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Green innovations: A new beginning of a low carbon economy

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ABSTRACT

Carbon footprint has become the latest global buzzword due to its non-friendly effects on the planet's ecosystem .The continuous deterioration of climate is mainly caused by the excessive release of green house gases (GHG) in the Earth's atmosphere. The growing awareness of environmental hazards has kindled a flame of innovations aimed at saving our planet. This paper outlines the various carbon-efficient advanced technological innovations in the field of textile sector aiming to accelerate clean revolution in the industry by reducing its carbon footprint and moving towards a new beginning of a low carbon economy and sustainable environment.

Key Words : Alternative sustainable fibres, New processing technologies; Recycling, Green machinery. Alternative carbon-neutral fuels, Low-emission technologies, Carbon capture storage (CCS) technologies

INTRODUCTION

Embracing a low carbon economy will be as momentous as the previous industrial revolutions. As the shift from coal to oil did. And the shift from gas light to electric light. It has the potential to give us the competitive edge in the new global economy. The scale of the challenge is extraordinary. We will need to reinvent in the way we live our lives, the way our world works–*Charles Hendry (June 2010), Minister for Energy, UK Government*

The higher concentration of Green House Gas (GHG) emissions in the atmosphere comprising of carbon dioxide (CO_2), methane(CH_4), nitrous oxide (N_2O), fluorocarbons and sulphur hexaflouride (SF_6) are the principal cause of global warming. With the growing environmental awareness among consumers and manufactureres, strict environmental norms, emerging of sensitivities related to sustainability, global challenges of building a more sustainable future,has become imperative in today's throat cutting competitive era for the manufacturers to come forward together and seek solutions to reduce the environmental impact, and then measure the progress, and finally benchmark a sound management towards reducing that impact. Textile sector being one of the major sources of emission of green house gases (GHG) needs to make serious commitments in terms of reducing its environmental impact through innovations in textile manufacturing.

Global textile industry has developed many innovative products and processes related to use of alternate sustainable technologies; reuse and recycling of water and wastes; conservation of energy; making the chemical processing eco-friendly to ultimately reduce the carbon emissions. Adoption of these innovative technologies will not only lead to the competitive sustainable development of textile

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and garment enterprises but also contribute towards India's voluntary commitment to reduce carbon emission by 25~40% before 2020 using 1990 as the base line in the Copenhagen conference in 2009.These are discussed in the succeeding paragraphs.

Alternative sustainable fibres and fabrics :

These fibres are biodegradable, eco-friendly and renewable which can be grown without herbicides, fungicides or pesticides, using less of energy or fuel, water and hence leaving a smaller footprint on the environment.

Use of *Bio-fibres* such as *Bamboo fibre* with its ability to sequesters 4 times more carbon dioxide and release 35% more oxygen than equivalent number of trees without the use of fertilizers; *Soy fibre* with its ability to minimize release of methane gas in landfills as it is derived from hulls of soybeans (left over after food production)*; Hemp fibre* being ideal for carbon sequestering as it quickly absorbs and stores CO_2 as plant matter; *Wool fibre* as an eco-friendly alternative to petroleum-based synthetics; and *Pina Fabric* with no requirement of pesticides ; and *Bark Cloth* with less water requirement and no carbon emissions are ideal for sustainable future.

Recycled fibres are 100% biodegradable and made of natural fibres, using clean manufacturing process with less water and pesticide consumption. *Tencel® (PLA)* is derived from corn developed by Nature Works LLC J4 and its production processes requires 20% to 50% less fossil fuel and very little dye to get deep colour. *Sorona bio-PDO fibre* is developed by DuPont from corn reducing carbon emissions by 30% and its manufacturing process further reduces greenhouse gas emissions by 63 %.*Crailar® Flax* is developed by Naturally Advanced Technologies Inc. for Levi Strauss & Co and requires 99% less water from cotton and minimal pesticides or herbicides (Ask Scientific,2014). *Eco-Fi, or Ecospun* is a polyester fibre made from recycled plastic bottles. *Lenpur* is an eco-friendly fibre made from the pulp of sustainable white fir trees.

Organic fabrics which are non-genetically engineered materials grown with natural fertilizers requires less than 63% of the energy than non-organic farming and engages in carbon sequestration by adding between 100-400kg of carbon per hectare to the soil each year.

Herbal textiles uses herbal extractions as well as vegetable dyes and natural substances like Indigo and Turmeric for skin, Cuscus grass for asthma, Sandalwood for stress etc on the fabric without contamination of water making it another eco friendly alternative.

New sustainable processing technologies :

Many eco-efficient finishing solutions in the form of innovative processing products and processes are used in textile sector which contribute to saving of resources and further reducing carbon emissions.

Innovation Processing Products such as *Azo free Dyes* does not require any chemicals or toxics for extraction and later its biomass can be used for energy generation. *Color Fast Finish system* is developed by 'BASF', as an intelligent coloration system, that combines dyeing, washing and finishing steps into one step, reducing the processing time and carbon dioxide emissions. *Tularevs XL dyes* are reactive dyes with higher fixative, low wash off and uniform sustainable dyeing with right first time (RFT) performance thus saving energy and water due to short dyeing and wash off cycle. *Cyclanon XC* are developed by German chemical firm 'BASF' as an after soaping agent which reduces the processing time and water consumption in comparison to the conventional system. *Industrial biodegradable and non corroding enzymes* are used for carrying out processing of fabrics such as scouring, stone washing, bleaching, dye wash off, desizing, softening etc leading to reduction in the usage of water and energy example-Ecostone®, Biotouch® , lipase or cellulose, Amylase etc.*Avitera™ Se and Eriopon Lt* are developed by The Huntsman Textile Effects team as a clearing additive, leading to 50% reduction in water in comparison to conventional technology. *Rucogen SOP* (Save Our Planet)

Ter-polymer derivative are used as eco-friendly washing off agent which reduces number of wash off baths and loads of colored water effluent. *Rucoflow CPB Liquid buffered alkali* are used for dye penetration which reduces the consumption of water and energy by simplifying the effluent treatment.

Innovative Processes such as *Cold Pad Batch Dyeing Technology* developed by the Australian Dyeing Company, reduces consumption of water by 45%, steam by 48%, electricity by 33%, salt by 100%,and emits 13% less carbondioxide in comparison to the conventional exhaust dyeing. *Air Dye Technology* developed by Colorep (California) causes massive reduction in the water usage from 200 Ltrs to 50 Ltrs and also eliminates the requirement of boilers, screen printing machines, scouring, chemicals etc. *Cold Transfer printing* also known as Cooltrans printing, enhances 99% of the dye transfer rate, 95% of print fixation, saves 87% of water and more than 31.5% energy. *Digital Printing Process* produces no wastes either of fabric, salt or ink, saves enormous amounts of dyes, water and energy, and worn designs can be printed directly on the jeans, reducing the finish-treatments greatly. *Advanced Denim technology* developed by Clariant reduces water consumption by 92%, generation of cotton waste by 63% and energy costs by 30%.

Simple modifications in processes by combination processes of dyeing and finishing process or various finishing processes saves water, time and energy with no intermittent washing, post dyeing wash off sequence and effluent treatment. *Low Liquor Processing Dyeing or finshing processes* where fixation can be done at the reduced liquor ratio results in reduced energy requirement in drying. *Low Temperature Drying* helps in developing the finish liquor composition that permits the finish fixation at reduced temperature. *Alternative Processing* such as Plasma finishing, Superficial CO_2 dyeing/finishing leads to energy and water conservation through recycling of dyeing waste water.

Recycling of wastes, water and textiles :

Recycling of wastes to make the products saves energy, natural resources, reduces GHG emissions and also prevents wastes going to landfills. It also prevents the release of methane gas from waste in the landfill, which has the capacity to heat up the atmosphere 21 times more than CO_2.*Waste heat* can be used in heat exchange devices while waste plastic bottles can be degraded into terephthalic acid (PTA), a major raw material used in making eco-friendly polyester fabrics 'waste2wear® fabrics' having zero carbon foot print. *Waste water* can be used in recycling of waste water from scouring, bleaching and dyeing processes; *Waste fabric* can be used in making fabrics and accessories, mattress filling, insulation and soundproofing for cars. *Paper waste* can be used for construction blocks known as 'greenbloks'

Green machinery and modifications :

Machine manufacturers of the world have developed various machine designs and have incorporated many modifications with the aim of reducing level of water or energy consumption. *Low Liquor Ratio Machines* reduces the consumption of water during pretreatment, dyeing and post dyeing wash off sequence. It also reduces energy for water heating at various processing steps and effective load on the effluent treatment. *Innovative finishing machine* developed by Gaston systems of USA applies finishes to fabrics using foam, hence conserving water. *Waterless dyeing machine* developed by DyeCoo Textile Systems of Netherlands uses carbon dioxide (CO_2) as a replacement for water to dye polyester, makes dyeing possible without water, chemicals and drying. *Insulation and heat recovery system* can be added in dyeing, drying and stenter machines to avoid undesired energy loss. *Filtration process* can be installed to recycle or re-use process water and alkali.

Alternative and carbon-neutral fuels :

The search for new alternatives to hydrocarbon fuels for transportation and electricity generation is going on vigorously due to increasing price, degrading effect of fossil fuels on the Earth's atmosphere

and desire to reduce green house gas emissions. *Hydrogen* is a renewable, carbon-free fuel and is cheaper than gasoline. Its combustion does not produce green house gases and produces only water vapor. *Bio fuels* such as biodiesel and bio ethanol are clean renewable alternative bio fuel as they are derived from wide range of vegetable oils, animal fats and plant materials. *Propane (LPG)* which is a by-product of natural gas processing and crude oil refining. It is less toxic with lower carbon content, low emission of GHG emissions and short lifetime (<2%) in the atmosphere than other fuels. *Nuclear Energy* is a safe, cost-effective and environmentally attractive source of power. The carbon emissions are relatively low through entire nuclear production even in comparison to wind energy.

Renewable and low-emission technologies :

Wind, solar power, hydro, tidal waves and biomass form better alternatives to the traditional high-carbon fossil fuels. Micro generation *i.e.* production of heat or electricity, usually from a low carbon source at the industry level including solar photovoltaic, micro-wind turbines, solar thermal water heating, fuel cells, micro combined heat and power, heat pumps, micro-hydro power schemes and biomass boilers is the answer to the fulfillment of the low-emission targets of the industries.

Carbon neutral or low emission transport :

The transportation sector consumes more than half of the oil reserves contributing to the emission of 21% greenhouse gases on the Earth. In order to combat global warming, reducing the vehicle emissions have to be on the top of the green agenda with the following measures:-

– *Fully-electric powered vehicles* charging its batteries from renewable source.

– *Electric Car Battery Technologies* -Eco Alkalines™ battery range with Carbonfree® product certification. Lithium-ion batteries are also reliable, high-density and carbon neutral batteries.

– *Fuel Cell Vehicle*-Fuel cell conversion either hydrogen, or a wide range of hydrocarbons and alcohols, into electricity and heat, at high efficiency and with low emissions

– *Hybrid Cars* use two or more distinct power sources *i.e.* traditional gas powered engine and electric motor powered by a battery. Energy efficiency is obtained by allowing kinetic energy to recharge the battery during braking, this being the main reason of reduced CO_2 emissions.

Carbon capture and storage (CCS) technologies :

The CCS technology in the form of Pre-combustion capture, Post- combustion capture and Oxyfuel capture can be used to modify fossil-fuel-burning power stations where the CO_2 generated normally going up the chimney is captured and safely stored in the ground during power production leading to purification of emissions.

Conclusion :

These above mentioned creative and thoughtful innovations have been developed by the textile industry in the world in response to the constant pressure from the environment conscious consumers and buyers. It can be a major step in fulfilling the commitment of environmental sustainability especially in terms of carbon emissions reduction by the textile manufacturers as well as their buyers.

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