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GeneralComments Boric acid is a very unique active, because it acts as a fungicide and insecticide simultaneously. It is widely used for the protection of wood against fungi and wood boring insects all over the world, e.g. in the USA, Australia, Japan or New Zealand. In these countries it is valued because of its very low toxicity. Boric acid has a very low vapour pressure and is therefore the active of choice to protect wood inside buildings against damage caused by insects and fungi. Boric acid offers significant environmental and health advantages over other preservatives, with low mammalian toxicity and low environmental impact.

AltIdentityAndProp There are no approved active substances listed in PT 8 (wood preservatives) that fulfill the unique dual efficacy (insecticidal and fungicidal efficacy) as boric acid. Boric acid act simultaneously on fungi and insects and is, because of this dual and high efficacy, exceptional. There are no potential alternative active ingredients, which fulfil the properties of boric acid, namely: low environmental toxicity, low toxicity to mammals, low vapor pressure, unique efficacy spectrum, anti-corrosion properties, buffer properties, penetration properties. Propiconazole and Tebuconazole are fungicides with a different range of efficacy but are already classified as substances of substitution or exclusion. IPBC shows a different range of fungicidal efficacy and decomposes very fast on the treated wooden surface and shows limited permanent protection for some weeks only. Quaternary compounds and Copper show different range of efficacy and limited penetration behaviour in wood and are considered as persistent in the aquatic habitat. The insecticide Permethrin has a different mode of action compared to borates, including boric acid and disodium tetraborate. Permethrin acts as a contact insecticide, the two boron containing actives act as stomach insecticides, which are therefore more specific to wood boring insects, which pick up the substance while gnawing through the wood. Permethrin is very unstable in alkaline solutions. This property severely limits the possible usage of Permethrin in wood preservative formulations, because these are most often alkaline concentrates and solutions.

Non-chemical alternatives

The only commercially available non-chemical method to protect wood in situations where fungi and insects can thrive, is a thermal treatment.

Thermally Modified Timber (TMT) shows increased durability against fungal attack, increased dimensional stability, but also decreased tensile and bending strengths.

TMT is not as durable in ground contact as chemically treated wood. For these reasons, TMT is used for some niche applications in UC 3, but not for construction wood in gardens and poles or posts (UC 4). It cannot replace chemically treated wood in these situations.

Some TMT has increased resistance against beetles - but none is resistant against termites.

Thermal modification treatment is also not suitable for the application of protecting freshly cut wood against sapstain and mould fungi. Only a chemical treatment can protect moist wood against discolouration during the storage period.

TechFeasibility

Boron containing actives, such as boric acid and disodium tetraborate are unique in their penetration properties. In aqueous solution they can penetrate deep into the wood structure and confer resistance to biological attack, not only on the surface of the treated wood, but also in deeper regions. This so-called penetration process of the preservative / active is of importance for all relevant wood preservation segments and applications such as anti-sapstain treatment, dipping treatment (UC 1 and UC 2) as well as for vacuum-pressure treatment applications (UC 3 and UC 4).

Other biocides, e.g. the quaternary ammonium compounds, Triazoles and insecticides, e.g. Permethrin, tend to stick to the wood matrix at the surface and can fail to protect the wood in deeper regions.

Borates show strong metal corrosion inhibition, buffering actions and stabilization properties within technical formulations reducing the acute risk for workers and bystanders.

Because of their low vapour pressure - neither Boric acid nor Disodium tetraborate evaporate into the atmosphere - a respiratory uptake of these biocides from treated wood is impossible. Therefore, Boron based active ingredients are the preferred active ingredients within buildings under roof.

Boron-based active ingredients have flame retardant and metal corrosion-inhibiting properties which provide an additional value in treated wood. Reduction of metal-corrosion is important when metal fasteners are used in wood construction.

Non-chemical alternative

TMT (thermally modified timber) is not suitable for long lasting protection of wood in ground contact (UC 4) or sea water contact (UC 5), or for protection against termites, or for protection of heavy duty construction wood, or for protection of sleepers or for protection of moist wood during storage.

The usability of TMT, especially in load bearing constructions, is severely impacted by the negative effect of the thermal treatment. As a rule of thumb, the higher the durability against fungi, the more severe the mechanical properties are decreased.

The very high energy consumption needed to produce TMT is also seen critical due to the associated high CO₂ emissions.

EcoFeasibility

We expect that developing new wood preservatives with actives other than boric acid will eventually result in higher prices of the preservatives and therefore impact our business. In the end the consumers will have to pay higher prices for the protected wood.

HazAndRisks

We are not able to correctly judge the hazards and risks of alternative wood preservatives, since these depend on the other actives used and on the resulting retentions, which might be higher in newly developed wood preservatives.

Borates have low toxicity to mammals and the lowest environmental toxicity in comparison to all other approved active biocidal substances in PT8.

Borates are the active substances with the lowest long-term toxicity despite the reprotoxic effects. The potential health risk of humans exposed to known wood preservatives containing several active substances is therefore in no case triggered by the boron compound but by the other active substances of the product. This means that non-prolongation of the approval of boron compounds would probably lead to new products with higher health risks because the boron compound must be replaced in most cases by active substances with higher toxicity. Therefore, non-prolongation of the approval of boron compounds would be in contrast to a key element of the BPR i.e. to ensure a high level of protection for humans and the environment and an adequate chemical diversity of the active substances to minimize the occurrence of resistances in the target organisms.

Boron is a ubiquitous element in nature and is one of seven elements which are essential to plant growth and classified as 'micro-nutrients'. No significant impact to the environment is expected from this class of substances if leachates of treated wood are considered about the complete life-time cycle of treated wood.

Availability

Availability of other approved actives depends on the supply to the wood preservation manufacturer.

Non-chemical alternative

Most companies are not set up to thermally treat wood. Typical equipment for wood preservation consists of dipping tanks or large vacuum-pressure vessels. These are

not suited for producing TMT.

AltSuitAvailConcl

Although there are no exactly matching alternatives on the market, there are other PT 8 actives that are used to design wood preservatives. Alternative actives include IPBC, quaternary ammonium compounds, propiconazole and permethrin.

None of these alternatives matches the spectrum of activity and all of them have severe technical limitations in comparison to Borates.

To achieve protection of wood against fungi and insects, at least two of these biocides need to be combined, one fungicide and one insecticide.

None of them will fulfil additional technical requirements, e.g. penetration, corrosion inhibition, buffering actions and stabilization properties.

Boron has a unique mode of action and in solution forms complexes with various substances, resulting in an inhibition of various metabolic functions of microorganisms and insects. This type of mode of action is unique amongst the registered active biocidal substances in PT 8. No formation of resistance is possible due to this special mode of action. Because of the mode of action, boron containing actives have a broad efficacy spectrum against various basidiomycetes belonging to the group of the brown rot and white rot fungi. Boric acid is therefore used as a co-biocide against copper-tolerant fungi (brown rot) in UC (Use classes) 3 and UC 4 conditions

OtherComments

We do not understand why boric acid, a wood preservative that is widely used in other countries and known for its low toxicity, poses a problem to the European population. We hope that boric acid can also in future be used for the design of wood preservatives, especially because all other alternative actives seem to be more harmful to the people and to the environment.

References

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Lloyd 1998 Borates and their biological applications. IRG/WP 98-30178
Peylo and Willeitner 2001 Bewertung von Boraten als Holzschutzmittel. Holz als Roh- und Werkstoff 58: 476-482

SubstanceName
ECNumber
CASNumber
CompetentAuthority
CommentRegarding
IntendedUse

Boric acid
233-139-2
10043-35-3
The Netherlands
8
Boric acid acts a fungicide and insecticide; and is used for

industrial, professional, and non-professional users as a preventive and curative wood preservative for wood and construction timbers in Use Classes 1, 2, 3 and 4a according to CEN 335-1 standard. Products are applied by vacuum pressure, dipping, injection, spraying/deluge, or brushing