

INFLUENCE OF ANTIOXIDANTS ON THERMAL PROPERTIES OF FIBROINS OF NATURAL POLYMER

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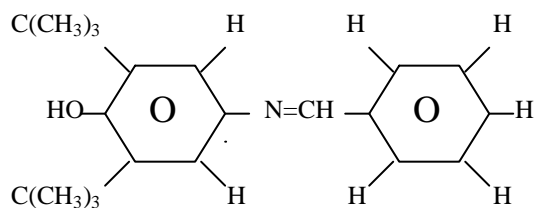
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Thermophysical properties of fibroins of natural polymer are investigated. It is established, that at injecting of antioxidants N- (3,5-di-tert-butyl-4-hydroxyphenil) salicylaldimin into the structure of fibroins, by additional fertilizing of caterpillars by last-named, amorphous sites increase and thus the stability of silk to external influences raises, i.e. the stabilization occurs due to sewing action of antioxidant.

Correlations between crystal and amorphous phases of fibroin of natural polymer, a degree of thermostability, temperatures of fusion, vitrifying and thermal destruction, we investigated by means of derivatographical analysis.

Derivatogrammes were taken from derivatographe Q 1000 of firms ÌÏ. Hinge plate of samples was 50-70 mg, mg was 100, sensitivity channel DTA was 1/5, DTG was 1/10, inert substance (oxide of aluminum) was fastened at 1000°C within 10 hours.

The natural polymer silk fibroin was used as object of research, received from caterpillars, both fed up by antioxidant, and without feeding. Since the IV age tested groups were fed up by antioxidant N- (3,5-di-tert-butyl-4-hydroxyphenil) salicylaldimin, with the formula:



In a fig. 1 fibroin dervetogramme of control and tested samples is given. According to the figure, character of curves DTA, TG, DTG for tested and control samples are similar.

From curves of losses of weight TG we see, that in the region 70-100 °C there is a loss of weight about 20-30 % (on DTG effects at 90-100 °C), that is caused by secretion of adsorptive moisture [1,2].

Endothermic effect on curve DTG (insert) in the region of 150-165 °C is connected with melting of a crystal part of fibroin [3]. The areas of endothermic effects on curves DTG at 330-360 °C, caused by destruction of fibroin, as we see from the insert, considerably increase versus the contents of antioxidant.

At the same time, according to the insert on DTA curve reduction of the area of endothermic effect is obviously seen at 165 °C, corresponding to melting of silk fibroin received with additional fertilizing of caterpillars by antioxidant. Ratios of areas of melting effect (vitrifying) of a crystal part of natural polymer between control and tested samples correspond to: $\hat{E} : \hat{I} = 4.4 : 3.2$, i.e. the degree of crystalline of the tested sample slightly decreases (approximately on 14 %). Along with this, the growth of vitrifying temperature on 15 °C is observed. Thus for the control samples $T_s = 150$ °C, and for the tested samples $T_s = 165$ °C. The presence of such changes in tested samples in comparison with control samples gives us the right to assert about increase in refractoriness of the crystal part of fibroin, received by

additional fertilizing of caterpillars of silkworm by antioxidant.

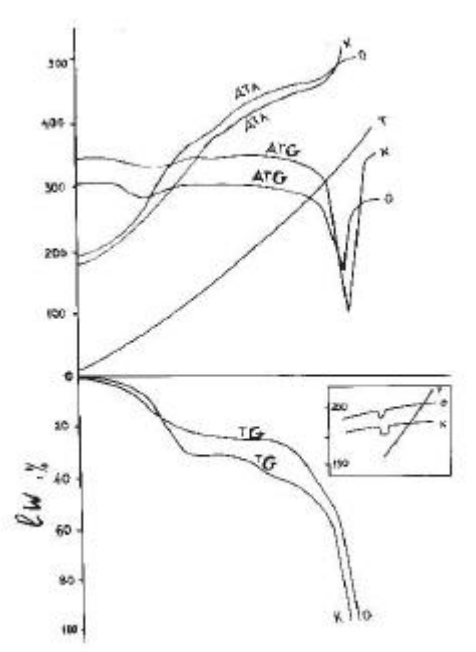


Fig.1. Derivatographical curves of fibroin: K are control, and O are tested samples

According to the fig.1, the beginning of thermal destruction of fibroin of the crystal part of natural polymer in the tested sample corresponds to 320 °C, and in the control samples to 300 °C. However the loss rate of weight (DTG) in the control sample is 1.9 times more, than in the tested sample that testifies on increase of a degree of refractoriness of tested samples.

On the basis of data of derivatographical researches of natural polymer fibroin it is possible to conclude, that antioxidant actively includes in the molecular structure of fibroin, in consequence the degree of crystalline decreases, and this causes increase of a degree of fibroin amorphism.

The following fact also is the confirmation of given conclusions: the antioxidant [4] has property to render the antiradical action, causing the delay of formation rate of free radicals in fibroin, and thus promotes to reduction of quantity of submicrocracks in a material.

Thus, we can tell, that at injection of the antioxidant into the structure of natural polymer silk, most likely, chemical bonds, causing a branching of macromolecules of fibroin are formed in lateral chains.

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