Closed retting for coir extraction with biogas recovery

Coir fibre is one of the strongest natural fibres. As a byproduct of coconut, it is an ideal environmentally friendly replacement for synthetic fibres in a variety of applications. Brown fibre is extracted mechanically from raw or dry coconut husks. Better quality white fibre is extracted from fresh husks after a biodegradation process called retting. Kerala produces the best quality white fibre in the world.

Retting is a microbiological process that converts degradeable plant components into soluble compounds. The concentration of dissolved substances can build up rapidly in the ret liquor if not removed effectively. In the closed retting process ret liquor is circulated through a high-rate anaerobic reactor to remove the dissolved substances.

Pollution Due to Retting

Husk retting is carried out by immersing coconut husks in lakes, rivers and ponds for period ranging between 6 months and 1 year. During retting, materials of the husk which bind fibres together are degraded and fibres are loosened. Extraction is simple and yields fibre with polished surface properties.

Natural phenolic compounds present in husk when exposed to air, undergo oxidation and generate dark coloured compounds which give brown colour to fibre. These compounds, once formed, can only be removed by chemical bleaching. During the retting process, phenolic compounds are removed to a large extent and therefore, the retted fibre is not coloured.

Retting leads to extensive pollution of water bodies. It is especially evident in the backwaters of Kerala, which have gained major economic importance because of its tourism potential.

Retting areas are almost devoid of higher aquatic life because of lack of oxygen. Fisheries in the area are non-existent.

Closed Retting

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- Rapid solubilization and acidification of about 50% of removable materials
- Slower solubilization of remaining compounds
- Residual phenolic substances that cause browning are present in liquor till last stages of retting.
- Crushing of husk enhances speed of retting.

A retting plant comprising of several tanks with flexible cover for preventing oxygen entry are provided for retting. Husk is crushed and loaded into a fresh tank each day. The tank is covered and left for maturation for 30 days, while its liquor is ciruclated through the methanogenic reactor. A single methanogenic reactor is used for circulation of liquor from all tanks.

Methane production is almost exclusively from a 'high-rate' UASB methanogenic reactor and no significant quantity is generated from the retting tanks. Therefore, it is possible to collect methane without expensive gas tight covering of the retting tanks.

Anaerobic reactors remove COD from liquid, recover it as methane-rich biogas. A high-rate anaerobic reactor has small size because it retains bacteria longer than liquid and reduces capital costs. The UASB reactor is used in the closed retting process for removal of dissolved substances from ret liquor. Methanogenesis is the anaerobic treatment of soluble wastewaters.

The basic process of anaerobic degradation is :

1. Acidogenesis - formation of fatty acids
2. Acetogenesis - formation of acetic acid, hydrogen and carbon dioxide from volatile fatty acids
3. Methanogenesis - formation of methane by a) break up of acetic acid b) synthesis from carbon dioxide and hydrogen

Benfits of Closed Retting

- Zero discharge
- No air pollution
- Retting period reduced to 30 days
- Coir fibre quality maintained
- No hazardous labour
- Pith as by-product (low-EC pith)
- Energy recovery - methane
- Retting can be carried out in plantation areas - no water body required
- Water bodies released for other uses

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