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Preparation and properties of particle board from dry pine needles

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Abstract

Pinus roxburghii commonly known as Chir pine or long leaf Indian pine is a species of pine and is native to the Himalayas. Its home extends from Tibet and Afghanistan through Pakistan, northern states of India, Nepal and Bhutan up to Myanmar. Chir pine covers approximately 0.678 Mha area in three states of India namely Himachal Pradesh, Jammu & Kashmir and Uttarakhand. Out of these three states, Uttarakhand alone covers a major portion of the Pine needles. The study has been under taken to utilize abundantly available dry pine needles in hilly region of Uttarakhand state in order to deal with forest fires in summers and also to cope up with the waste.

Keywords: Pine, native, forest fires

Introduction

Pinus roxburghii commonly known as Chir pine or long leaf Indian pine is a species of pine and is native to the Himalayas. Its home extends from Tibet and Afghanistan through Pakistan, northern states of India, Nepal and Bhutan up to Myanmar. Chir pine covers approximately 0.678 Mha area in three states of India namely Himachal Pradesh, Jammu & Kashmir and Uttarakhand. Out of these three states, Uttarakhand alone covers a major portion (0.412 Mha) of Chir pine forests. The uses of Chir pine as a timber and fuel wood are among few major indigenous uses in Uttarakhand. During autumn, the dried needles form a dense carpet on the forest floor, which the local people gather in large bundles to serve as bedding for their cattle round the year. The green needles are used to make tiny hand brooms and other decorative items. Forests with Chir pine are very prone to fire as their foliage easily catches fire; however, the pine itself is resistant to it. Except few uses, as mentioned above, this enormously available biomass from pine forests remains underutilized.

Pine needles It is an eco-friendly material. They help to reduce the consumption of wood which in turn reduces or slows down the progress of deforestation and global warming. The material cost is low as it can be collected and recycled easily from the coconut-based product stores. Therefore, recycling coconut wastes and extracting the coconut fibre to transform it into useful products can be a better solution to the environmental issue while saving disposal cost. For decades, wood has been the main raw material for particleboards. Particleboard is readily manufactured from virtually any wood/timber material, including sawdust, mill residues and recycled wood as technology for particleboard manufacture advances. It is one of the oldest composites to be produced and has been the world's dominant furniture panel.

Methods

Preparation

Dry leaf waste were collected from the district of Nainital and Almora of Uttarakhand state. After collection of dry waste leaves of Pine trees lying on the floor, these were again sundried in natural environment so that no amount of moisture should remain in them. After that these leaves were chopped off into smaller particles so that it will become easier to grind them in the grinder in order to make powder out of it. The powder thus prepared is then sieved and is then passed through 2 mesh or around 2 mm fine particle size.

Adhesive used for this study were commercial Marine Fevicol which consist of polyvinyl alcohol (PVA) glue. About 1/3 part of adhesive is used i.e. for 4kgs of leaf powder, 1.3-1.4kgs of Fevicol is used to prepare a perfect particle.

Particle and adhesive mixture thus prepared is then poured into 30x20 cm mould and the thickness of the board was maintained around 1.5 cms. It is then placed in open environment for drying and making it hard. Some weights were put on it in order to press it and make it uniform. The board took about 40-50 days to completely dry.

Board Testing

The testing was conducted both for physical and mechanical. Board density, water absorption and thickness swelling were parameters measured for physical properties. Board mechanical properties were measured for its flexural strength, internal bond and screw withdrawal. Mechanical properties were tested using Universal Testing Machine.

Results and Discussion

Physical Properties Thickness swelling is the main parameter to describe the stability of dimension for particleboards. The thickness swelling of particleboards in this research were decreased with the increased percentage of the adhesive, both for PF and UF

Another properties that investigated in this study was screw withdrawal values So that in future some furnitures can be made by using the particle board thus prepared. The values were range between 189.06-650.13 N. The highest screw withdrawal was given by board with fine particle and 12%UF. Poor screw withdrawal on coarse size particleboard due to the wide surface area of particle lead to low adhesive absorption.

In conclusion,

wood waste from home industry sawmill can be utilized as raw material for particleboard. Dimensional stability of the boards increases with the increase of adhesive concentration. Physical properties of the boards mostly meet the requirement of standard (JIS A5908- 2003). The amount of adhesive affects the mechanical properties of the boards. 12% adhesive performs higher properties both physical and mechanical. Urea formaldehyde (UF) adhesive was more suitable with wood waste since it gives better testing result. Fine size particles (6 mesh or 2.00 mm) with either UF or PF 12% give superior board properties.

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