Description for the general Public

Fabrics made of natural fibers are readily used because of their many features, such as soft and pleasant grip, breathability, good absorbency, easy dyeing and color fastness, as well as the possibility of mechanical and chemical washing. Natural fibers, which are renewable and biodegradable raw materials, also have many beneficial features, such as availability, and thus low price, reduced health risks during processing and use, low density and relatively good mechanical strength. However, there are a number of properties such as flammability, water absorption, biodegradation by microorganisms or compatibility with plastics that limit their widespread use in many areas.

Improving fire safety is extremely important for human health and life, as well as huge material losses caused by fires. A significant proportion of fires explode as a result of ignition of textiles that equip buildings, which is why increasingly stringent standards are forcing manufacturers to seek new solutions to increase ignition resistance and thus safety.

A large number of fireproof compounds with various structures and modes of operation are available on the market. Halogen compounds are still the largest group among them, but the world is turning away from this kind of solutions and looking for alternative methods to reduce flammability. This is due to the strong corrosive and toxic effects of these compounds, as well as the threat they pose to both the environment and human health. In addition, most of the available flame retardant compounds do not have the ability to permanently bind to the ground. Therefore, obtaining new non-halogen compounds with flame retardant activity is the subject of research in many scientific centers around the world and is part of the mainstream ecological solutions.

The research planned as part of the implementation of this project is aimed at applying new organosilicon compounds with embedded phosphoro-amine moieties (being an alternative to halogen flame retardants) and determining the impact of their structure on the fire retardant effect on cotton fabrics. An additional goal of this project is to examine the impact of the flame retardant connection method (in a one or two-stage process) on the effectiveness of its operation as well as the durability of the modification performed. To this end, synthesis of new phosphate-amine derivatives containing unsaturated moieties will be made, which in the thiol-ene addition reaction will be combined with mercapto derivatives of silanes, polysiloxanes and silsesquioxanes.

Derivatives thus produced will be used to modify fabrics in a one-step process. In the two-stage process, however, the fabric will first be modified with mercaptosilane and then, through the addition of thiol-ene, unsaturated phosphate-amine derivatives will be attached. The obtained compounds will be examined spectroscopically. A surface analysis of modified fabrics will also be performed. The impact of reaction conditions, modification methods and structure of the used organosilicon derivatives on the flame retardant effect will be verified based on the results of flammability and thermal stability tests of the obtained samples.