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Short Communications

Development of fully automatic powerlooms (Anugraha Tejas) for coir geotextiles

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A fully automatic powerloom (Anugraha-Tejas) has been designed and developed. In this automatic power loom, the human intervention has been completely ignored, letting the machines and mechanisms to take over the mass production of geotextiles. The treadles of the wooden loom are replaced by pneumatic pedals making the work less complicated. This loom can function by one person skilled or unskilled. As it does not involve heavy work, it can be easily operated by women also. The loom is versatile and cost effective.

Keywords: Coir fibre, Biological degradation, Geotextiles, Organic fibre, Powerloom, Soil erosion

Coir geotextiles have significantly proven their significance as these are weather resistant and hold high resistance to fungal and bacterial decomposition. The rate of decomposition of coir is much less than any other natural fibre.[1] These characteristics are attributed to the high lignin content in the fibre. Natural resiliency, durability and resistance to dampness and rot are the significant characteristics to use coir for manufacturing ropes, yarns, mats, mattings and rugs[2]. Coir, in the form of woven mesh matting or nonwoven stitch bonded blankets, is used in engineering applications in the geotechnical field. The lifetime of the coir geotextiles is determined by the sub grade soil strength which is denoted by CBR value which varies according to the soil type. If the tension carrying capacity of the geotextiles is less than that of the CBR value of that particular soil, it leads to generation of crack. The usage of coir, natural fibre, is the effective way to increase and modify the properties of the sub grade soil[3]. Geotextiles are mostly manufactured from synthetic polymeric materials. These materials are derived from the byproducts of petroleum – raw material which is becoming scarce with passage of time. A search for alternative raw materials, that are ecofriendly and available abundantly for years to come, led to a limited use of natural geotextiles. Limitations in mechanical properties and the lack of concerted developmental efforts of natural geotextiles are the two primary reasons for the present state of its unsatisfactory growth[4].

The most preliminary natural fibre used for geotextiles is jute followed by coir. Handlooms were initially used for manufacturing geotextile mattings without the involvement of machines. For handlooms, skilled and pundit weavers are required to manufacture the geotextile mattings. Manufacturing of geotextiles has always been an agenda in the business, and copious looms are further manufactured for the production purpose, depending upon the variability in the texture and sizing. The first mechanisations were implemented on the design of wooden loom which led to the development of semi automatic loom, which had functioned pneumatically. In order to run the semi automatic power looms, 350g of power was required to process, whereas in wooden loom almost 5 kg of force was to be exerted on the treadles. In view of above, the present study was undertaken to design and develop the fully automatic loom (Anugraha-Tejas), for geo textile production.

Experimental

Cast iron, the most significantly used iron for industrial purpose due to its extensive mechanical properties, was used for casting machine parts, such as treadle lever, tightening wheel, tappet, emery rollers and pulleys. This is brittle and possesses carbon greater than 2% and economical as compared to aluminium. Mild steel (MS) was used for fabricating the frame of the loom, take up rollers, winding roller and tightening roller. The crank shaft and the gears were fabricated using MS EN8, which is known for its strength and less carbon content. The heddle frames were made of GI tube and the reed was made from chromium steel. Shuttle and the picking stick were developed using compressed and seasoned wood. The guiding pulleys were fabricated using nylon, and the moving parts of the loom were covered using GI sheet.

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Fig. 1 — Automatic Anugraha Tejas loom

The warps are initially fed through the heddle frame and the weft (picking) through a shuttle medium which is ignited by picking sticks placed on either sides of the loom for continuous mechanisation. The picking occurs as the cam engages with the shaft, which heaves the shaft, resulting in ramming of the picking stick. The cycle is followed by beating, where the reed is moved longitudinal to the warps and results in tightening of them. Once the beating is completed, the next cycle is initiated and the second shaft is elevated leading to a reverse motion.

Results and Discussion

The automatic Anugraha Tejas (Fig. 1) is capable of producing an output above 800 m^2/ 2 shifts/ day. The width of the geotextile manufactured in Anugraha Tejas is limited to one meter during the development process and eventually the width can be increased depending upon the requirement. The operations performed in the loom can be fulfilled by one skilled or unskilled worker. Since the loom's operation doesn't involve heavy works to that of handlooms, women can easily operate the loom giving rise to women empowerment. The loom can function by one person, skilled or unskilled. The loom produces the geotextiles dimensioned width of 1m and can be manipulated as per the necessity.

Coir being a lignocellulosic natural fibre has its importance in the engineering field due to its properties such as tensile strength and yield strength[5]. These properties contribute a major role in the usage of coir fibre in various engineering arenas. The coir geotextiles with grass are found to be very much effective in preventing erosion in order to retain moisture and also facilitate stability of road pavements[6]. The hitch is predominantly reflected on the rural and diminutively on the sub-urban areas. The use of coir geotextiles is necessitated to avoid and also to overcome problems such as landslides and erosions. Hence, automatic Anugraha Tejas is certainly considered as a boon in the coir geotextiles industries. The geo textiles thus produced are proposed for various applications depending upon the ability and stability of the product. The loom consists of various gearing mechanisms varying from spur gears to ratchet gear mechanism.

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