NON-WOVENS INNOVATIVE CLADDING FOR SHELTER PURPOSES

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WHAT ARE NON-WOVEN FABRICS?

Nonwovens are unique, high-tech, engineered fabrics made from fibres and which are used across a wide range of applications and products. Nonwovens are innovative, versatile and indispensable. Modern life would be quite literally impossible without them.

A nonwoven is a sheet of fibres, continuous filaments, or chopped yarns of any nature or origin, that have been formed into a web by any means, and bonded together by any means, with the exception of weaving or knitting.
Non-woven fabrics based on traditional felt technology. Felt is a non-woven fabric made using natural fibres, water, soap and agitation to form a dense fabric of permanently interlocking fibres.
RAW MATERIALS FOR NON-WOVENS

• ANY FIBRES (NATURAL AND MAN-MADE) CAN BE USED FOR THE PRODUCTION OF NON WOVENS

• FIBRES CAN BE USED IN STAPLE (SHORT AND LONG) OR FILAMENT FORM
AREAS OF USE

• Geotextile
• Automotive
• Clothing and Shoe wear
• Wipes and mops
• Artificial leather
• Hygiene (diapers)
• Medical
• Filter
• Industrial
NON-WOVEN PRODUCTION

WEB FORMATION

WEB BONDING
DRY WEB FORMATION AND NEEDLE PUNCH NON-WOVEN PRODUCTION
NON-WOVEN PRODUCTION
NEDDLE PUNCH PROCESS PARAMETERS

Penetration (mm)  Punch density (iğne/cm²)

0 96,00 1 98,00 2 100,00 3 102,00 4 104,00 5 106,00 6 108,00 7 110,00

Punch density – Tensile Strength Graph
• Advantages of non woven fabrics

• Very short time to produce

• Production varieties

• Superior properties (heat and sound insulation, etc.)
TENTS

Tents from past to present

• First settlements after cave
• First dwellings before permanent dwellings
• Military temporary settlements
• Sports and leisure use
• Natural disaster and refugee camps
The use of tents in ages

- Most civilizations (Ancient Egypt, Roman Empire, Mongolians, Ottoman Empire, American Indians, etc.) used tents in various activities.
- Living quarters,
- Military purposes
- Sports and other activities
- For temporary settlements
Tent fabrics used in history

- Felt fabrics from natural hair fibers
- Non woven fabrics
- Woven fabrics
- Made with natural fibers
Tents today

- Tents are mostly used in natural disasters and refugee camps
- Military, sport and leisure activities
- Nearly all tents are made from woven fabrics
- Very little non woven fabrics are used
- Man made fibers are used besides natural fibers
PROJECT ABOUT IMPROVEMENT OF TENT FABRIC

DEVELOPMENT OF ECO-FRIENDLY NONWOVEN BASED NATURAL DISASTER TENT FABRIC THAT HAVE FLAME RETARDANCY, WATER REPELLENCY, HEAT AND SOUND INSULATION, ANTI BACTERIAL, AND BREATHABILITY PROPERTIES
RELEVANT INSTITUTIONS AND ORGANIZATIONS

PROJECT COORDINATOR

• HASSAN GROUP (Ch.E. Umut Burak DALBUDAK)

ACADEMIC CONSULTANCY

• MARMARA UNIVERSITY (Prof. Dr. Mehmet AKALIN)

FINANCIAL SUPPORT

• TUBITAK (Scientific and Technological Research Council of Turkey)

BENEFICIARY ORGANIZATIONS WITH TECHNICAL AND APPLICATION SUPPORT

• TURKISH RED CRESCENT
• IFRC SRU
THREE IMPORTANT MAPS

• Natural Disasters and Refugee Camps Analysis

• Climate Conditions

• Population Density
INTRODUCTION
INTRODUCTION
INTRODUCTION

• Increase in the number of natural disasters and refugee camps in the world

• Importance of improving the living conditions in the tents that long term living and also one of us may have to live in
AIMS OF THE PROJECT

• Need to protect from fire

• Fire is the most common cause of fatalities in camps and tents

• Use of inherently flame retarded fibres in non-woven production
Need to protect from cold weather conditions

- Advantages of using non woven for cold weather conditions
- Varieties of non woven production for insulation
- Present usage of non woven internally in Turkish Red Crescent Tents.
Need to protect from hot weather conditions

- Natural disaster and refugee camp tents are also used in hot weather conditions.

- Advantages of using non wovens for hot climate conditions
Need for sound insulation

- High number of tents and their close proximity.
- Advantages of using non-woven for sound insulation
Need of protecting tents from harsh weather conditions (i.e. heavy rain)

- Adverse effects of rain in tents
- Problem of condensation
- Need for breathability
Importance of breathability of the tent fabric

• Problem of condensation caused by cooking and breathing in a tent.
• Need to keep the tent condensation free.
• Breathability of the fabric used for tent is important
Need to keep the tent anti microbial and reduce the effects caused by insects.

- Due to outside conditions and the presence of high humidity with in the tent specially made with natural fibres micro organisms grow very quickly.
- Insects are drawn into tents due to cooking activities which spreads the disease.
What materials are used in natural disaster tents today?

- Outer roof fabric (woven with coated PVC)
- Outer side walls (woven fabric)
- Inner tent fabric (woven for Red Cross, non woven for Turkish Red Crescent)
- As a fibre mostly cotton, polyester and poly/cotton are used
What materials are used in natural disaster tents today?
What do we want to do?

• Improve the present inner tent fabrics
• Improve the living conditions in a tent
• Produce a fabric (inner, outer and for roof) to achieve this
• New idea of producing tent fabrics in a very short period of time
• Create a new specifications for the new tent fabrics
Fibers that could be used in new tent fabric

- Man made fibers
- Recycled fibers
- Hollow fibers
- Micro, Nano fibers
- FR fibers
- Insulating fibers
Chemicals and semi finished products that could be used in a new tent fabric

- FR chemicals
- Anti microbial chemicals
- Water resist chemicals
- Insect repellents
- Insulating paints
- Breathable films
- Metallized films
- UV additives
IMPLEMENTATION METHODS

- Literature Survey
- Sample Trials
- Production of Prototype
- Pre Production
- FEEDBACK
TENT FABRIC TESTS

MECHANIC TESTS

• Area Density g/m²

• Thickness mm

• Tensile Strength and Elongation N, %

• Tearing Strength N

• Tensile Elongation Under 100N Load (Creep Deformation) %
TENT FABRIC TESTS

OTHER PROPERTIES

- Anti bacterial effect %
- pH
- Martindale Abrasion
- Sound Absorption $\alpha$
- Air Permeability mm/s
- Thermal Coefficient of Resistance m²K/W
- Water Vapour Resistance m²Pa/W
- Flame Retardancy
- Ultrasonic Weldability
## RESULTS

<table>
<thead>
<tr>
<th>TEST NAME</th>
<th>TEST METHOD</th>
<th>UNIT</th>
<th>NON WOVEN TENT FABRIC</th>
<th>OUTER WOVEN SIDE WALLS</th>
<th>INNER WOVEN TENT FABRIC</th>
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<td>WARP -</td>
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TESTS ON TENTS

• FIELD TESTS
RESULTS

• % 30 LESS ENERGY IS REQUIRED TO KEEP THE NON-WOVEN FABRIC BOX (1m3) AT CONSTANT TEMPERATURE THAN THE STANDARD WOVEN FABRIC BOX (1m3)
RESULTS

Compared with exterior minimum recorded temperature, the winter room provides a reduction of 5.9°C.
The Kızılay tent without winter room provides a reduction of 4.6°C (1.1°C colder than the tent with winter room).

Preliminary conclusions:
The winter room has an insulation capacity more effective than the Kızılay tent without winter room on the mide recorded temp.

Table 08: The minimum and maximum temperature measured inside the tent Kızılay tent with winter room and the Family tent with winter kit during the testing period, in comparison to the outside max and min temperatures.

The recorded data in table 08 clearly shows that the minimum inside temperature of both, the Family tent and the Kızılay tent is very similar in position 1 (next to the roof). The minimum recorded temperatures in position 1 are higher in the Family tent than in the Kızılay tent in the same position. The recorded min temperatures in position 1 do not provide a significant variation between tents (just 0.6°C better reduction in the Kızılay tent with winter room).

The maximum recorded temperatures in position 1 are lower inside the Kızılay tent with winter room in comparison with the Family tent in the same position. The Kızılay winter room provides 4.6°C of reduction on the maximum temperatures in comparison with the Family tent in the same position.

The Logtag automatically register the temperature every 15 min during the whole testing period in total registering 2880 measures for each Logtag (in total 57600 lectures). The Logtag data was recuperated by the IFRC-SRU Research Officer at the end of the testing period and processed for analysis.

Table 06 and 07: The minimum and maximum temperature measured inside the tent during the testing period, in comparison to the outside max and min temperatures.

Compared with exterior maximum recorded temperature, the winter room provides a positive reduction of around 4°C.
The Kızılay tent without winter room does not provide a significant reduction on the maximum recorded temperatures, furthermore the greenhouse effect in one of the tents provides an increase of the max temperatures in 4.7°C.

Preliminary conclusions:
The winter room has an insulation capacity more effective than the Kızılay tent without winter room on the max recorded temperatures.
RESULTS

• TWO RESULTS SHOW THE IMPORTANCE OF TENT DESIGN
RESULTS
RESULTS

Advantages of this project

• Experiences of tent production facilities of Turkish Red Crescent and other private companies
• Experience of HASSAN in non woven fabric production
• Quicker production of non wovens in case of real emergency situations
• Better properties of nonwoven fabrics in terms of properties required for tents
• Eco friendly and sustainable production
CONCLUSIONS

• NON-WOVEN PRODUCTION IS THE FAR MOST SUPERIOR METHOD OF PRODUCTION OF FABRICS FOR INDUSTRIAL USE IN TERMS OF;
  » PRODUCTION SPEED 50000 TENT 2500000M2 FABRIC
  » NO NEED FOR LARGE STOCKS
  » LESS STOCK KEEPING COSTS
  » STOCKING PROBLEMS DUE TO HEAT AND HUMIDITY
  » COST ((AT LEAST %30))
  » FABRIC PROPERTIES
  » WIDER RANGE OF PRODUCTION
  » VARIETIE OF FIBRE USE
  » COMBINATION WITH DIFFERENT PRODUCTION TECHNIQUES
CONCLUSIONS

• IN THIS PROJECT TENT FABRICS TESTED; NON WOVEN FABRICS HAVE SHOWN PROPERTIES BETTER THAN WOVEN FABRICS INTERMS OF;
  – HEAT AND COLD INSULATION
  – SOUND INSULATION
  – WATER REPELLENCY
  – FLAME RETARDANCY
  AND BESIDES THAT FABRICS WERE
  – ANTIMICROBIC
  – BREATHABLE PERMEABLE
  – UV ABSORBER (FOR SUMMER USE)
  – ULTRASONICLY WELDABLE
  – ENVIREMENTAL FRIENDLY SUSTAINABLE (RECYCLED RAW MATERIAL)
CONCLUSIONS

• FIELD TESTS HAVE SHOWN ALSO BETTER PROPERTIES;
  – USING LESS ENERGY TO KEEP THE TENT AT CONSTANT TEMPERATURE (KEEPING WARMER)
  – GREEN HOUSE EFFECT (COOLER) IN ONE TEST
CONCLUSIONS

• AS A RESULT OF THIS PROJECT WE HAVE PRODUCED THREE IMPROVED NON WOVEN FABRIC FOR TENTS;

  » IMPROVED NON-WOVEN INNER TENT FABRIC (WINTERSATION AND SUMMERSATION KIT)
  » NON-WOVEN OUTER TENT FABRIC (NEW)
  » METALISED NON-WOVEN ROOFING FABRIC (NEW)
## TECHNICAL DATA SHEET

**PRODUCT CODE:** N118  
**PRODUCT NAME:** NON WOVEN TENT FABRIC

### RAW MATERIAL - FIBER TYPE

<table>
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<tr>
<th>TEST NAME</th>
<th>TEST METHOD</th>
<th>UNIT</th>
<th>CRITERIA OF ACCEPTANCE</th>
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Thank you for your attention....

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+905322414949
Brief Introduction About The Project

Our aim in this project is to improve living conditions in natural disaster tents. Improving the natural disaster tent fabrics in terms of:

- flame retardancy,
- heat and sound insulation,
- water repellency,
- breathability and
- anti bacterial properties
Reasons and aim of starting this project

- Increase in the number of natural disasters and refugee camps in the world
- Importance of improving the living conditions in the tents that one of us may have to live in.
- Losses of life in tent fires.
- Heat and sound insulation problems of tents.
- Breathability of the tents.
- Water resistance of tents due to heavy weather conditions.
- Increase of illnesses in the tents due to microorganisms and bacterials growth.