

INTRODUCTION

INTRODUCTION

Necessity is the mother of invention and in this era of technological development, man has tapped every resource to develop newer products. Beyond developing technologies for the benefit of mankind, it is also essential to study simultaneously their impact on the environment so that the cyclic processes which the nature has devised for conservation of resources is not affected. This on one hand has improved life but on other side increased ecological problems which have deep rooted pollution of land, air and water. Development in science and technology also had resulted in comforts and waste. In reference to this, waste management has become one of the significant factors on which academicians and researchers have to focus upon. Textiles, one of the vital industries contribute a major share to national Gross Domestic Product and simultaneously generate pollution.

Coimbatore (Tamilnadu, India) crowned to be the 'Manchester of India' is also referred to as the 'Spinning hub of South India'; with hundreds of spinning mills around the state. Cotton and its issues are inevitably of greater importance here. Cotton, the major textile crop plays an eminent role in pollution. During processing of converting cotton kapas from field into a textile material, various types of cotton wastes are reported to be expelled. The total cotton fiber consumption in our country is estimated to be 26 lakh tons per year, of which approximately 2, 10, 000 tons of cotton dust (non-saleable waste) is produced during yarn manufacturing process. Cotton Corporation of India Limited released the statistics on cotton consumption by textile mills that showcase 36.62 % (16, 38, 295 metric tons) of cotton is used by the mills from Tamilnadu.

These are usually taken to the willow mills for recovery of good quality cotton fibers. This leaves a final trash from cotton spinning process called willow waste or willow dust. This willow waste is too short a fiber to be used for any textile application and is just disposed off as landfills, which if not degraded properly leads to infectious diseases and release of foul odor causing a hindrance to the ecosystem and people. Most of these wastes are disposed off by burning, which in turn increase carbon dioxide level in the atmosphere which adds on to the global warming.

The recovered cotton fibers from willow mill were used to make low count coarse fabrics and in the production of nonwovens. The willow waste was purchased by the farmers to be used as bedding material in mushroom cultivation and as compost on agricultural fields to hold water for longer duration. Apart from these, the purchased waste was used as a stuffing material in upholsteries and as a raw material in making high quality papers. The local newspapers frequently highlight on the ill-effects of using this willow waste as food for cows and hens. Due to the depletion of grazing lands and economical downfall faced by farmers, the situation still persists without any solution. These damage the intestine and gut, causing severe pain and turn into a carcinogen which can even lead to the death of the animal, (28th September, 2012, 'Thinamalar', Coimbatore Edition). This directly and indirectly enters human food chain, polluting the whole system and ecological balance. Even though farmers and small scale industries reuse this willow waste, the available options are less compared to the quantity of waste generated. The majority of this waste, left as stock, however, is either incinerated or thrown away in landfills.

The material is usually stocked up to be disposed off into landfills annually which increase the risk of fire accidents. Apart from these, due to the dusty nature of the cotton dust, varied lung related problems have been reported to exist among mill workers, causing minor sinusitis to lung cancer. This is one of the major crises faced by cotton mill owners. Additionally, in rainy seasons and storing excess quantities, the situation becomes unmanageable and highly risky. There were fewer published data's related to willow waste and its reuse. The knowledge gap was found amidst industry personnel working with cotton wastes. Apart from few conventional reuse techniques, there was no awareness around the globe even between industrialists and professionals related to this industry. This added momentum to explore deeper into this issue and find solutions for future.

In this era of green consumerism people's preference for organic products has introduced number of inventory practices for the development and effective utilization of cotton textile and its by-products. The generation of waste was such that it got naturally recycled, being mostly biodegradable. Conversely, after the advent of industrial revolution different types of wastes came into existence which are often both non-biodegradable and highly hazardous.

Organic farming is popular now-a-days in order to bring back the fertility of the soil health, increase the water holding capacity of the soil, increase the nutrient count of the soil and hence prevent soil erosion. The micronutrients in the Indian soils have been depleted to a great extent due to application of synthetic fertilizers. Natural fertilizers, compost and soil amendment have enabled organic cotton to a viable enterprise.

A group of scholars from Guru Jambheshwar University of Science and Technology, Haryana (India), reported a study on application of earthworms in handling toxic textile sludge. Reports on pot culture experiments and analysis on the composition of the manure, confirms to be very effective and safe on plants. The research has confirmed that toxic textile sludge can be composted and vermicomposted. Therefore the waste could be recycled into a bio-compost by the use of vermicomposting and enzyme technology which can be a very convincing effort to reduce and recycle waste. In addition to creating home for millions of microorganisms it plays a vital role in reducing the toxicity of the wastes.

In view of global warming, reduction in deforestation has to be a concern for everyone. On the other hand, usage of paper has increased. An alternate source for paper making is the need of the hour. Willow waste gives a promising scope to produce degradable sheets that could be used for various applications, which definitely has an established market globally. Aesthetically appealing and eco-friendly degradable willow waste paper products will be a newer class of disposable and compostable paper products.

In a critical situation like the oil spill in Gulf of Mexico, where huge amount of crude oil is dispersed in the sea, the existing booms and skimmers were very less effective. The largest skimmer has the capacity to absorb 800 gallons of crude oil in one hour, which is commented to be relatively slow. Cotton based materials, are suggested to be a wondrous solution in sopping up the oil from seawater. This educates that cotton fibers perform greatly well when used as a medium to absorb water and oil. Apart the amazing property of cotton enhanced with suitable finishes, to absorb water, upto seventy times of its original weight [Singh et al., (2014), Singh and Ramkumar, (2014)], lay the foundation to test the efficacy of absorbent materials from the selected willow waste.

The global demand for energy is ever-increasing that has been triggering reason for identification of new renewable energy sources. Preparation of petroleum

reserves has also forced the exploration of other renewable energy resources. Cellulosic wastes generated in tons in an agricultural country like India can be used for the production of bio-energy. Willow waste when converted into a fuel material and will help the industries to add a newer knowledge on existing available fuel options.

As per the reports from OCED-FAE Agricultural outlook report (2013-2022). India is expected to be the top producer and world's largest producer of cotton by the year 2022. The overall world cotton production is also expected to grow at 1.6% per annum and it is published in the report that the consumption of cotton in India will be higher among any other country in the years to come, (www.fibre2fashion.com/news and <http://articles.Economictimes.Indiatimes.com>). As a natural process, the amount of wastes associated with this will also increase. This suggests the need for undertaking and exploring willow waste for sustainable solutions. The rationale behind the reported issues, research gaps identified and considering the lack of awareness on recycling options suitable for willow waste, the protocols were designed.

In a nutshell, a study to recycle and up-cycle the selected waste into the above listed products was momentous. The scope of the research encompasses of benefitting the farmers, industrialists, spinning and willow mill owners and to the ecology and future generations to come. The basis of the proposed research **“Exploring the recycling potentialities of cotton waste for production of innovative sustainable products”** is to add facts regarding the utilisation of willow waste in an eco-friendly means with sustainability as focal point.

The major objectives of the study is to,

- elicit information regarding types of spinning wastes and identify unused cotton fiber waste,
- analyze the composition and properties of selected cotton fiber waste,
- conduct various pilot studies and find suitable recycling techniques in developing innovative sustainable products and
- develop prototypes, test, analyze and compare the effectiveness of the prepared products.