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RETURN TO FLAME RETARDANTS OF WOOD

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ABSTRACT

Modification of combustible materials, against easy ignition and combustion is an effort of many researchers. Modification of traditional materials, wood and textiles from natural mate-does it for their natural character quite complicated. Despite this complexity, it is one of the roads within the fire prevention.

KEYWORDS:
wood; fire retardant of wood;

INTRODUCTION

All flammable materials are trying to adapt so that this negative feature - burning, burning behaviour - it is the most suppressed. Such treatment is usually economically challenging. Must meet a number of conditions that can be summed up in one sentence - not negatively affect other technical, sanitary, or aesthetic characteristics [9]. If we talk about the economic performance of each security measure, including fire is economically challenging. Protective measures must be reviewed and certified and have a certain reliability. This includes the verification of flame retardants and their effects, aging stability, and others properties. All of these features, are testing methods based on the results of classified material in each class of reaction to fire, or pursuing other properties retardant treatments. General requirements for flame are listed in chapter 1 of this paper. Verification of these properties (especially retarding capacity) is quite difficult when drafting new flame, their development, formulation, technology for their preparation, and their technology applications. In placing these processes is necessary to find other means of evaluation that are simple, cost-efficient, but reliable and give informative value of the results obtained.

1. WOOD RETARDANTS
1.1 The principles of wood retardants

At retardation treatment, respectively flame retardant, the effects of the burning process, particularly by the ability to take the heat, the ability of degeneration or to stage their own burning.
Methods of improving the properties in terms of fire protection can be specified as follows [2, 3, 7]:

- Stabilize the decomposition combustion products,
- Fireproof or hardly flammable insulating coatings,
- By additives to the application of heat to melt and form a non-combustible coating,
- By additives having antioxidant effect, its decomposition occurs inert coating flame quenching,
- Support for establishment of a carbon structure, carbon residue, which prevents the spread of burning material
- in depth,
- By additives which interrupt the mechanism of chain reactions by binding free radicals.

Flame retardant (flame retardant) usually has a catalyst function that can modify the rate necessary to achieve chemical equilibrium, but cannot change the intensity of the heat flow, the lack of, or excess oxygen resulting changes in conditions and expressions of burning. But may alter or affect the process of making fuel and its ignitability. In the later stages of the combustion process, particularly in the high heat flow, options are already very limited fire retardant. For effective fire retardant are detrimental reactions that take place at various stages of the start of combustion, as initiation (contact of wood - heat), visible (released flammable gases - oxygen) or termination (resulting solid residues - oxygen) [1, 6, 8].

Retardant is a rather complicated process and is mainly based on the use of mutually supplying and influence retarding systems. A separate but related problem is the increased toxicity of combustion gases retarded materials.

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Surface treatment of the fiber or textile retardant system applied by conventional impregnation process - dipping, spraying, and the like. The favourable fire retardant is in this way achieved in particular textile materials of natural origin based on cellulose. The most effective way retardation in the mass is the addition of a reactive retarder directly to the polymerization or polycondensation process.

Flame retardants can be divided into four groups:

- The first group consists of flame, which release non-combustible gases in the temperature range in which are formed, flammable gases, such as decomposition of wood. This causes the dilution of combustible gases, reduces their concentration and laments the ignition. The most common compounds used to protect wood and cellulose materials against the effects of fire are various inorganic salts. Their advantage is a good solubility in water and so the possibility of applying various impregnation process [3].
- The second group consists of flame that accumulate heat sources and thus the source of "cool down". These retardants currently have little application usage, as quickly subject to aging and decreasing their effectiveness.
- The third group consists of Intumescent-foaming flame retardants. Their efficiency is highest, this replicative widest. Their effectiveness is actually a two-stage, physics-non chemical.
- The fourth type flame retardants are mechanical type, such as films and various coverings of non-combustible materials. The application of such flame wood while active, but not without risks.

Flame retardants play an important role in the application is a similar wood, but other materials and devices, such as electrical equipment and appliances, cable wiring, floor coverings, textiles (clothing), wall and ceiling coverings, plastics, furniture and others.

From modern flame requires complex retardation, retardation is not only the process of burning material, but also, for example. Treatment fumes arising from the burning material. Ideal retarder reduces the amount of waste products and should also cover their potential toxicity. [11].

1.2 Application options of retardants for wood

Method of application determines the type itself retarder such as intumescent flame can be applied as paint. Flame of the first group, which are based on water-soluble mineral salt solution can be applied by painting, soaking or impregnating. The results of the experiment, which compared the efficacy of the retarder according to the application are shown in Fig. 1

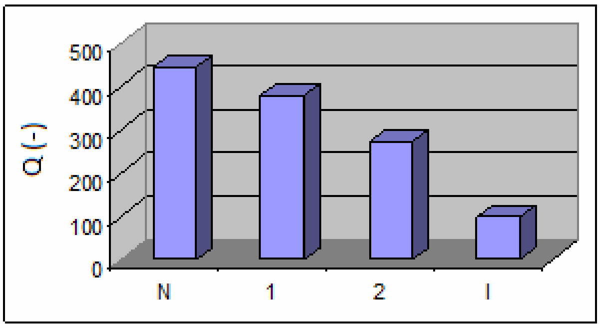

Fig. 1 The effectiveness of the barrier, depending on the application
(N- untreated material 1 - single coat, 2 - two-sided coating, I – impregnation),
(Q - value for inclusion in class according to STN 73 0862).

It is the picture can be seen that the effect of the retarder technology application. It is very important and influences the value of Q in the test of flammability (the now unused method). This experiment was evaluated inferior retarder, which was produced from sloughing of products for the production of fertilizers. Classifications treated material to then-evaluation "of flammability degree" varies greatly according to adjustment. If untreated material falling into the degree of flammability C2, as well as material prepared sided coating, two-coat material classified up to the flammability C1. The impregnated is included in B of flammability, of course, using the same retarder [7].

2. EVALUATION FLAME RETARDANTS

2.1 Evaluation by the EU - Reaction to fire

The aim of standardization institutions of EU is determined harmonized procedure for the classification of the reaction to fire performance of construction applicable to all EU countries [12]. This classification is based on test

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procedures set out in the standards and procedures apply to these two categories of products, construction products except for floor coverings (see Tab. 1).

2.2 Evaluation retardants non-standard method

Non-standard laboratory method has the aim enormous burden retarder with minimal influence of substrate material. Therefore, as a woody plant served thin and, where appropriate, in terms of the final use of the edge exposure of the sample to the flame. Beech veneer with a thickness of 1 mm. For these veneers are applied on both sides coated by flame prescribed for the retarder.

Table 1 Classes of reaction to fire performance of construction products except flooring

Class	Testing methods	Classification criteria	Additional classification
A1	STN EN ISO 1182 (1)	$\Delta T \leq 30$ °C	-
		$\Delta m \leq 50$ %	
		$t_f = 0$	
	STN ENI SO 1716	$PSC \leq 2{,}0\ MJ.kg^{-1}$ (1)	-
		$PSC \leq 2{,}0\ MJ.kg-^{1}$ (2)(2a)	
		$PSC \leq 2{,}0\ MJ.kg^{-1}$ (3)	
		$PSC \leq 2{,}0\ MJ.kg^{-1}$ (4)	
A2	STN EN ISO 1182 (1)	$\Delta T \leq 50$ °C	-
		$\Delta m \leq 50$ %	
		$t_f = 20$	
	STN EN ISO 1716	$PSC \leq 3{,}0\ MJ.kg^{-1}$ (1)	-
		$PSC \leq 4{,}0\ MJ.kg-^{1}$ (2)	
		$PSC \leq 4{,}0\ MJ.kg^{-1}$ (3)	
		$PSC \leq 3{,}0\ MJ.kg^{-1}$ (4)	
	STN EN 13823	$FIGRA \leq 120\ W.s^{-1}$	smoke (s) burning drops (d)
		LFS	
		$THR_{600s} \leq 7{,}5$ MJ	
B	STN EN 13823	$FIGRA \leq 120\ W.s^{-1}$	smoke (s) burning drops (d)
		LFS	
		$THR_{600s} \leq 7{,}5$ MJ	
	STN EN ISO 11925-2 (5) exposition = 30	$Fs \leq 150$ mm 60 s	
C	STN EN 13823	$FIGRA \leq 250\ W.s^{-1}$	smoke (s) burning drops (d)
		LFS	
		$THR_{600s} \leq 15$ MJ	
	STN EN ISO 11925-2 (5) exposition = 30	$Fs \leq 150$ mm 60 s	
D	STN EN 13823	$FIGRA \leq 750\ W.s^{-1}$	smoke (s) burning drops (d)
	STN EN ISO 11925-2 (5) exposition = 30	$Fs \leq 150$ mm 60 s	
E	STN EN ISO 11925-2 (5) exposition = 15 s	$Fs \leq 150$ mm 20 s	burning drops (d)
F	without definition		

Notes on Table. 1

For homogeneous products and substantial components of non-homogeneous products. (2) For each external non-significant element of non-homogeneous products. (2) Alternatively, each element having an outer insignificant PCS ≤2,0 MJ / m2, provided that the product complies with the following standards EN 13823: FIGRA≤ 20W / s and

LFS <edge of the test sample and THR600s ≤ 4,0 MJ and s1 and d0. (3) For any internal non-significant element of non-homogeneous products. (4) for the whole product. (5) In the last phase of development of the test method introduced changes in the measurement of smoke, the effects of which require further investigation. This may lead to changes in thresholds or parameters for the detection of smoke generation. s1 = SMOGRA≤ 30 m2 / s2 and TSP600s ≤50 m2 / s2 = SMOGRA≤ 180 m2 / s2 and TSP600s ≤200 m2. s3= S1 or s2 does not. (6) d0 = no flaming droplets / particles when tested according to EN 13823 for 600s, d1 = no flaming droplets / particles persisting longer than 10 s in EN 13823 within 600 s, d2 = d0 or d1 does not. (7) Pass = no ignition of the paper (no classification). Found = Ignition paper (d2 classification) (8) In the conditions of exposure of the surface of the sample to the flame, and, where appropriate, in terms of the final use of the edge exposure of the sample to the flame. (9) The length of the test = 30 min. (10) Critical flux is designed as a radiant heat flux at which the flame extinguishes or the flow of radiant heat after 30 minutes of testing, whichever are the lower (i.e., the flow corresponding to the maximum flame spread) s1 = Smoke ≤ 750% min. (11) s2 = s1 does not. (12) In terms of exposure to the sample surface flame.

After drying and "aging of" retarder test was performed. The source was a source of flame, gas-new burner propane, a relatively strong intensity. Sample (see Fig.2) with dimensions of 100x100 mm, is received in a device horizontally. Continuously measured weight loss during the test. Photo equipment not standardized test is in Fig. 3. Material: spruce was supplied by other species - beech, since this had more homogeneous properties that affect the overall outcome of the experiment. This allowed more sensitive evaluation of the samples tested and the manufacturer's recommended better representation of the retarder retarding the components and their concentrations [4, 5, 10].

Fig. 2 Sample for nonstandard experiment

Fig. 3. Testing equipment

Evaluation is apparent from the presentation of the results obtained. As mentioned above the main assessment criterion is the continuous measurement of weight loss. If within the first minute retarder is weight loss only up to 5%, we think of it as a good flame. Weight loss of 5% means that the 'spend' approach flame and burn the substrate to be treated retardant. The second criterion is the total weight loss within three minutes, which was the end of the experiment. If the treated material - a thin veneer - withstand strong intensity of the gas flame the specified time flame me requesting effectiveness.

2.3 Evaluation of fire retardants with non-standard method

The smallest "outsized" test the box test. It consists of two simultaneous ignition control boxes - unadjusted and adjusted retardant. Naturally, the boxes are made of the same material, in this case from spruce wood, thickness 20 mm. The source of ignition is 500 g of moisture 8% and 0.4 l of diesel and 0.1 l of petrol. Both samples (boxes) are ignited simultaneously. Evaluation criterion is a visual recording or video recording.

3. RESULTS OF EXPERIMENT

3.1 Results retardants non-standard method

Experiment results are documented on the charts, which continuing the recorded weight loss of five test samples in each experiment. Barriers were tested anonymously, they were assigned numbers (samples) and the evaluator did not know their detailed composition. Of course, it was necessary to verify the methodology. As has been tried and tested 24-retardant modifications it can be stated that the method has been verified.

First, we present curves for courses failed retarder, which is failed the monitored criteria. As shown in Fig. 4 see weight loss exceeded the allowable limit rather than a percentage of 60 - the second. Four samples withstand up to about 30 seconds, while weight loss was greater than 15%. The best weight loss in this case, do not talk about quality but that the sample has burned and fell off the retaining under-steering. Absence during the fifth sample says that the sample fell within 10 seconds of the experiment. The flame was ineffective.

Fig.5 is a course "successful" retarder marked-cycle of Fig. 2. This figure represents the evaluation parameter to 60 s. and Fig. 5 is evaluating a parameter of the same 300 with the retarder. You clearly see the percentage of retarder recorded consistently in all five samples tested.

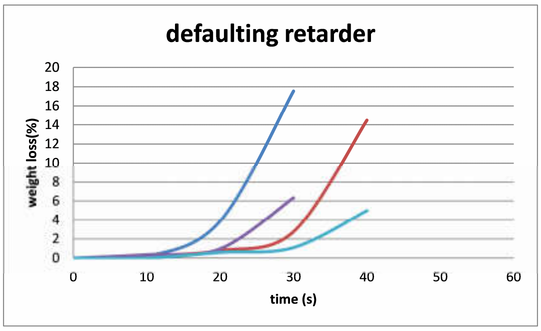

Fig. 4 Progress curves continuously measured weight loss in an unsuccessful ineffective flame retardants wood

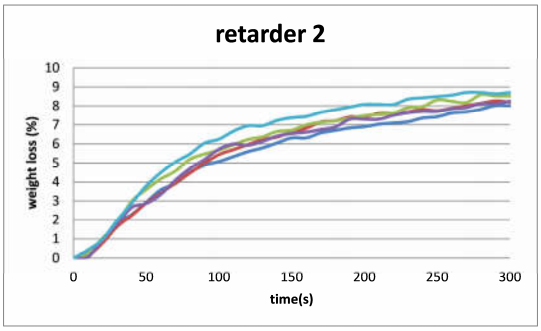

Fig. 5 Progress curves continuously measured weight loss after successful effective flame retardants timber 60 with 2 test.

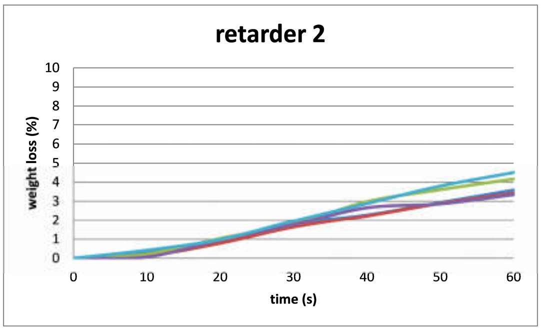

Fig. 6 Progress curves continuously measured weight loss after successful effective flame retardants timber 300 with 2 test.

3.2 Results retardants outsized standardized method

The results of this test were recorded on a video recording from which three sequences present only in Fig. 7. This is just one retarder that has been successful in a number of tests and were prepared there from more for this test. For each sequence is exact time of the initiation of the experiment.

Fig. 7 Sequences of video of large-test standard method

CONCLUSION

Application of quality retarder ensures that fire when exposed to the source either does not occur at all or will be significantly slower spread. Not endanger large area and allow time for evacuation and intervention. In doing so, the application of the retarder is relatively simple, does not require frequent and relatively expensive revisions and such in parts of roof construction is easily controllable and partially recoverable. What is important is the choice of the retarder and its appropriate application in a given environment.

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