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Technical Note

# Stabilisation of soil using hybrid needlepunched nonwoven geotextiles

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ABSTRACT

In the past, natural and synthetic fibre based geotextiles have been used for short- and long-term applications of soil erosion. It is well known that these geotextiles complement each other in terms of various physical and mechanical properties. In this study, an attempt has been made to study various properties of hybrid geotextiles. These hybrid geotextiles have been produced from the blend of polypropylene/viscose and polyester/viscose fibres in defined weight proportions (0%, 20%, 40%, 60%, 80% and 100%). Subsequently, a comparison has been made between various physical and mechanical properties of needlepunched nonwoven geotextiles. In this research work, it was found that hybrid geotextiles made of viscose (up to 40 wt.%) can replace 100% polypropylene or polyester based geotextiles.



## 1. Introduction

Soil erosion due to rainfall or wind is highly detrimental to the environment and it can be reduced by growing and maintaining the dense cover of herbaceous vegetation (Gray, 1995; Mickovski et al., 2010). However, the growth of vegetation is slow and may not be uniformly spread in the desired region. Therefore, geotextiles are required to be used for uniform and rapid growth of vegetation in addition to fulfilment of reinforcement function. In general, geotextiles can be made from synthetic and natural fibres but the former fibre type has been widely used in civil engineering applications primarily due to their superior mechanical properties and long-term durability. Nevertheless, natural fibre based geotextiles are environment friendly, less costly, easily available, and ecologically compatible as they are degraded within the soil (Lekha, 2004; Sarsby, 2007). Several researchers have demonstrated the use of natural fibres including jute, flax, coir, wood and bamboo in various applications of geotextiles such as soil erosion control, vertical drains, road bases, bank protection and slope stabilisation (Ahn et al., 2002; Basu et al., 2009; Bera et al., 2009; Chauhan et al., 2008; Datye and Gore, 1994; Kaniraj and Rao, 1994; Lee et al., 1994; Lekha, 2004; Lekha & Kavitha, 2006; Park, 2009; Rao et al., 2000; Rawal and Anandjiwala, 2007; Sanyal and Chakraborty, 1994; Subaida et al., 2008, 2009; Slater, 2003; Tan et al., 1993). Particularly, jute and coir fibres have been successfully used for vegetal growth as they have high water absorption and moisture uptake which makes them ideal material for such applications (Lekha, 2004; Ranganathan, 1994). However, the coir geotextile was found to be degraded due to the microbial action in the soil in addition to the effect of rain and sun (Lekha, 2004). Furthermore, the coir net retained only 22% of its initial tensile strength at the end of seven months after it is deployed in the soil. Similar strength loss in coir netting was reported by Balan and Venkatappa Rao (1996). In addition, the natural fibres have inherent variation in properties that can result in loss of tensile strength (Rawal and Anandjiwala, 2007). Furthermore, in applications where natural fibres are exposed to microbiological agents and solar radiation, the effectiveness of these fibres is expected to reduce (Wall et al., 1971). The effect of solar radiation is not limited to natural fibres but synthetic fibres such as polypropylene also has a poor resistance to ultra-violet radiation (Zanten, 1986).

Cellulosic regenerated fibre such as viscose rayon is highly suitable for soil stabilisation applications as it is biodegradable, capable of holding water and has uniform inherent properties. However, it has low strength and stiffness in comparison to the synthetic fibres namely, polyester and polypropylene. Thus, the overall objective of the present work is to compare and analyse the properties of hybrid needlepunched nonwoven geotextiles produced from regenerated cellulosic and synthetic fibres (polyester and polypropylene) that can be potentially used for soil stabilisation applications. Furthermore, the changes in porosity of

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