PRELIMINARY OBSERVATIONS ON THE BREAKDOWN OF COIR IN SOIL
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Coir decomposition Coir preservation Lignin-cellulose

Summary
Coco fibres are used as a wrapper of plastic drain pipes. An investigation has been made of the decomposition of these fibres in soil. Unaffected and partly decayed fibres were washed and placed on cellulose-containing agar plates. Unaffected coir rarely showed growth. Around the partly decayed fibres nearly always fungi developed. A number of these, cellulose-decomposing fungi were isolated and identified. Total reducing sugars, hexoses, lignin and nitrogen were estimated in unaffected and partly decayed coir samples. Especially the nitrogen content correlated with the stage of decomposition of the fibres. A laboratory method is described for studying the breakdown of coir under conditions more or less equal to those in the field.

Introduction
Coir wrappers around plastic drain pipes are used in the Netherlands on a rather large scale. However, in certain soils after having functioned for one or two years the filter capacity may be reduced owing to partly decay of the coir. In some instances the wrapper was found to be wholly decomposed. This study deals with the breakdown of coir under soil conditions and the chemical analysis of the original coir, including the partly decomposed material. Up to now the chemical composition and the microbial breakdown of coir have only scarlet been studied. Menon reported data on the chemical analysis of unaffected commercial coir. The main features of coco fibres with special reference to the spiral fibrillar structure has been recorded by Stern.

Materials and methods
Microbial breakdown of coir under laboratory conditions
A coir mat (10 x 10 cm), pierced by a hollow glass pipe, was placed on a flower pot of 200 ml capacity, standing upside down in a two liter glass jar. About 1500 g of a medium-textured subsoil of recent marine origin was brought into the jar which was painted black to avoid the growth of algae. The aerobic jars (Fig. 1A) contained 200 ml of water. The liquid level was marked on a paintless part of the jar so that water lost by evaporation could be filled up. The anaerobic set (Fig. 1B) was entirely filled up with water. The jars of these sets were provided with covers. They were incubated at 25°C.
Wood-stain treatment of coir
The coir mat of some aerobic and anaerobic jars had been soaked in woodstain (Gori 44) for 16 hours. This stain contains 5% pentachlorfenol as the active compound.

Isolation of fungi
Soil particles were removed from the coir after which the fibres were washed for 24 hours with running tap water. Then three single fibres were placed on a cellulose-containing agar plate. After 6–9 days incubation at 25°C, the fungi were isolated.

Cellulose-containing media
The cellulose agar contained $K_2HPO_4$, 1 g; $MgSO_4\cdot 7H_2O$, 0.5 g; $(NH_4)_2SO_4$, 0.5 g; soil extract, 50 ml; ground filter paper, 2.5 g and agar, 10 g, filled up to 1 l with tap water. The pH was adjusted to 7.0.

A different method for checking cellulose breakdown was carried out in tubes with 5 ml of the basal medium containing a slip of filter paper (1 × 7 cm).

Chemical analyses
For the estimation of total reducing sugars, hexoses and lignin, thoroughly washed coir, cut to pieces of 1–15 mm, was dried overnight at 105°C. A weighed sample of about 1 g of fibres was treated with 11.25 ml sulphuric acid (72%) during 6 h at room temperature. Then, 124 ml distilled water was added making the solution about 2 N. After a 6 hours treatment in a boiling waterbath, the solution was filtered, until acid-free, through a dried and weighed paper filter. The unaffected lignin was estimated by weighing. The filtrate was filled up to 500 ml and reducing sugars, calculated as glucose, were estimated according to Somogyi⁴. The hexose content, calculated as glucose was determined with the anthrone-sulphuric acid method.

The nitrogen content of the coir was estimated according to the Kjeldahl method. Weighed samples of about 1 g fibres were destructed with 20 ml concentrated sulphuric acid and 5 g of a mixture containing 950 g $K_2SO_4$; 15 g CuSO₄·5H₂O and 20 g Se.

Results

Microbial decay of coir
Partly decomposed coco fibres from the wrapper of plastic drain pipes were digged up 11–30 months after placing the drains. The soil in which the decay of the wrapper was observed was a medium-textured subsoil of recent marine origin occurring in a polder with a ground water table fluctuating between 60 and 150 cm. Sample No 7 was a partly reduced subsoil and sample Y was derived from the wrapper of plastic drain pipes that had been in close contact with the surface of a moist soil during about 4 months (Table 1). Nearly all the coco fibres, after thorough washing gave fungal growth on the cellulose-containing agar medium, and isolation of a pure culture was often possible. Bacteria were rarely isolated. The isolated fungi were identified as: *Cladorrhinum foecundissimum* – Sace and March; *Cladorrhinum* sp. II – Gams and Domsch²; *Fusarium culmorum* (W. G. Smith) Sacc; *Fusarium oxysporum* – Schlecht ex Fr; *Fusarium* spec.; *Gliocladium roseum* – Bain; and *Trichoderma viride* – Pers. ex S. F. Gray.

All the isolates were able to decompose cellulose on the agar medium as well as in the filter paper – containing liquid.