Survey Paper on Air Permeability Property of Non-Woven Fabrics

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Abstract- Air permeability of the non-woven fabrics is important property which indicates the thermal insulation characteristic of the fabrics. Air permeability of the fabric is an important fabric property which measures the rate of air flow through a fabric under differential pressure conditions. It decides the thermal insulation properties of the needle punched non-woven fabric. These properties are tested for the non-woven fabric used in this study and reported. Air permeability of non-woven fabrics containing various blend compositions of various fibres was investigated in this paper.

Indexed Terms- Air permeability, thermal insulation, needle punched, blend compositions

I. INTRODUCTION

This chapter deals with the dependence of air permeability on the geometrical properties of needle punched non-woven fabrics, namely areal density, thickness and porosity with different blend proportions. Air permeability is an important property which gives an indication of thermal insulation. This information will be useful for designing non-woven fabrics. Air permeability indicates thermal insulation and a lower value implies better insulation. In the application of non-woven fabrics as Geo-textiles, it is important that they have good thermal insulation.

II. STUDIES ON AIR PERMEABILITY OF NON-WOVEN FABRICS

Debnath and Madhusoothanan (2010) have reported on compression, thermal insulation and air permeability of needle punched non-woven fabrics produced from fibres significantly differing in cross section and fabric weight. Also, workers such as Kothari andDas (1994) have also conducted studies on compressibility. It has been found that fabric thickness and fabric weight affect air permeability and thermal insulation value. Debnath and Madhusoothanan (2009) have also dealt with compression properties of polyester needle punched fabric.

Zhu *et al.* (2015) have discussed air permeability of polyester non-woven fabrics and its dependence on thickness, porosity and areal density. It was found that air permeability has decreased with increase in thickness and increased with an increase in porosity. Cincik and Koc (2012) have conducted a detailed study on the air permeability of polyester/viscose blended needle punched non-woven. Five different blend ratios were produced with four different areal density and three different punch densities were employed. Air permeability has been found to be affected by the blend ratio of polyester/viscose fibres, fabric mass per unit area and needling density. Prediction of air permeability was facilitated by the statistical model given. An excellent review on the bulk density and physical properties of needle punched non-woven fabrics by Midha and Mukopadhyay (2005) have been published.

Venkataraman *et al.* (2014) have studied the thermal insulation characteristic of aerogel and Nano porous fibrous materials. They used SEM images for carrying the physical configuration of the aerogel based fibrous composites. They found that the percentage of Nano porosity of aerogel based composite structure influence on the air permeability. The fibrous structure, density and the aerogel present in the composite have a cogent effect on thermal properties on overall structures.

Maity *et al.* (2012) have studied the structure – property relationship of needle punched non-woven fabric. They found that increasing angle of cut direction of the specimen would decrease the tensile strength. The parallel web showed improved tearing and bursting strength. The sound insulation properties depend on a number of fibres per unit volume in the density of the fabric.

Kothari and Newton (1974) have studied the effect of different fabric parameters on the air permeability of the non-woven fabrics. They found that air permeability of the non-woven fabric is indirectly proportional to the weight per unit area.

Birat *et al.* (2015) have discussed the thermal and dimensional stability of injection moulded sisal glass fibre hybrid polypropylene Bio composites.

Sengupta *et al.* (1999) have studied the properties of non-woven fabric. They found that the air permeability of fibres made of jute and its blend having low polypropylene content increased with punch density, while it was lower for blends containing texturized jute and polypropylene.

A study was carried out on thermal conductivity of needle punched non-woven fabrics produced from blends comprising polyester and polypropylene fibres in different proportions. The effects on punch density and blend ratio on the thermal conductivity of non-woven fabrics have been investigated. Varkiyani *et al.* (2011) have considered seven fabrics comprising of 100% polypropylene and 100% polyester, 80%polyester and 20%polypropylene, 60%polyester and 40% polypropylene, 40% polyester and 60% polypropylene, 20% polyester and 80% polypropylene and 100% polyester fabric for compression studies.

Their results show that thermal conductivity of non-woven fabrics is increased by reducing punch density. An increase in pressure in respect of polyester has led to a decrease in thermal conductivity. Thermal conductivity of 100% polyester non-woven fabric is found to be lower than that of 100% polypropylene. The blended fabric shows better insulating potential than those of pure polyester and polypropylene fabrics. Particularly, the fabric produced with 60% polyester and 40% polypropylene showed lowest thermal conductivity which implies better thermal insulation.

Mohammadi *et al. (2002)* have also conducted studies on thermal conductivity of needle punchednon-woven fabrics made of glass and ceramic fibres. They report that the thermal conductivity of needled non-woven structures can be predicted by the high degree of accuracy using a model with fabric thickness, porosity and structure along with applied temperature. A theoretical equation for the combined thermal conductive, convective and radiative heat flows through heterogeneous multi-layer fibrous materials.

Lunenschloss and Gupta (1981) have discussed new developments in needling technology. Sengupta *et al. (2005)* have studied the effect of dynamic loading on jute and jute/polypropylene blended needle punched non-woven fabric. They observed that with the increase in cycles of dynamic loading, the thickness loss increases with diminishing rate up to a certain limit and thereafter it does not change.

Midha *et al.* (2004) have discussed the properties of hollow polyester needle punched fabrics. They have found that as a web gets consolidated the compressibility decreases, recovery increases and stiffness generally increase. Cross laid structure shows higher compressibility and lower recovery as compared to parallel laid web.

Debnath *et al.* (1994) have studied the properties of needle punched non-woven blankets produced from polyester.

CONCLUSION

Air permeability of non-woven fabrics containing various blend compositions of sisal and polypropylene was investigated in this paper. The investigation shows that the thermal insulation of non-woven fabric is an important property for technical application. It also insists that the rate of air flow through a fabric under different pressure is very much essential for road laying application.

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