

Treatment of wastewater from livestock rearing with aquatic plants

Adaptability

Wastewater draining from livestock farms contains large quantities of nitrogen, phosphorus and soluble inorganic compounds. It is difficult to remove these from the water by conventional cleaning treatments such as filters.

They can be effectively removed by plants, in a way which is low-cost and environmentally friendly. Two species were particularly effective in wastewater treatment, water hyacinth and water dropwort. The most effective hydraulic retention time (HRT) of wastewater was about 10 days in a pond or open tank planted in one of these aquatic plants.

The plants

Water dropwort

Water dropwort (*Oenanthe stolonifera*) is a perennial creeper sometimes known as “water celery” (Fig. 1). A native of Southeast Asia, its stems and leaves can be eaten as a vegetable, either raw or cooked. It is propagated by root division, and grows best in shallow water up to 20 cm deep, or on the wet edges of ponds and streams.

Water hyacinth

Water hyacinth (*Eichhorma crassipes*) is a native of tropical South America. It is a rapidly growing water plant which floats on the surface of the water (Fig. 2). It has a spectacular purple flower, and was often introduced as an ornamental plant into Asian countries where it subsequently became a major aquatic weed. It reproduces by breaking into pieces, each of which can develop as a separate plant.



Fig. 1. Water dropwort, also known as water celery

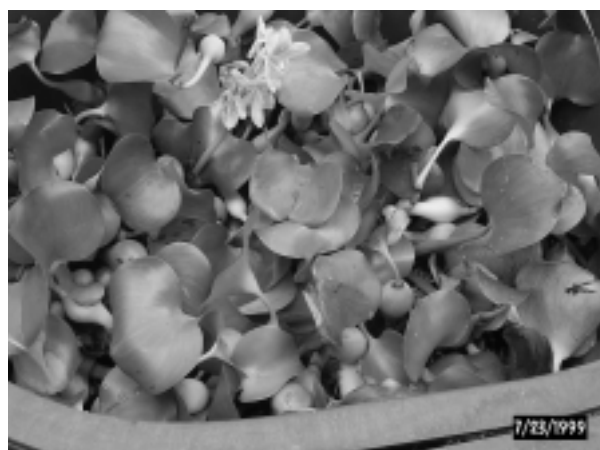


Fig. 2. Water hyacinth

The wastewater treatment

The wastewater from livestock pens first flows into a sedimentation pond, where the solid wastes settle to the bottom as sediment. It is left there for several days. The cleaned wastewater then flows into an open tank where either water hyacinth or water dropwort is growing. The surface of the water in the tank is covered with the plants (approximately 400 plants/tank).

If water hyacinth is used, the tank can be any depth. However, water dropwort can grow only in fairly shallow water, which limits the capacity of the treatment tank. If water dropwort is used, the tank should be about 30 cm deep. Water dropwort is adapted to a cooler climate, while water hyacinth grows better in a warm one.

The dimensions of the tank depend on the amount of wastewater to be treated. For example, the wastes from 10 head of cattle would be around 456 liters. The tank would need to be about six meters square (6m x 6m) and half a meter deep. This tank would have a total volume of 18 cubic meters and a surface area of 36 square meters. It would be able to hold about 30 days' wastewater from the cattle shed.

The wastewater is retained in the treatment tank for ten days. During this time, the level of phosphorus in the water falls by 57-58%, while 44% of the nitrogen is removed.

The BOD_5 is a way of measuring the level of organic matter in water. During the ten days' treatment, the BOD_5 falls by 80-90%. This means that the treated wastewater meets the minimum standards of most Southeast Asian countries. It can safely be discharged into rivers, streams and lakes without further treatment.

The plants themselves may be harvested and used as an organic fertilizer. They can either be applied directly as a green manure, or composted.

Precautions

- ❑ Water Hyacinth and Water Dropwort cannot be grown in cold areas, as their growth stops when the temperature falls below 15°C
- ❑ To prevent the aquatic plants from being washed away through the exit drain of the pond or tank, where the treated water flows out, it is recommended to install ropes across the pond or tank. The ropes also make it easier to collect dead plants from the tank.

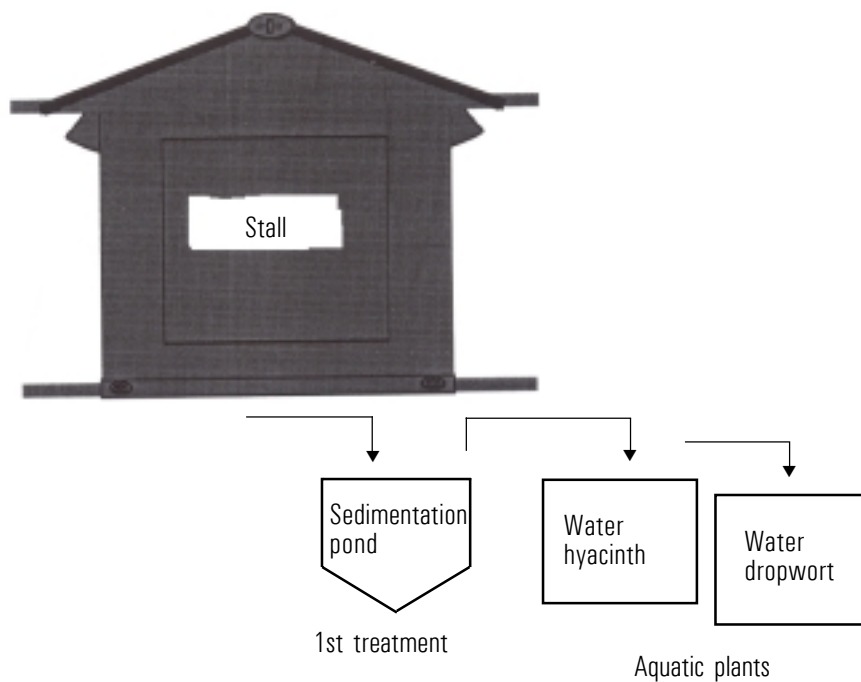


Fig. 3. Diagram of the treatment system