Ongoing Projects Sponsored By Ministry of Textile

ONGOING PROJECTS

I MECHANICAL PROCESSING

1. Smart shade-net through auto-regulation of thermal and light radiation

Shade-net is used to cut-off the extra sunlight and allow the remaining desired sunlight to the plant. Plants require the sunlight reaching them should be in diffused form not in specular form. Conventional shade-nets cut the extra sunlight but direct the desired sunlight to the plants mostly in specular form which is undesired. In tropical and sub-tropical regions sunlight present in the day time is extreme and temperature is also very high. So to get the optimum results it is required to keep sunlight and temperature both at optimum level. Thermal energy which causes rise in temperature is carried by the Infrared portion of the spectrum. Conventional shade-net are transparent to the infrared radiation, which causes rise in temperature inside the net-house. Thus, project envisages developing shade-nets which can reflect IR energy along with the light energy and simultaneously incoming light to be more suitable i.e. in diffused form.

As per objective, various IR reflective materials were studied. Based on the study, TiO_2 and silver nano particles based materials were identified as suitable raw material for regulation of light and thermal behaviour. Development of Nanocomposite filament with 0.5 wt % of nanomaterial capable of regulating light and thermal behaviour is done. Development of shade nets from the nanocomposite filament is being planned.

2. Development of multi-purpose shade net for water harvesting

Atmospheric water is generally clean, does not contain harmful micro-organisms and is immediately suitable for irrigation purposes. Given that fog harvesting is particularly suitable for mountainous areas where communities often live in remote condition, capital investment and other costs are generally found to be low in comparison with conventional sources of water supply. Currently the villagers have to travel long distances to collect water and it is time and energy consuming. The water harvesting by the proposed technology would enable them to harvest and use water at their locales itself.

The proposed nets will be made from a polypropylene mesh that is extremely efficient at collecting water droplets. Different structures of the shade net suitable for the application for water harvesting is being studied and samples are being developed with different geometry of the tape and filament yarn.

Simultaneously the coating chemicals have been identified for enhancing the condensation. Weather data related to North east foggy region has been collected. Lab Model has been set-up with artificial climate control to study optimum shade-Net structure for actual field trials. The plan for the installation of the nets and positioning of the nets in the north east region is being explored.

3. Design and development of an instrumental set up for measuring the wind blockage percentage of horticultural wind break nets

Wind break nets are used to give protection to the crops. Windy conditions can often double the amount of fuel needed to heat a greenhouse or nursery structure. Properly designed windbreaks have been shown in some cases to cut structural heating and cooling costs by as much as 10 to 40 percent. In areas with hot, dry winds, windbreaks can reduce the summertime cost of cooling greenhouse. Control of above factors helps in getting optimum yield of crop. Wind nets are manufactured by knitting / weaving Polypropylene /polyester monofilament / tape yarns with varied constructions. Till date however, noinstrument is available to quantify the amount of wind blockage achieved by the net. Hence, the proposed project aims at development of a set up for measuring wind blockage percentage of nets which is one of the key parameter in protection of crops.

As per the objective of the project, the wind velocity and pressure levels at different zones of the country were studied. Schematic diagram of the machine was finalised and various components required for the set-up is being procured. The working range for the parameters such as wind velocity, temperature and relative humidity has been identified. Fabrication work of the set-up has commenced as per the finalised design.

4. Development of next generation thermochromatic thermoregulatory agrotextiles for horticulture application

Intensity of sunlight increases from morning to noon and sometimes its intensity is so high that it can affect the growth of plant or effects it survival. Shade nets protect them from excessive sunlight however when sunlight is less it hampers the photosynthesis. In this project, it is proposed to develop photochromic/ thermoregulatory agrotextiles for horticulture/agriculture application. The envisaged agrotextile fabric will be active in nature and responsive to the change in light intensity. It may gradually change from colorless state to dark color along with the increased light intensity. So this unique fabric will reflect the variable screening property and keep the availability of light to the plants at optimum level that may enhance the plant productivity and quality.

The project work commenced from 1st April 2018.

5. Development of High Strength Cost effective Seamless Technical Circular Fabric from Heavy Denier Multifilament Yarns

Seam is always a problem in a circular fabric as strength of the fabric at seam is less [15-20%] from other parts of the fabric. During their application all parts of the fabric come under stress and there are always chances of failure at seam. Thus, seamless circular fabrics are ideal for such applications. Thus, in this project it is envisaged to develop technical fabric using heavy denier multifilament yarns which may be used in both warp and weft directions. There will not be any seam in the envisaged fabrics. Technical fabrics may be seamless as well as flat. So fabric will be homogeneous and have same strength in all parts of the fabric in warp direction. Owing to the same strength in all parts, envisaged seamless fabrics can be ideal for applications like Geo-tubes, Geo-bags, Geo-textile encased columns in road construction, fire escape chute systems fabrics etc. The envisaged method to develop fabric by circular weaving system will bypass several processes being currently used in conventional woven fabric development and weave directly, which saves considerable cost and time.

The project work commenced from 1st April 2018.

6. Design & development of a digital instrument for measuring the thermoregulatory properties of textiles

There are few fabrics available in the market which can control the body temperature and keep the wearer cool in a hot weather or warm in an extremely cold weather. Some fabric manufacturers claims that their innovative fabric can reduce the body temperature by around 10-15 °C. But unfortunately, there is no such instrument available in the market to objectively assess this sort of thermoregulatory properties of functional textiles.

SASMIRA has already developed the instrument for measuring the thermal conductivity of Textiles. Under this proposed project, the same instrument may be modified suitable for measuring the thermal regulatory properties of the fabric in transient method as well as steady state method. The instrument will also be particularly useful in the objective assessment of the cooling effect of the textiles, where there is no instrument available worldwide.

The project work commenced from 1st April 2018.

7. PP/Jute hybrid mulch mat for moisture and temperature management in horticulture application

Mulching is a technique of covering soil with some suitable means like straw, film, Agrotextile ground/mulch cover. It suppresses the weed growth around the plant. Two main products which are currently being used for mulching application are mulching film and Agrotextile Ground Cover. Mulching films have several drawbacks viz. Non-biodegradable in nature, Single use, Low strength (Makes it susceptible to tear and damage during its usage). Based-upon the nature of material used Agrotextile mulch/ground cover is divided into two broad categories, one is synthetic mulch e.g. PP and HDPE mulch mat another one is mulch mat made-of natural material like Jute.Synthetic mulch is strong but non-biodegradable although recyclable while jute mulch is bio-degradable but GSM of the suitable mulch is generally very high. Thus, this project envisages developing a PP/Jute hybrid mulch. To preserve the biodegradable nature of jute, PP would be mixed with keratin extracted from waste like chicken feathers. The proposed hybrid mulch fabric would combine the positives of two categories and eliminate the negative effects. The envisaged product would be relatively light weight and less porous, it will facilitate creating appropriate environment for cultivation.

As per objective, literature survey has been completed, suitable raw material (PP and Jute material) has been identified. Material development viz.compounding of UV additive to PP polymer is in process.

II. CHEMICAL PROCESSING

1. Development of biodegradable agro textile products for horticulture application using keratin based waste products

Currently, nursery containers are produced using materials obtained from oil or natural gas and are becoming an increasingly expensive commodity. Biodegradable nursery containers would be boon to the environment and producers alike. In this project, it is envisaged to make biodegradable pots from chicken feathers for horticulture applications. As proposed in the project, these pots will be made of keratin and PP/PMMA will have a better shelf life and will not crack or wither as fast as their plastic counterparts. The percentage ofpolymeric addition to the keratin will be optimized to get the desired biodegradable extent and shelf life.

Literature survey was done for finding out various ways of keratin extraction from chicken feathers. Methods like chemical extraction (sulphitolysis method), enzymatic extraction and using hydrophobic ionic liquids were applied to extract keratin. Various protein extraction methods have been identified and optimization of pretreatment process for chicken feathers with respect to different extraction assay is in progress. Optimization of proper plasticization parameters is in progress.

2. Biological synthesis of bio-degradable textile polymer

Modern life has been influenced by plastic due to their useful physical properties and low production cost all these plastic polymers are derived from non-renewable petrochemicals and are non-bio-degradable which ultimately pollutes the environment. Currently there is no potential substrate which can replace the plastic which is need of the hour. In this idea it is proposed a methodology for the development of biopolymer which can have more or less similar properties like plastic and it can used as substitute of the plastic in many areas e.g. sapling bags.

As per objective of the project, nine Poly (hydroxybutyrate) (PHB), a polyester producing bacteria have been isolated for the synthesis of bio degradable textile polymer. These Poly (hydroxybutyrate) (PHB) are being extracted and the best combination will be used for production of the textile polymer by extrusion or moulding and applied as agricultural ground covers / crop covers.

3. Biotransformation of naturally occurring phenolic compounds for development of eco-friendly flame retardants (FR) for imparting functionality to textiles

Eco-friendly FRs are the need of the hour. All halogenated FR currently in use are toxic and carcinogenic in nature. These materials are banned in most countries. Other FR materials need strong chemicals, reagents and high temperature for synthesis. Hence, an enzymatic biotransformation is most viable option being economical affordable, eco-friendly and energy conserving. The aim of this project is to create a new novel class of non-halogenated flameretardants with good char and heat release capacities by the use of biocatalytic enzymes in predominantly aqueous / benign solvent environment. Also use of renewable raw materials (monomers and catalysts) for the synthesis of these FRs will be attempted.

Readily available Cardanol was procured and were characterized for phenol content. Other Natural sources like pomegranate were also explored for extraction of Phenolic Compounds. Extractions of enzymes required for bio transformation are underway. The formulation of the flame retardant auxiliary from the enzymatic route is being developed. The optimized formulation will be applied as a flame retardant chemical for textile and the comparison will be made with synthetic flame retardants.

A paper on “Biotransformation of naturally occurring phenols and their application for development of eco-friendly Flame Retardants” was presented at 14th Asian Textile Conference (ATC-14)” held at Hong Kong on 30th June 2017.

4. Establishment of methodology for green processing of cotton using supercritical carbon dioxide technology

Cotton is the most important natural fibre used in the textile industries worldwide. A significant part of the apparel export from India is dominated by cotton garments. The wet processing on cotton consumes huge amount of chemicals and water. The waste water thus generated after the processing of cotton is discharged as effluent. This has caused serious environmental problems. Alternative methods are being used to save water viz., low liquor ratio, pad-sizing, ozone processing, enzyme desizing, multiple wet cycle for garment washing, removing water from stone wash, etc. However, all these methods have not been able to minimize the effluent load from wet processing's of cotton. Supercritical carbon dioxide (SC-CO2) technology as an alternative to present conventional method can be considered.

SASMIRA with support from Ministry of Textiles has developed prototype of SC-CO2 set-up on which polyester dyeing has shown encouraging results. In the proposed project it is envisaged to establish a methodology for green processing of cotton using SC-CO2 technology. Various wet processing trials viz., scouring, desizing, bleaching, dyeing, etc. would be conducted on this set-up to establish and develop waterless processing of cotton.

The project work commenced from 1st April 2018.

5. Design and development of low cost reusable sanitary pads for Indian women

India produces several hundred million used sanitary pads a month, but has no disposal protocols. Incinerators are rare and can have unpleasant environmental impacts if used at scale. Commercial pads are too expensive for most underprivileged schoolgirls and young women. They opt for low cost reusable cloth pads which however, are unhygienic and uncomfortable. An initiative to make available sustainable low cost, safe, absorbent and degradable quality sanitary pads to the poor schoolgirls and young women is necessary. Thus, the project envisages designing and developing low cost reusable sanitary pads using locally available biodegradable materials.

The project work commenced from 1st April 2018.