TEXTILE COMPOSITES USED IN EXTENSION GROWING SEASON OF PLANTS

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REZUMAT: Pentru materialele utilizate in agricultura, acțiunea vântului si a grindinei conduc la o degradare mecanica care se manifesta prin fisuri, orificii si pierderea flexibilității. Lucrarea prezintă analiza alurii diagramei efort deformație pentru materialele textile compozite supuse studiului, utilizate in extinderea sezonului de creștere a plantelor. Valorificarea acesteia se aplică direct în stabilirea unui regim de prelucrare tehnologică, caracterizat prin corelarea parametrilor cu caracteristicile materialului prelucrat.

Cuvinte cheie: materiale textile compozite, diagrama efort-deformație, extinderea sezonului de creștere a plantelor

ABSTRACT: For the materials used in agriculture, the action of the wind and hail results in a mechanical degradation that manifests through cracks, holes and loss of flexibility. The paper presents the analysis of the stress-strain diagram for the composite textile materials under study, used in extending the growing season of plants. Its use is directly applied in establishing a technological processing regime, characterized by correlating the parameters with the characteristics of the processed material.

Keywords: composite textile materials, stress-strain diagram, extension of plant growing season

1.INTRODUTION

A large expansion in all countries producing vegetables is to use polymer films yielding significant changes in the technological process. It is more resistant to mechanical factors due to the flexibility, with the possibility of selective transmission of solar radiation and enables complex shapes and economical solar. Synthesis of new additives able to improve light transmission and create the necessary microclimate for crops in greenhouses covered with polymer films, helped to extend land where to practice protected agriculture. The role of these additives is to select only certain wavelengths of sunlight, what are needed for plant development. The main advantages are productivity and thus reduce agrochemical use [1, 2]. The field of technical textiles requires knowledge of many stages of processing and phenomena's [3, 4].

The spectrum of the radiation comprises visible range with wavelengths in the 480-700 nm. When passing electromagnetic waves specific to the visible and UV, through a transparent glass material or from hydrocarbon polymers, radiation changes its frequency. Basically visible and ultraviolet radiations are infrared radiation having a greater thermal effect as the wavelength is greater.

Ultraviolet radiation wavelengths of 290-490nm and 500-700nm visible radiation is absorbed by pigments of plants and play an important role in all physiological processes. Ultraviolet radiation with wavelengths of 300-500 nm takes part in several biochemical processes in the fruit as: albumin synthesis, the formation of vitamins. Plants grow very fast under the influence of radiation values of 600-700 nm red orange and less under the influence of values 400-460 nm violet radiation. After coating the conductive layer, yarns shows greater rigidity, but can be used to obtain textile materials such as woven fabrics [5, 6, 7].

For growing practically acts only ultraviolet and violet radiation of 300-400nm and 600-700 nm red orange 750-1000 nm infrared radiation does not take part in photochemical process plant. Infrared radiation above 750 nm is absorbed by the water in the plant cells and causes a large temperature lift. Polymeric films thus contribute to the development of production in greenhouses by increasing photosynthesis [8]. It is considered as a normal activity, plants need radiation 300-700 nm physiological limits, prevailed with yellow and green spectrum radiation. It has been demonstrated that orange and red radiation accelerates flowering and fructification, causing the increase in the leaves.

Now after recent research is to determine what areas of the solar spectrum influence positively or negatively, directly in plant growth and development. It is advisable to visible radiation, of different wavelengths between 380-760 nm. Radiation with wavelength of 440-475 nm in the red area of the solar spectrum causes elongation of plants, radiation in the blue assist in the formation of the hormone which regulates phototropism [9, 10].

It was found that the main pigments in plant leave: chlorophyll, carotene absorbs radiation with wavelength of 395-685 nm so a wide range of violet-green to orange-red [11, 12]. Depending on the characteristics of transparency of the materials, it is known that bottles containing more than 0.3 % iron completely block the UV radiation passing through the normal bottles resulting in a low greenhouse effect [13, 14].

2. EXPERIMENTAL PART

2.1. Materials and methods

Composite fabrics, is a series of products which are viewed as a challenge to traditional notions about the role of technical textile materials, processes and products. It creates the premise that technical textiles composites used in agriculture to find its place in a wider industry and a market for flexible engineering materials.

Plant fibres, perceived as environmentally sustainable substitutes to are increasingly being employed as reinforcements in polymer matrix composites. Films coverings greenhouses allow selective transfer of energy between the inside of the greenhouse and outdoors. To retain maximum heat inside the solar ideal film must show maximum transmission of solar radiation and in particular in the field of IR. Maintaining heat is achieved by choosing certain specific polymers to create films. Influences to the film thickness: thin film will keep the temperature lower than the thicker films

There is increasing interest in the use of textile composites in diverse applications. Optimal design and application of the materials requires that the behaviour be predictable. The last two decades has seen a remarkable expansion in the literature on modelling of textile composites.

Experimental research focused on the development of composite textile materials proposed in the regulation of temperature regime, for extension of plant growing season. The composite materials were obtained from two-component: textile materials and polymer films of polyethylene, with the possibility of selection of the wavelength in the IR range.

2.2. Results and discussions

In the exploitation process, the composite material is subject to degradation phenomenon known as the "aging" of factors due to a mechanical, physical or chemical action both from the outside and from the inside. The effect of wind and hail lead to mechanical degradation which is manifested by cracking and loss of flexibility. The materials are described by mechanical properties determined in static or dynamic conditions, such as elasticity and plasticity, tensile strength and elongation. If a material is subjected to the action of an external force and did not break immediately, but takes the force that changes its linear shape and size but keeping the volume constant, it can be said that the material is deformed. As shown in figure 2.1, where after removal of the force, the material recovers its original shape is said to have suffered a temporary elastic deformation.

The phenomenon of deformation of the material under a force is shown in figure 2.1. This property material to deform elastically under an external force is called elasticity, Hooke's law respecting the proportional relationship between elastic force and relative elongation. According to the proposed model can determine the variation of the elastic force and elongation in the range of proportionality relative to elastic deformation performed to the composite material

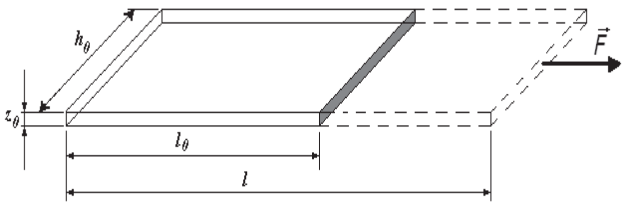

Fig. 2.1 The phenomenon of deformation of the composite textile material by force

The composite material obtained of the two components, has been requested with constant gradient, and gradually deformed until the moment of breakage, the character of stress- strain diagram is shown in the figure 2.2.

In the area of OP proportionality, the elongation of materials is in accordance with Hooke's law:

$$\frac{\Delta l}{l_0} = \frac{1}{E} \cdot \frac{F}{S} \qquad (2.1)$$

where: F - elastic force; S - cross section; E-Young's modulus of elasticity (constant).

The formula is also written:

$$\varepsilon_r = \frac{1}{E} \cdot \sigma \tag{2.2}$$

where:

$$\varepsilon_r = \frac{\Delta l}{l_0}$$ relative elongation;

$$\sigma = \frac{F}{S}$$ normal unit effort;

Thus:

$$F = \frac{E \cdot S}{l_0} \cdot \Delta l = \frac{E \cdot z_0 \cdot h_0}{l_0} \cdot \Delta l \tag{2.3}$$

where:

z_0- thickness of the specimen

h_0 - width of the specimen

In the area of proportionality OP, from the performed experiments, we have:

$$F = m_1 \cdot \Delta l = \frac{y_1}{x_1} \cdot \Delta l \tag{2.4}$$

where m_1 determined by $P(x_1, y_1)$

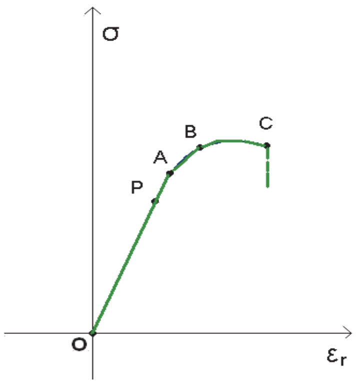

Fig.2.2 The character of stress- strain diagram for textile composite materials studied

The two relationships allow Young's modulus of elasticity to be determined:

$$\frac{E \cdot z_0 \cdot h_0}{l_0} = \frac{y_1}{x_1} \leftrightarrow E = \frac{z_0 \cdot h_0}{l_0} \cdot \frac{y_1}{x_1} \tag{2.5}$$

The evaluation of the stress strain diagram for the studied textile materials allows us to analyze the rigidity of the material according to its thickness.

3. CONCLUSIONS

The tensile properties of the composite materials were evidenced by the interpretation of the stress-strain diagram that contributes to a functional design of the composite materials for applications in extending the growing season of plants. Thus the basic element offered by the analysis consists in the connection between the rigidity of the material and the thickness of the composite material. Establish more accurate point P, end of the range of proportionality Young, and modulus of elasticity, allows a correct design of the composite material. Thus the modulus of elasticity is higher the material deformation resistance is higher.

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