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A Study on the Effects of Physical Properties and Thermal Properties of Nonwoven Fabric

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***Abstract*: This paper reviews the manufacturing methods of a nonwoven with suitable fabric for thermal properties, porosity and physical properties. Nonwoven fabrics are basically classified as layers of sheet are prepared by web structures combined together by tagging fiber mechanically, thermally, chemically. The non-woven is made through needle punching, the needle punched sheets are flat and the material that are made from single separate fibers. Nonwovens are materials that are permeable and manufactured using different methods from the traditional methods of fabric manufacture. Especially while producing non-woven fabric through needle punching technique it describes more pores in its structure and using of recycled polyester helps to reduce the fabric wastage and to get the market needs. Thermal isolation is one of the important functional properties required in various field such has automobile textiles and domestic use. In this project the influence of porosity on thermal properties of polyester non-woven fabrics was analyzed.**

***Keywords*: Nonwoven, Needle punching, Porosity, Air periability.**

1. Introduction

Nonwovens are the fabrics that are manufactured using stable and long fibres by blending together using chemical, mechanical, and heat treatment Non-woven are mainly manufactured in web structure the nonwovens are of a sheet that often have no need of converting into yarn for the formation of fabric. Polyester in non-woven replaces the natural fabrics to meet requirement improves basically the polymer is extracted from petroleum based products [22]. In polyester it the result shows that water filtration efficiency is increased by 8% as compared to other fibres [24]. Needle punching is the oldest and also a well-established method of forming non-woven textile materials. Needle punching is a process of combining fibres mechanically. The needle punched non-woven technology is considered as one of forwarded developing technology [21].This needle punching process is considered to produce mainly for medium and heavy weight non-woven. The needle punching is a process that doesn't requires weaving or knitting processed yarns and no need of converting fibre to the yarn. Recycled fibres can be used to decrease the cost price mainly so useful in certain applications [20] (one time application) ex: luxury accommodations, schools, hospitals etc. Now woven are the fabric area engineered fabrics have limited life and are very high durable [28]. These fabrics are used in specific qualities such as thermal insulation, and softness are suited for such jobs.

The recycled fibres help in achieving and to meet present market requirement as per the author [3]. Maximum yield can be achieved from raw material. And both natural and man-made fibers are used in the process for better specifications. In many studies it absorbed that the polyester has great filtration parameters that are good at filtration [23].The recycled fibre materials have any benefits since they are cheap and average best as compared to normal fibres [2].

1) Non-woven fabric manufacturing process

Non-woven are mainly manufactured in web structure or sheets. The fibers bonded together using the chemical, mechanical, heat treatment [13]. For the fabric production process both the short and long continuous fibres can be used. the nonwovens are of a sheet that often no need of converting into yarn for the formation of fabric [27].Unless like other fabric the manufacturing of nonwovens doesn't need of conversion from fibre to yarn instead it's a direct fabric manufacturing process [14]. Non-wovens are manufactured at the cheap of cost and its more durable fabric and can be used almost all applications such as water filters, face masks, soil stabilizers etc [15].

2) Working principle of needle punching nonwoven technology

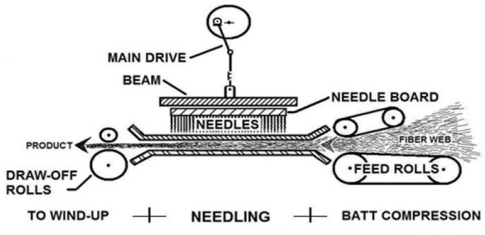

Fig. 1. Needle punching mechanism

3) Carding process

The process opens and individuals the fiber then combed them so that length of every fibre is same and oriented combes in the direction of cylinder moving are aligned in the parallel direction.

4) Web feeder

The layered web is adjusted to meet the quality requirements and standards and is sended to the needle punching machine.

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Web feeder mainly uses to avoid the web from damaging, changing its shape. Nonwoven fabric has both fiber and web properties [6]

5) Needle punching

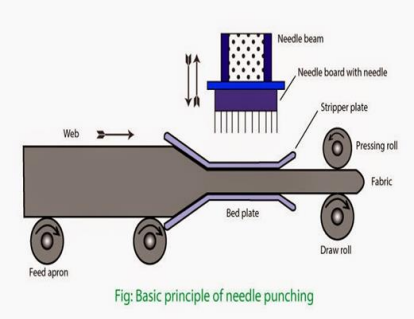

Fig. 2. Needle punching technique

Here the web is delivered to needle loom the total numbers of needles are punched at a time due to the continuous penetration of needles the fibre get mechanically interlocked the count of repetitions of needle punching is changed as the requirement and quality of fabric

6) Cutting and winding

The produced fabric is winded to the roll and packed the end of the fabric to avoid the fabric loss during transport. Edges of the fabric is removed using sceser to give the even shape of the fabric.

7) Porosity

The porosity of the fabric is defined as the fraction of void volume and the volume of the fabric [25]. This can calculated fro fabric and fabric densities. The particular thickness and gsm the void space are available in the total material itself. The porosity is one of main essential criteria that shows the fabric properties mainly such as air and water and liquid absorption the porosity valve is ranges from zero to one.

Table 1
Porosity

Valves	**Content**
Zero	No of fibers acclumented in the non-woven fabric
One	No of available void space
Porosity	1-FVF
FVF	fiber volume fraction

In polyester it is observed that the porosity is influenced by air permeability the result says that increase in air permeability the porosity of fabric also increases[19].For finding or to determine filtration efficiency to the fabric pore size is mainly required. There are any methods available to measure pore size of non-woven fabrics [11] .they are

The porosity value can be calculated using the formula

$$\text{Porosity (H)}: Va/Vm \quad [8]$$

The average or appopriate porosity is calculated by passing a spherical glass of different sizes taken from 50 to 500mm.

8) Bursting strength

The bursting strength is directly proportional to fabric weight, needle punch density hence if the bursting strength increases fabric weight also increases and the needle penetration length. Hence the bursting strength of non-woven fabric using needle punching is studied and analyzed. In polyester fibre due to increase in fabric weight and penetration length of needle the bursting strength also increases [18] in polyester it also shows that needle penetration also influences the bursting strength.

9) Thermal insulation

The thermal insulation can also be say as a flux of heat which is divided by the temperature gradient. For most of the textile fabric materials conductivity is one of the main important factor [29]. Polyester in one of the fibre is hardly known as insulation of heat. Here the thermal properties of non-woven and different blends of non-woven are calculated. The blending the polyester fibre with woollenized improves the thermal properties of fibre. In thermal insulation the effectiveness of nonwoven fabric is normally calculated by bulk density, compactness and porosity of the fabric [12]. For to find properties of thermal insulation different experiments is to be carried there are to find the weight and needling density of the fabric as the same way for the blended fabric too. In journals they noticed the according to their experiments that increase in fabric weight leeds to increase in thermal properties too. The total count of unit area of fabric is proportional to thermal insulation. And the thermal resistance of the fabric increases with decreasing of needle density.

2. Conclusion

Here the polyester many major great properties has the ability of replacing the present market natural fibres and has the ability to reach the market needs and the process of needle punching of conversion of fibre to nonwoven fabric and finally different test such as porosity level and thermal insulation properties are attempted to find accurate quality of the fabric.

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