

## The impact of a fire protection of wood on molds growth.

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**Abstract:** *The impact of a fire protection of wood on molds growth.* In the framework of development of the new preparations for wood, studies were made on fire retardant. One of the stages of the research was to determine the susceptibility of preparation on microfungi growth. Research was conducted in two variants of fungi due to the test. At first it was the *Ch. globosum* and the second a mixture of microfungi. After the process of leaching efficiency of preparations is decreasing. In the case of a microfungi mixture in all cases is decreasing fungistatic activity.

*Keywords:* fire retardants, guanidine carbonate, urea, microfungi

### INTRODUCTION

The existing fire-retardants for wood provide with increased resistance to infection even while maintaining his drawing and color. Wood protected with fire retardants, sometimes it is prone to developing of microfungi, which determines the composition of the preparations. The effectiveness of preparations containing salts of phosphorous can be greatly enhanced by the presence of some nitrogen-containing compounds (such as urea), the occurrence of such synergies will allow achieving higher resistance to fire at lower concentrations used preparations. May be observed strong synergy between boric acid and the phosphate guanylurea, results their different mechanisms of action and different temperature activation (Wang, Li, Winandy, 2004, Oberley, 1991). Another important ingredient used in the protection of wood against fire is guanidine phosphate. Less widespread but also effective ingredients are guanidine chloride and guanidine carbonate. The most commonly used fire retardants to wood are preparations based on inorganic salts such as diammonium phosphate, monoammonium phosphate, zinc chloride, ammonium sulphate, borax and boric acid, and all preparations contain the nitrogen, phosphorus or boron elements.

In the framework of development of the new preparations for wood, studies were made on fire retardant. One of the research stages was to determine the susceptibility of fire retardant on growth of microfungi. To test uses two flame retardant products which are the subject of the patent application, consisting of a mixture of boric acid, monoammonium phosphate, diammonium phosphate and respectively for the test version of urea (A1) or guanidine carbonate (A2).

### MATERIALS AND METHODS

Field work on flame retardant mixtures for wood was made. Used 10 samples for each series, made of pine softwood (*Pinus sylvestris* L.) with dimensions 40 × 40 × 5 mm (the first dimension along the fibers). Samples were impregnated with tested mixtures: 5, 10, 15 and 20%. After 14 days the air-conditioning in the room with a relative air humidity of 65 ± 5% and a temperature of 21 ± 1°C, mycological studies have been carried out. After sterilization in an autoclave samples laid on the surface of the sterile agar medium solidified with the addition of salt according to Czapek-Dox'a. The inoculation was done with water test spores in two variants of fungi due to the test. At first it was the *Chaetomium globosum* Kunze 6205 ATTC and the second a mixture of microfungi such as *Aspergillus niger* v. Thiegh. *Paecilomyces varioti* Bainier, *Penicillium cyclopium* Westing, *Penicillium funiculosum*

Thom, *Trichoderma viride* Persoon ex S.F. Gray aggr. Samples with agar in Petri dishes were placed in the thermostat where temperature has been maintained at the level of  $28 \pm 1^\circ\text{C}$  and relative air humidity of  $95 \pm 5\%$  for 3 weeks. To determine the fungistatic value uses a visual assessment (Ważny, 1977). Samples impregnated with preparations A1 and A2 have undergone accelerated leaching (samples with index W) process based on a modification of the standard PN-EN 84 (2000). Leaching process lasted 7 days with cyclic exchange of water every 12 hours. After a period of air conditioning, samples were tested using the test fungus *Ch. globosum* Kunze ATTC 6205 infected as above.

## RESULTS

On figures from 1 to 5 shows the dynamics of growth of fungal test samples. These results allow the evaluation of fungicidal properties adopted in variants and their concentrations of flame retardant formulations. Observing the growth speed of spores on not protected wood, it was found that after a week of driving mycological test, mycelium grew 80% of the surface of the samples. This means that the conditions for growth of microfungi were correct. In the case of a mixture of microfungi, it can be concluded that the formula A1 showed higher resistance to sprouting at all concentrations compared to preparation A2. Wood protected with A2 faster growth by microfungi what is most visible at a concentration of 10%, where the second day of the test showed a sharp growth of fungi on the surface resulting in the final phase of the test total overgrowth of samples. In the case of a preparation A1 fungal growth on the surface was slower (fig. 1, 2). The samples treated with a 15% solution of both preparations and not undergone leaching were not overgrowth by *Ch. globosum*. With the increase in the concentration of both preparations the degree of overgrowth increases mainly for wood protected with A2. However, after leaching process more efficient has proved to be an A1 preparation (fig.3, 4, 5).

In the research carried out, it was found that at lower values of absorbed preparations ranging from  $65\text{-}70 \text{ kg/m}^3$  (tab. 1), wood is not exposed to the test fungus. After the process of leaching efficiency of preparations is decreasing, however, the duration of the test period, longer than the standard adopted is 14 days, allows declaring with a rather large wood resistance to fungus by tested preparations. In the case of a mixture of microfungi shrinking resistance in all cases, however, protected wood with preparation A1 is more resistant.

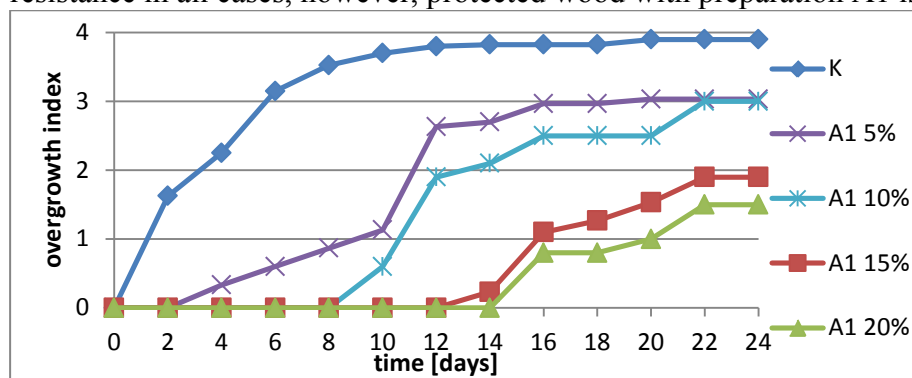


Fig. 1. The index of overgrowth samples protected with preparation A1. a mixture of the test fungi

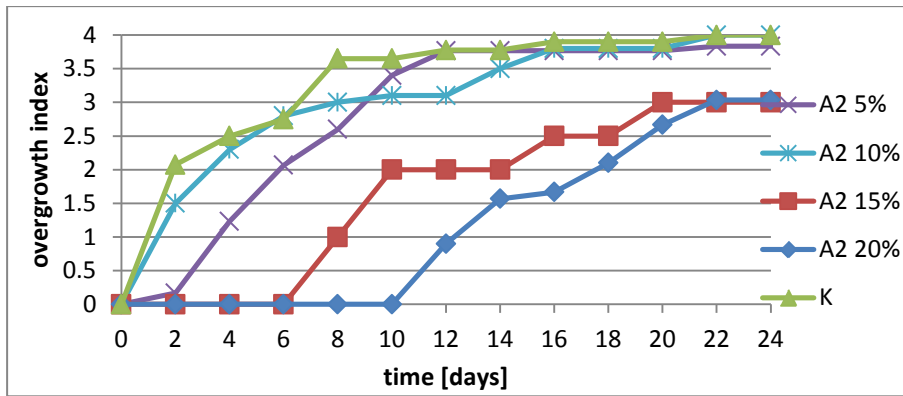


Fig. 2. The index of overgrowth samples protected with preparation A2 a mixture of the test fungi

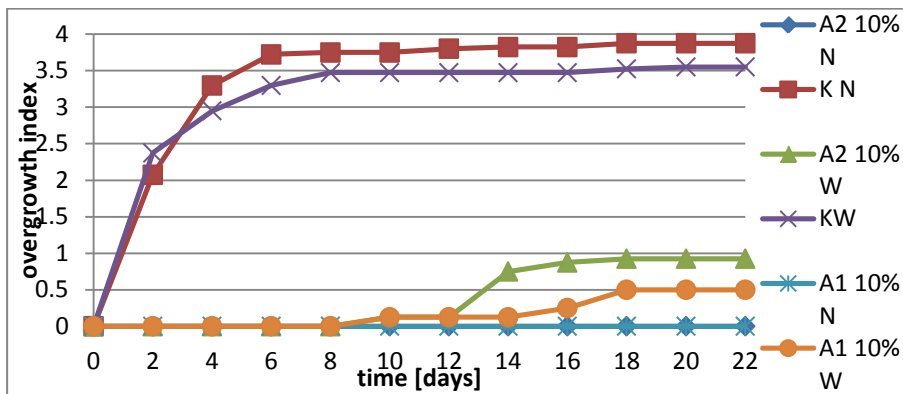


Fig. 3. Overgrowth index of *Ch. globosum* of samples containing 10% preparations.

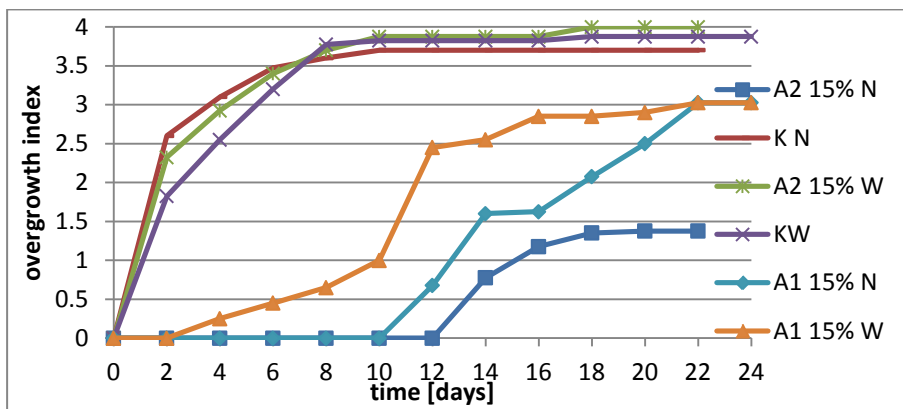


Fig. 4. Overgrowth index of *Ch. globosum* of samples containing 15% preparations.

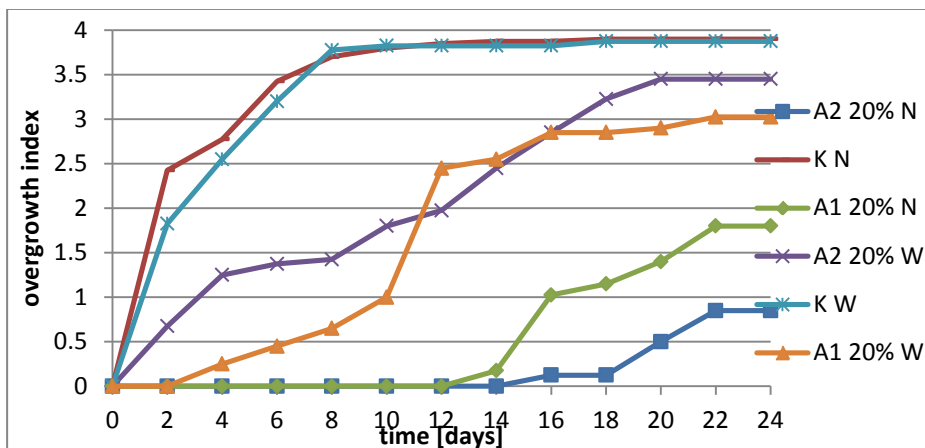


Fig. 5. Overgrowth index of *Ch. globosum* of samples containing 20% preparations.

preparation	concentration [%]	Absorption [kg/m <sup>3</sup> ]
A1	10	69,270
A2		64,816
A1	15	109,690
A2		100,092
A1	20	146,997
A2		128,976

**Table 1.** Summary of the results obtained with mean values of samples saturation of three preparations with concentrations of 10, 15 and 20%.

## CONCLUSIONS

Compounds containing in their composition of nitrogen can affect an accelerated growth of microfungi on the surface of the wood acting as medium. It is also dependent on the type of fungus, microfungi test conditions as well as the composition of and the degree of absorption of the preparation

Replace in the composition of the preparation of urea by guanidine carbonate has an adverse effect on the sprouting of wood by microfungi.

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**Streszczenie:** *Wpływ zabezpieczenia ogniochronnego na porastanie drewna przez grzyby pleśniowe.*

W ramach prac nad nowymi preparatami ochrony drewna wykonano badania rozwojowego środka solnego ukierunkowanego na działanie przeciwogniowe. Jednym z etapów badań nad wytypowanymi środkami było określenie podatności zabezpieczonego drewna na porastanie mikrogrzybami. Badania przeprowadzono w dwóch wariantach ze względu na rodzaj grzybów testowych. W pierwszym był to *Ch. globosum*, a w drugim mieszanina mikrogrzybów. Po procesie mycia skuteczność badanych preparatów maleje. W przypadku mieszaniny mikrogrzybów odporność na porastanie we wszystkich przypadkach maleje.

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