

Principal: Tech-Wood **Project manager:** Ir. B.F. Tjeerdsma
Nederland B.V.

1. Introduction

1.1 Assignment

Tech-Wood commissioned SHR Timber Research to carry out investigations on the durability of their wood fibre polypropylene compounds in (severe) exterior applications. The durability in soil-contact, the resistance against softrot fungi and bacteria has been tested according to the European standard ENV 807.

1.2 Date assignment

4 December 2003

2. Materials and methods

2.1 Tested product

Two types of material products are delivered by Tech-Wood ®, Wood-PP compound material

2.2 Product description

2.3 Procedure

Tech-Wood ® produces wood fibre/polymer compounds by extrusion. The resulting profile can have several applications. In case the material is applied in situations where there is a risk of wetting, the material is potentially susceptible for deterioration by fungal attack. The most severe exterior conditions are classified in user class 4 where the material is in water or soil contact. In this case softrot fungi in combination with wood-destroying bacteria will be dominant. The resistance against these micro-organisms is tested according to ENV 807.

Details of the procedure can be found in the appendix of this report

Results & conclusions

The complete testing period is 32 weeks. The test contains two measuring and evaluation points: after 16 and 32 weeks of exposure in soil contact. The end results after 16 and 32 weeks of testing are described and evaluated below.

The average mass loss and corresponding moisture content of the two compound materials and reference materials after 16 and 32 weeks of exposure in the soil-test are shown in the table below.

Table: Mass loss of the composite samples after 16 and 32 weeks exposure in the soil-test (ENV 807)

| | 1 | 2 | reference | reference | reference |
|--|-----------|-----------|------------------|------------------|------------------|
| | Tech-wood | Tech-wood | Beech | Scots pine | Azobé (Bongossi) |
| wood ratio % | 70 | 70 | 100 | 100 | 100 |
| exposure period | | | | | |
| 16 weeks | | | | | |
| Moisture content % | 28 | 28 | 168 | 97 | 52 |
| Mass loss % | 2,9 | 2,7 | 44,1 | 20,2 | 4,0 |
| 32 weeks | | | | | |
| Moisture content % | 30 | 30 | 257 | 104 | 56 |
| Mass loss % | 4,3 | 4,2 | 57,5 | 26,9 | 6,5 |
| <i>All values (percentages) are the median value 18 independent measurements and samples</i> | | | | | |

From the results shown in the table above it can be seen that the soil in this test had a high biological activity. This can be deduced from the high mass losses of the reference species Beech and Scots pine. Considering this active soil the found mass losses for the composite material Tech-Wood can be regarded as low.

Table: x-value and rating durability classes (based on 16 and 32 weeks of exposure)

| Compound | | Wood | x-value | | Durability class according to criteria 350-1 | | |
|--|-------------|---------|----------|----------|--|----------|---|
| | | | 16 weeks | 32 weeks | 16 weeks | 32 weeks | |
| | | ratio | | | | | |
| | | % | - | - | - | - | |
| 1 | Tech-Wood 1 | Wood-pp | 70 | 0,14 | 0,16 | 1 | 2 |
| 2 | Tech-Wood 2 | Wood-pp | 70 | 0,13 | 0,16 | 1 | 2 |
| reference | | Azobé | 100 | 0,19 | 0,24 | 2 | 2 |
| <i>x-value measured on results of reference scots pine</i> | | | | | | | |

Official there is no validated correlation between the x-value (see appendix) determined according ENV 807 and the rating of durability classes according to EN 350-1. However since there is not an alternative yet this rating is being used in practise for determining the natural durability of wood. In the present tests a

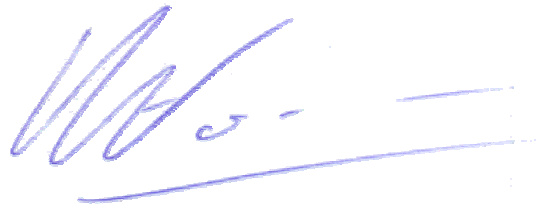
composite material is being tested, containing only partly wood. Because no comparing information for this material is available the comparison with the natural durability of wood is being made. Please note that this interpretation of the test results is not part of the applied standard.

The x-value and the rating in durability classes based on criteria described in EN350-1 are shown in the table above. It can be seen that the material can be categorised in durability class 1 or 2. The results of the composite material can be compared to the results of Azobé in this test. Azobé is a well known and frequently used wood species for exterior conditions in civil engineering. In the literature this wood species is classified as durability class 1-2. This is also in accordance with the results found in this test.

Based on the results after 16 and 32 weeks, durability classes 1 and 2 found for the wood-pp material correspond with the classification very durable to durable material, with respect to the resistance against soil inhabiting organisms.

A handwritten signature in blue ink, appearing to read 'B. F. Tjeerdsma', written in a cursive style.

Ir. B. F. Tjeerdsma
Project manager

A handwritten signature in blue ink, appearing to read 'W.J. Homan', written in a cursive style.

Ir. W.J. Homan
Manager Wood Technology

Appendix:**Details of test procedure**

The sample dimensions of the test profiles are: 5 mm X 10 mm X 100 mm.

Prior to the fungal test the material is leached with water. Leaching of samples is performed according EN 84. The samples are vacuum- pressure impregnated with demineralised water and conditioned under water for two weeks.

Drying followed for determination of moisture content and dry mass per sample for a number of samples from each compound. The rest of the (wet) samples were used for the soil-test of ENV 807, 18 samples for each period and for each compound material.

Soil test. Duration 32 weeks
Two exposure periods, after 16 and 32 weeks
Beech, Scots pine sapwood and Azobé (Bongossi) will be used as reference wood species.
Soil is the standard John Innes II type of soil. Temperature during the test is 27 °C (± 5 °C), moisture 90% RH (± 5%).

After the exposure period the moisture content and the mass loss is determined of each individual sample.

The total number of samples in the fungi test are:

- 18 samples per period
- 2 periods
- 2 types of wood-pp composite material

SHR Timber Research has delivered reference material of Scots pine sapwood, Beech and Azobé.

Assessment of the test

For assessment of the test the x-value is calculated for the test material specimen using losses in mass and the following formula:

$$X = \frac{\text{Median value for the test material specimens}}{\text{Median value for reference timber specimens}}$$

Officially there is no validated correlation between the x-value determined according ENV 807 and the rating of durability classes according to EN 350-1. However since there is not an alternative yet this rating is being used in practice.

A new European standard (described in document CEN/TC 38/WG 23 N35) is being evaluated at this moment, in which there will be an official link between the x-values based on the test results of ENV 807 and the rating in durability classes. Both criteria (old and new) can be found in the table below

| Durability class | Criteria According EN 350-1 | Criteria CEN/TC 38/WG 23 N35 | Definition |
|------------------|-----------------------------|------------------------------|--------------------|
| 1 | $x = < 0,15$ | $x = < 0,10$ | Very durable |
| 2 | $0,15 < x \leq 0,30$ | $0,10 < x \leq 0,20$ | Durable |
| 3 | $0,30 < x \leq 0,60$ | $0,20 < x \leq 0,40$ | Moderately durable |
| 4 | $0,60 < x \leq 0,90$ | $0,40 < x \leq 0,80$ | Slightly durable |
| 5 | $x > 0,90$ | $x > 0,80$ | Not durable |