



Co-financed by Greece and the European Union



Development of a **Textile** with **Silica** coating for environmental friendly control of insects in **Agricultural** production

Deliverable [11]: *[Coated woven fabric]*

Version 1.0: first version delivered on 28/03/2019

Version 1.1: second version delivered on 28/11/2019 (the results from test with insects are added)

This project is co-financed by the European Union and Greek national funds through the bilateral Greece-Germany S & T Cooperation Program, Competitiveness, Entrepreneurship & Innovation (EPANEK) (project code: T2DGE-0120).

Project Details:

Programme: Bilateral Greece-Germany S & T Cooperation Program, Competitiveness, Entrepreneurship & Innovation

Project Title: Development of a textile with Silica coating for environmental friendly control of insects in agricultural production

Project Acronym: AgriTexSil

Proposal Number: T2DGE-0120

Time Frame: 29/05/2018 – 28/08/2022

Deliverable Details

WP: [4 Textile prototyping]

Task(s): [4.1]: [Production of Nets], [4.2]: Evaluation of coated woven nets

Deliverable Title: [Coated woven fabric]

Deliverable type: Demonstrator, Confidential, only for members of the consortium (including the Commission Services)

Lead beneficiary: [Thrace NG]

Involved Partners: [Thrace NG, P&S]

Deadline for delivery: month [10], [28/03/2019]

Date of delivery: version 1.1 [28/11/2019]

The current version was released after the evaluation of the effect of different types of silica nanoparticles or of screens covered with different types of silica nanoparticles on insect's mortality or knockdown.

Abbreviations:

ITA: Institut für Textiltechnik, Germany

UTH: University of Thessaly, Greece

ThraceNG: Thrace Nonwovens & Geosynthetics S.A.

P&S: Powder and Surface GmbH

Del [11]: [Coated woven fabric]

Table of Contents

1. Summary.....	4
2. Introduction.....	5
2.1 Optical testing methods.....	6
2.2 Mechanical test methods.....	7
2.3 Methodology followed and description of the deliverable findings.....	10
2.4 Representation of the measured samples.....	14
2.5 Effects of covering on light transmittance.....	17
2.6 Results from air permeability.....	18
2.7 Results from tensile testing.....	20
2.8 Effects on insects.....	23
3. Discussion and Conclusion.....	27
4. Annex I.....	28
4.1 Literature cited.....	28

List of Figures

Figure 1: Testing methods for coated textile.....	4
Figure 2. 25 mesh net.....	6
Figure 3. Stereomicroscope Leica M205C (Leica Microsystems GmbH, Wetzlar, Deutschland) [Lei19].....	7
Figure 4. Tested and to be tested specimen.....	9
Figure 5. Produced woven structure using multifilament yarns.....	10
Figure 6. Woven insect net of 25 mesh produced by using HDPE monofilament yarns.....	11
Figure 7. Produced woven insect net structure of 40 (a) and 50 (b) mesh by using HDPE monofilament yarns.....	11
Figure 8. Activation plasma in the foreground, coating plasma behind.....	13
Figure 9. Overview of analysed samples.....	16
Figure 10. Visualization of test results.....	19
Figure 11. Visualization of test results.....	21
Figure 12. Evaluation of insect's mortality as affected by three types of silica nanoparticles.....	24
Figure 13. Effect of different types of silica nanoparticles on <i>Sitophilus oryzae</i> adults (left) and <i>Tribolium confusum</i> larvae (right) mortality after one or seven days of exposure to a 1000 ppm concentration of silica nanoparticles.....	24

Del [11]: [Coated woven fabric]

Figure 14. Effect of different types of silica nanoparticles on *Sitophilus oryzae* adults (left) and *Tribolium confusum* larvae (right) mortality after one, two or ten days of exposure to insect screens covered with different types of silica nanoparticles.....25

Figure 15. Effect of different types of silica nanoparticles on *Sitophilus oryzae* adults (left) and *Tribolium confusum* larvae (right) knockdown after different time exposure (5, 10, 15, 20, 30, 45 and 60 mins) to insect screens covered with different types of silica nanoparticles.....25

List of Tables

Table 1. The average sizes of some of the most common pests that attack greenhouse crops and the maximum sizes of the openings in a screen that can exclude these insects (Bethke and Paine, 1991; Bethke et al., 1994). The same table was presented by Teitel, (2007). 5

Table 2. Technical characteristics of the produced woven insect nets..... 12

Table 3. Overview deposition results Sylobloc S200..... 14

Table 4. Overview of samples. 15

Table 5. Additional Samples. 15

Table 6. Overview of light transmittance results..... 17

Table 7. Effect of factors and factor combinations..... 18

Table 8. Results of air permeability tests..... 19

Table 9. Effect of Primer (A) and covering Repetition (B) on screen properties.....20

Table 10. Results of tensile tests20

Table 11. Results from DoE.....21

Table 12. Tenacity results.....22

Del [11]: [Coated woven fabric]

1. Summary

In this deliverable the production of coated woven nets is described. Initially, two type of yarns (multifilament and monofilament) were produced so as to be subsequently used for the construction of woven insect nets. After conducting weaving trials, the monofilament yarns were found to be suitable for the production of insect nets. Therefore, monofilament yarns were used for the production of three different types of woven nets. Specifically, 25, 40 and 50 mesh woven nets were produced in flat shuttle looms. The differences in the construction of the nets resulted in nets with different opening sizes and ventilation properties. The silica coated woven nets were produced with pilot plasma coating unit. In this process, the polymer is plasticized by a cold plasma jet. The silica particles are inject with a special distribution pump into the plasma jet and melted in the surface of the polymer. Therefore, no additional adhesive is need, which could destroy the nanostructure of the silica particles.

Coated textiles were analysed in microscopy for light transmittance as well as for air permeability and tenacity, as shown in Figure 1. It was shown that the coating of the textile does not have a negative effect on the tenacity, but does influence the air permeability and the light permeability. The biggest effect is thereby caused by the particle size, where bigger particles result in a bigger reduction.

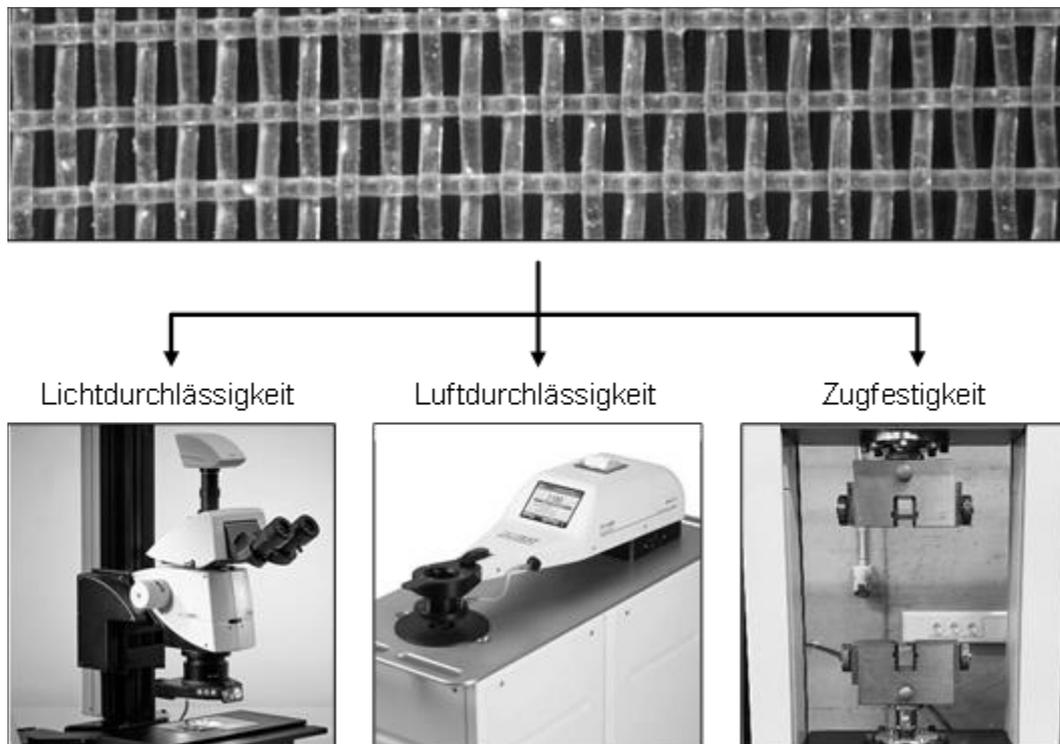


Figure 1: Testing methods for coated textile

Del [11]: [Coated woven fabric]



Co-financed by Greece and the European Union

The deliverable is available upon request

Please send e-mail to the project coordinator: nkatsoul@uth.gr

D [10]: [Data of the fiber's characterization]

