, permeability, filter media, plant species (reed) etc. is being carried out at Mother Dairy, Delhi.

Selection of Plant Species

Following list of species can be tried:-

- Phragmites australis (reed)
- Phragmites Karka (reed)
- Arundo donax (Mediterranean reed)
- Typha latifolia (cattail) Ø Ø Typha angustifolia (cattail)
- Iris pseudacorus
- Schoenopletus lacustris (bulrush)
- Scirpus Lacustris

For horizontal **RZTS** all helophytes can be used which are deep-rooted and oxygenate the rhizosphere through the roots. For vertical systems, the plant selection is less critical, because the oxygen input is enhanced by the intermittent surface application. However, in mother dairy plant, Phragmites australis has been used in both horizontal and vertical filter-beds.

Planting Techniques:

Planting of reeds can be done in the following ways:

- Reeds can be planted as rhizomes, seedlings or planted clumps.
- Clumps can be planted during all seasons. (2/m²)
- Rhizomes grow best when planted in spring. (4-6/m²)
- Seedlings should planted preferable in spring. (3-5/m²)

Planting should be done from supporting boards to avoid compaction of the filter media. Initially the plants should be kept well watered, but not flooded. With well-developed shoots in the growth period, a sufficient supply of nutrients is required. If wastewater is used for initial watering, precautions like avoidance of stagnation have to be taken to inhibit the formation of **H₂S** within the filter bed.