

LABORATORY TESTS OF WOOD IMPREGNATED WITH SODIUM SILICATE AGAINST THE ATTACK OF "LIMNORIA TRIPUNCTATA" MENZIES.

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SUMARIO

Amostras de alburno de Pinus sylvestris L. foram impregnadas com silicato de sódio e testadas contra o ataque de broca marinha Limnoria tripunctata Menzies em laboratório.

Os resultados não foram satisfatórios, e sugerem que o silicato de sódio foi lixiviado ou que a sílica é de menor ação quando introduzida na madeira pelo processo utilizado em comparação com a sílica naturalmente existente em algumas espécies de madeira.

1. INTRODUCTION

The aim of this work was to test the resistance of wood treated with sodium silicate against the attack of *Limnoria tripunctata* Menzies under laboratory conditions. In general reasonable durability against marine borers is expected when the natural silica content of timbers reaches 1%.

SERPA (1977/78), concluded by an experiment carried out in Recife Harbour, that wood preserved with sodium silicate showed some efficiency against the attack of *Bankia fimbriatula* Roch and Moll during the first six months of immersion.

According to BUB-BODMAR and TILGER (1922), sodium silicate was used to protect wood already in the past century. In this book RANSOME (1845) describes a method of treatment using evacuation of the air, treatment with water glass by pressure and dipping in an acid solution.

HOCHMANN (in NICHOLAS, 1973) reported that untreated samples of Southern pine were damaged within 3 — 6 months of immersion while panels impregnated with a high silica content were little damaged after two years of immersion in laboratory tests against marine borers.

Therefore we supposed that silica (Si O_2) fixed in wood in a crystallized form could be efficient against *Limnoria*.

The experiment was conducted in the BUNDESANSTALT FÜR MATERIAL-PRÜFUNG — BAM (Iufro — Group 5.1 "Biological Testing of Materials) Berlin-Dahlem, under the supervision of Dr. Helmut Kühne and with the technical help of Mr. E. von Seydlitz-Kurzbach and Dr. H. Geyer, during a three month's stay of the author.

2. MATERIAL AND METHODS

Five series of soft wood — pine sapwood (*Pinus sylvestris* L.) — with different treatments were tested.

Size of samples: 2,5 x 1,0 x 0,5 cm (in fibre direction)

2.1. Treatments

1st series: control (untreated)

2nd series: treated with sodium silicate (1% of SiO_2)

3rd series: treated with sodium silicate (1% of SiO_2) and afterwards with hydrochloric acid (5% solution)

4th series: treated with sodium silicate (10% of SiO_2)

5th series: treated with sodium silicate (10% of SiO_2) and afterwards with hydrochloric acid was applied in order to reduce the leaching of sodium silicate.

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2.2. Impregnation process, leaching and biological tests.

The samples were impregnated by a full cell process.

In the beginning a vacuum of 0,9 k Pa was applied for 20 minutes and after this period the preservative solution was added until the samples were immersed. Then the vacuum was removed and the samples were kept immersed for one hour at atmospheric pressure.

After impregnation of the samples they were weighed. Then they were dried in a container that was closed in the beginning and opened successively during the last two weeks of a period of one month.

After drying, series 3 and 5 (see 2.1) were treated with HCl (5% solution), by the same process of preservation.

The retention of silica was determined by the uptake of the solution of sodium silicate (see table 1)

Table 1: Retention of SiO₂ (kg/m³) according to treatment applied.

TREATMENTS	Retention of SiO ₂ kg/m ³
control	0
with sodium silicate (1% SiO ₂)	8
with sodium silicate (1% SiO ₂) + HCl (5% solution)	8
with sodium silicate (10% SiO ₂)	84
with sodium silicate (10% SiO ₂) + HCl (5% solution)	85

Subsequently the samples were leached according to DIN EN 84⁽¹⁾ for fourteen days. When this leaching was finished the wood specimens were stored for another 4 weeks in artificial seawater.

Afterwards the wood specimens were placed in Petri dishes (diameter 7 cm) with about 40 ml of artificial seawater each, and ten medium-sized (15 mm) *Limnoria tripunctata* Menzies specimens were added to each block.

During the first week the water in the dishes was changed three times (dead animals were substituted during the first week), and the number of animals on and in the wood was recorded. From the second week up to the fourth week the water was changed twice a week and from that time only once a week.

At the end of the test, i.e. after 12 weeks, the animals were removed from the wood blocks by means of a thin needle (turned out of their tunnels). The number of living animals were noted as well as the number of tunnels on the samples.

3. RESULTS AND CONCLUSIONS

According to the observations at the end of the test, none of the treatments prevented attack by *Limnoria tripunctata* Menzies.

Figure I represents the number of living animals during the period of 12 weeks.

The graphs are similar for all treatments, with a decrease in the number of animals in all blocks, including the control block. A slight decrease of *Limnoria* is normal in a laboratory test under artificial conditions. Why mortality was relatively high also in the control blocks is not obvious.

All blocks contained tunnels of the gribbles.

From these results it can be concluded that either both the sodium silicate treatment and the combination of sodium silicate plus hydrochloric acid, were leached out of the wood, or that the silica — in the way it was introduced into the wood — is less efficient than when the silica is incorporated into the tissues during the growth of the tree and makes the timber species naturally durable.

1) "Wood preservatives: accelerated aging of treated wood prior to biological testing; leaching procedure, 1976".

4. SUMMARY

Sapwood samples of *Pinus sylvestris* L. were impregnated with sodium silicate and tested against the attack of the marine borer *Limnoria tripunctata* Menzies in the laboratory.

The results were unsatisfactory; it seems as if the sodium silicate was leached or as if the silica is less active when introduced into wood by the process used here in comparison with the silica naturally existing in some species of wood.

5. LITERATURE

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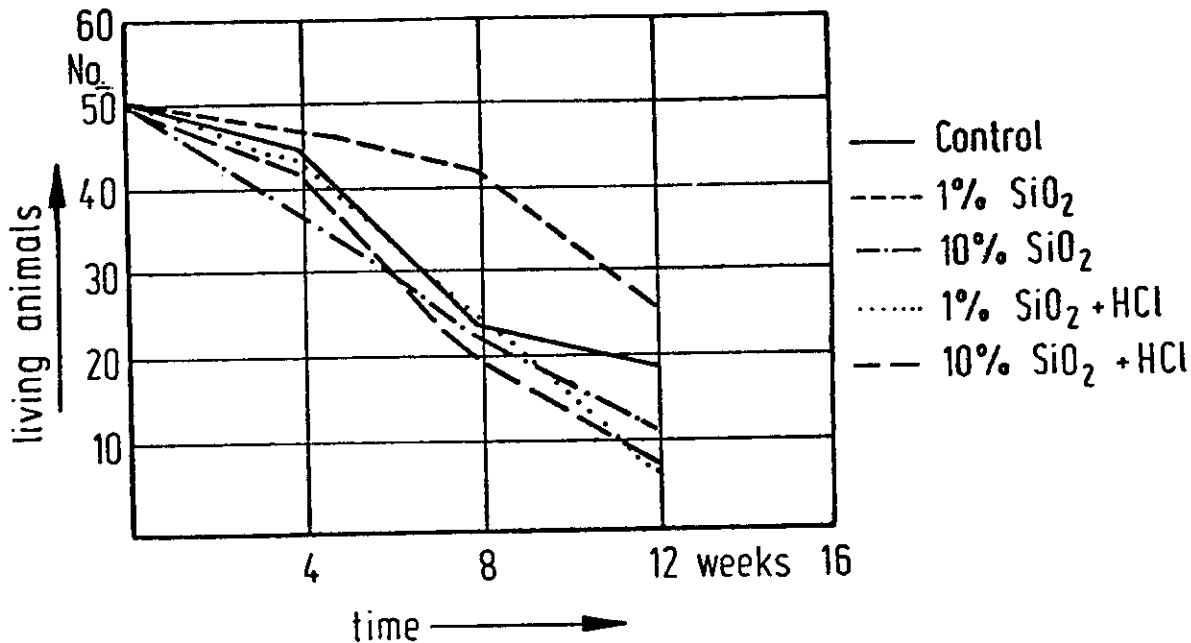


Fig. 1: Survival of *Limnoria tripunctata* Menzies on pine sapwood treated with sodium silicate.