SYNERGIC EFFECT OF FIRE RETARDANTS AND THEIR ANALOGUES FOR TEXTILE MATERIALS

[1]N.Sh. Muzaffarova, [2]F.N. Nurkulov, [3] N. B. Toshtemirova

[1]Termiz Branch of Tashkent Medical Academy, Head of the Department of Medical and Biological Chemistry, PhD.

[2]Tashkent Scientific Research Institute of Chemical Technology, professor

[3]Termiz Branch of Tashkent Medical Academy, 2nd year student of treatment-2 faculty

https://doi.org/10.5281/zenodo.10630047

Abstract. *This work compares the thermal stability of natural textile materials, flame retardants and natural textile materials modified with flame retardants, and also studies the mechanisms of thermal stability and synergistic effect.*

Keywords: *flame retardant, oligomer, textile materials, synergistic effect.*

Introdaction. Today, it is important to protect people from various negative factors, and special textile materials with high protective properties have a special place here. Special clothing is widely used for firefighters, oil and gas industry, welders, metallurgists and workers of various manufacturing enterprises [1]. It is very important to know the mechanism of action of refractory materials.

These new oligomeric flame retardants are obtained from local raw materials and differ from other types of flame retardants due to the simplicity of the technology of modification with textile materials, which is economically effective [2, 3, 4].

Materials and methods: flame retardants based on brands with the initial chemical composition FM, FPM, PA, FP and FMM and oligomeric flame retardants obtained by modifying natural textile materials with the influence of temperature (Differential-thermogravimetric method. DTG-60/ (Shimadzu)) the thermooxidation destruction kinetics was studied using laboratory equipment.

During this laboratory experiment, thermal stability of natural textile materials, flame retardants and natural textile materials modified with flame retardants were studied.

The use of a mixture of several antipyrenes at once, or antipyrenes that contain compounds containing metals, nitrogen, phosphorus, as well as composites based on them, is the most effective way to reduce the flammability of a polymer material.

Antipyrenes with this synergistic effect contain chemical compositions and active additives that enhance their effects in preventing flare-ups. Various nanoscale or related additives have been extensively studied in many literature to increase the resistance of polymers to heat and fire, and oligomers containing zinc, magnesium, nitrogen and phosphorus, which have synergistic effects in the antipyrenes we offer, have found evidence from studies of their competitiveness with analogs.

Increased fire resistance under the action of oligomeric antipyrenes, which contained zinc, magnesium, nitrogen and phosphorus, has been studied and analyzed using various methods.

For example, due to the fact that nitrogen and phosphorus in antipyrene act as catalysts for metals in their composition at high temperatures, oxygen exposure is accelerated, and barriers appear that restrict oxygen access to the flammable environment.

Metal oxide acts as a catalyst in antipyrene, contributing to the formation of carbon residues and, as a result, slows down the combustion process, and at the expense of hydroxyl groups, water, as a result of the formation of vapors, prolongs the flame temperature to exceed 100os, as a result of which the flame is eliminated.

Synergistic-acting additives make antipyrenes the most effective in all. The proposed oligomeric antipyrenes that contain magnesium, zinc, nitrogen, and phosphorus increases their synergistic effect in natural textile materials have been studied by TGA thermal decomposition analysis of antipyrene treated as well as untreated samples as a result of test experiments. Antipyrenes consisting of nitrogen and phosphorus have been found to be thermally stable as a result of their synergistic effect on antipyrenes that relatively contain metals, nitrogen, and phosphorus.

In sheep, the formation of water vapors at the expense of hydroxide guruches under the influence of temperature of oligomeric antipyrenes of the FPM and FM brand prevents the increase in temperature and leads to a slowdown in ignition.

In contrast, low levels of metal guruches in antipyrene act as catalysts in nitrogen and phosphorus mixtures by accelerating the reaction of their interaction with oxygen, so that oxygen access to the flame environment slows down and reduces the continued flame caused by nitrogen and phosphorus oxides and the formation of water vapor.

In addition, the synergistic effect can be theoretically justified by the fact that metal guruches form Cox layers based on salts stable to high temperatures with carbon residues and phosphorus, while increasing the temperature stability of textile materials.

Special attention from the analysis of the results of the experimental test is that in the modification of cellulose-based natural textile materials with phosphorus, nitrogen and metal-stored antipyrenes, it was found that a modification process was carried out, partly due to the activity of hydroxyl groups with phosphorus and nitrogen bonds.

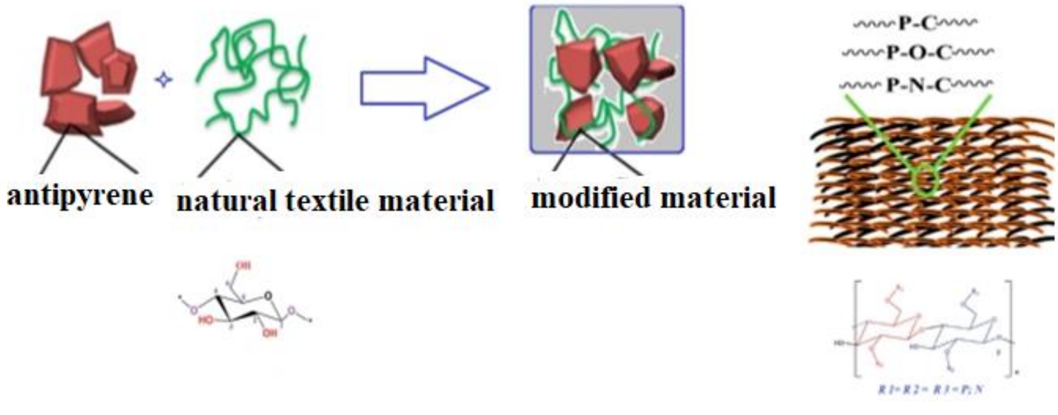
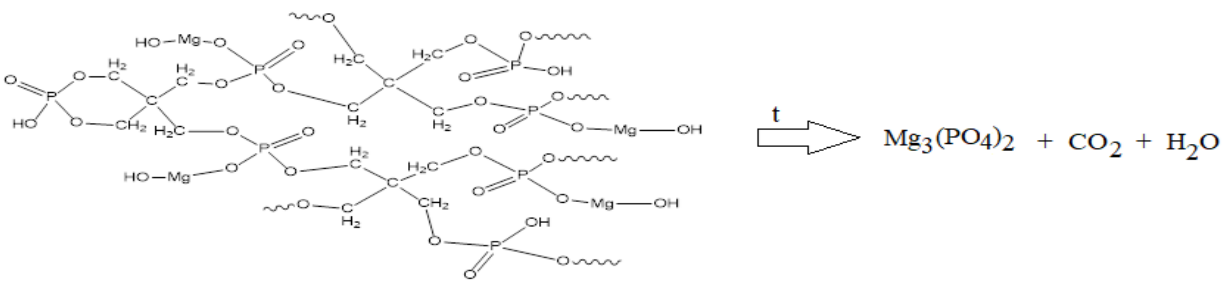


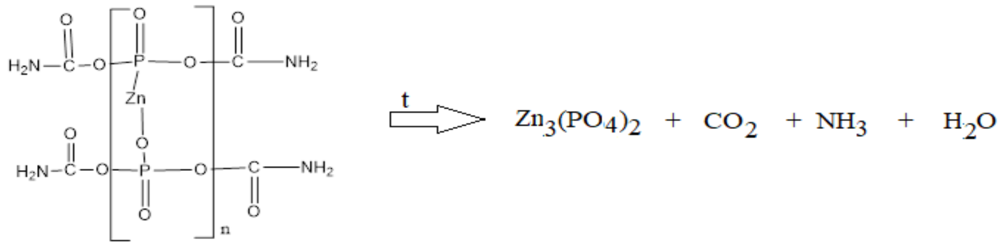
Figure 1. A common mechanism for the modification of natural textile materials with antipyrenes.

In the sheep reaction, variations of FPM and FM brand antipyrenes produced by the high temperature produced by flame exposure are cited.

ФПМ



ФМ



The proposed FM, FPM, Pa, FP, and FMM brand antipyrene synergistic effect results in a relatively increased temperature-induced Coke formation.

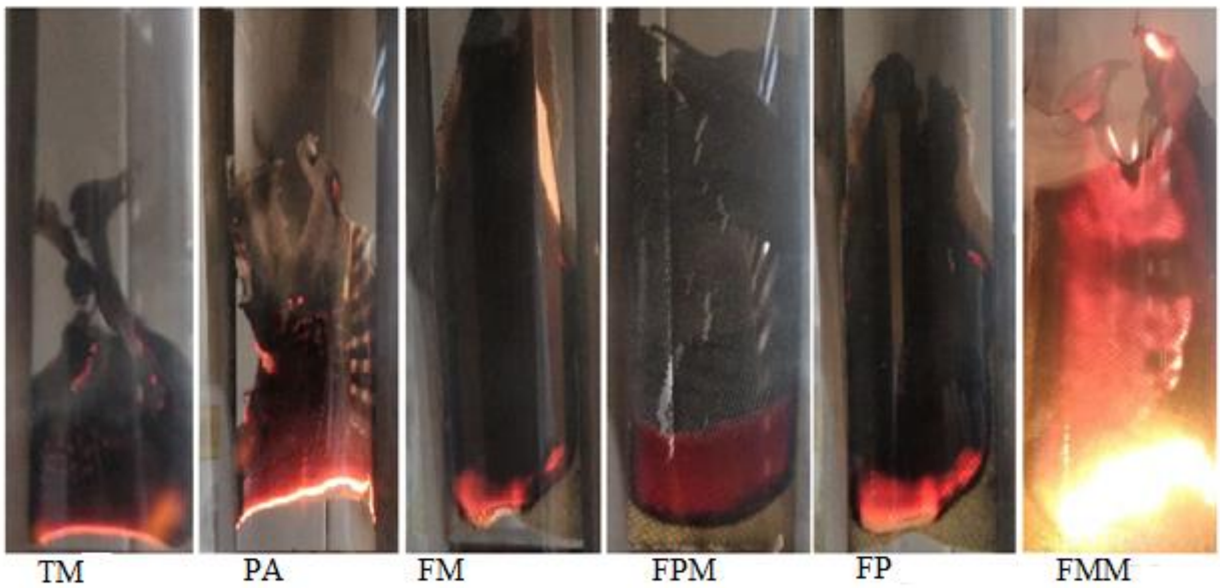


Figure 2. Coking of proposed FM, FPM, Pa, FP and FMM branded antipyrenes under the influence of temperature.

The proposed antipyrenes can also be explained by the fact that antipyrenes with synergistic effects are highly effective according to the results of TGA analysis, increasing its thermal stability. In TGA analysis, thermal decomposition of natural textile materials was found to have lost 50% mass up to a temperature of 300os.

Accordingly, the 50% mass loss of materials treated with a 15% solution of FM, FPM, Pa, FP and FMM brand antipyrenes was broken down in the 300-400^0 C temperature range. The highest result was found to be materials treated with FM and FPM brand antipyrenes with a mass loss of 50% at temperatures of 380-400^{0}C.

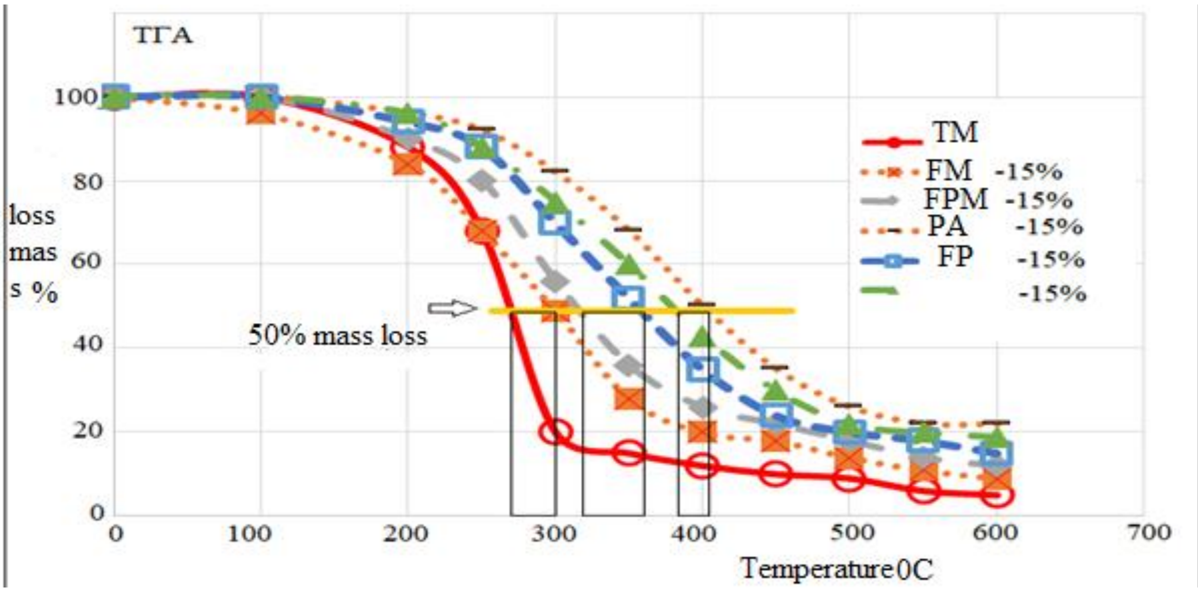


Figure 3. Tga analysis of textile materials (TMS) treated and untreated with a 15% solution of FM, FPM, Pa, FP and FMM brand antipyrenes.

Composites that form natural textile materials with antipyrenes contain compounds that contain carbon, oxygen, and phosphorus, and as a result of uniform distribution of these compounds on the surface of the fabric, fireproofness and other properties are improved.

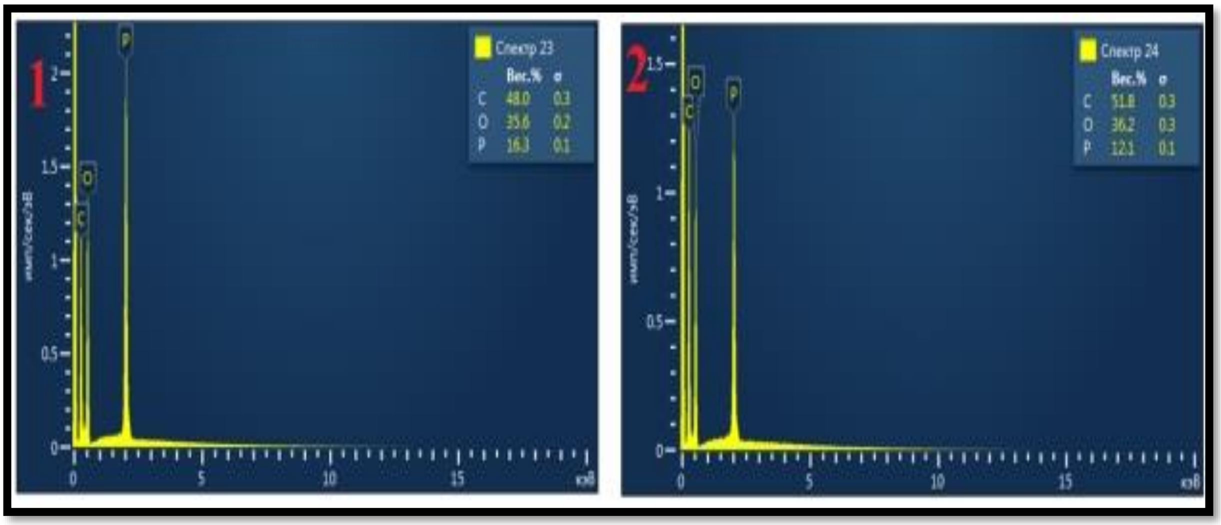


Figure 3.22. Element analysis of FP-branded composites

The physical and mechanical properties of flame retardant composites, which have formed natural textile materials with the proposed FM, FPM, Pa and FP mark antipyrene modifiers, as well as competition tolerance with analogs, as well as treatment with an antipyrene solution consisting of environmentally friendly compositions, make them more economical.

Conclusion. The synergistic efficacy of the so-called antipyrenes was analyzed by TGA analysis to investigate whether they could be applied to high levels of fire as stable antipyrenes in textile materials.

REFERENCES

1. Таусарова Б.Р., Абдрахменова Г.С., Биримжанова З.С. Применнеие полиэтиленполиамина и гидрофосфат калия для придания огнезащитных свойств

целлюлозным текстильным материалам // Химический журнал Казахстана.-2016.-№2.-С.201-207.

2. Музаффарова Н.Ш., Нурқулов Ф.Н., Жалилов А.Т. Фосфат кислота, пентаэритрит ва магний гидроксид асосида пахта матолари учун антипирен // Ўзбекистон композицион материаллар. Илмий-техникавий ва амалий журнали. №3. 2022 й. 95-98 б.
3. Музаффарова Н.Ш., Нурқулов Ф.Н., Жалилов А.Т. Оловбардош тўқимачилик материаллари учун фосфор, азот сақлаган антипиренлар // НамДУ илмий ахборотномаси - Научный вестник НамГУ 2022 й. 10-сон. 152-156 б.
4. Sh M. N., Nurqulov F. N. Study of oligomer-antipyrine synthesis andproperties of nitrogen, phosphorus and zinc storage //International Scientific Journal Theoretical & Applied Science. – 2022. – С. 489-492.