Icecube Assisted Extraction of Euphorbia Tirucalli Fiber a New Frontier in Sustainable Textiles

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***Abstract*—A major focus of this research is the environmental impact of using *Euphorbia tirucalli* dye, especially in comparison to conventional synthetic dyes. The textile industry is increasingly looking to sustainable alternatives to synthetic dyes in light of growing environmental concerns. This study examines the extraction of natural dyes from *Euphorbia tirucalli* (also known as pencil plant), a hardy, drought-resistant species, for use in green textiles. The extraction process was optimized through experimentation with different solvents, temperatures, and extraction times to maximize the dye yield. The chemical characterization of the dye reveals its potential for producing a range of vibrant colors suitable for textile applications. In addition, the study examines the dye's performance on various fabrics, evaluating color fastness, durability, and overall aesthetic quality. To emphasize the environmental benefits of plant-based colors, toxicity testing, biodegradability, and water use were evaluated. The findings imply that *Euphorbia tirucalli* presents a viable substitute that will lessen reliance on dangerous synthetic dyes while also encouraging sustainability in the textile sector. According to this study, the use of plant-based dyes, such *Euphorbia tirucalli*, can greatly aid in the creation of environmentally friendly, sustainable textile goods while satisfying market expectations for high-performance, low-impact materials.**

***Index Terms*—Dye, Plant-based colors, Sustainability, Low-impact materials.**

I. INTRODUCTION

My research focused on comparing the varieties of natural fiber that have been case-studied with those used in technological textiles. learned about the research of fiber source types and procedures. Inductive education on natural fibers from historical to contemporary identifying fresh concepts in the present and improving them in the future *Euphorbia tirucalli* is a multifunctional plant of great importance. You are aware of latex's cytotoxicity, which enhanced further adjustments to the investigation in my research. Numerous medical applications for it have been partially verified by testing. The use of latex in conventional medicine should be discouraged due to its associations with the epidemiology of Burkitt's lymphoma and its ability to promote tumor growth. To fully understand its antibacterial and anti-arthritic properties, more research is necessary. Originally, a woven fabric and the weaving techniques were referred to as "textiles." Any material composed of yarns or interlacing fibers is referred to as a textile. Raw wool, flax, cotton, or other material fibers are spun into long strands to create yarn. Weaving, knitting, crocheting, knotting, or pressing fibers together are methods used to create textiles. investigation. Industrialization and the advent of contemporary manufacturing processes have drastically changed the pace and scope of textile production, which is a craft. Nonetheless, there aren't many differences between the traditional and contemporary techniques for the three main categories of textiles satin, twill, and plain weave. Over time, the phrase has acquired broader meanings, such as adhering to the fiber. Staple fibers and filaments for use in yarn production or in the making of tufted, knitted, woven, or nonwoven textiles, yarns manufactured from synthetic or natural fibers Fabrics and other items manufactured from yarns or fibers, as well as clothing and other items made from the aforementioned materials that keep their original drape and flexibility. Natural fibers are those that originate from the bodies of plants or animals, or from geological processes. They can be a part of composite materials, in which the qualities are affected by the orientation of the fibers. Let's examine the fiber around

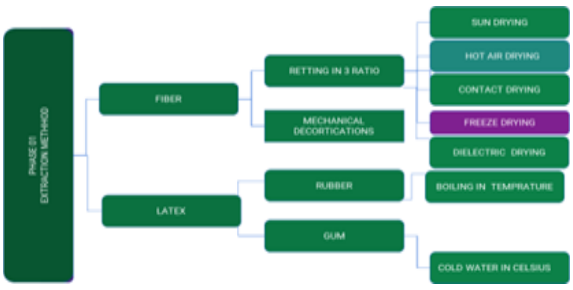
and the blends of other natural materials with *Euphorbia tirucalli.*

OBJECTIVES:

- To observe the environmental problems due to synthetic fibre and to identify the solution using zero waste management and natural fibre
- To understand about extraction and blending process of natural fibre and study about fibre composition
- To analyze the testing process of fibre taken and to review the toxicity in humans of *Euphorbia tirucalli* plants.
- Describe the typical history and physical findings following *Euphorbia tirucalli sap* exposure.
- Outline the evaluation and treatment of common *Euphorbia tirucalli sap* exposures.
- Identify and describe the treatment of severe complications related to *Euphorbia tirucalli sap* exposure.

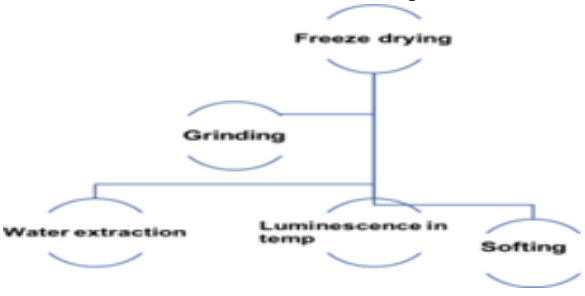
II. EXPERIMENTAL PROCEDURE

The experimental procedure pertaining to the title "Extraction of *Euphorbia tirucalli* and Development of woven fabric using *Euphorbia tirucalli, Cannabis Sativa ssp. Sativa*"



Flowchart of methodology of Euphorbia tirucalli

Flow Chart of Freeze Extraction of Euphorbia tirucalli



Natural fiber

Natural fibre's or natural fibres are fibre's that are produced by geological processes, or from the bodies of plants or animals. They can be used as a component of composite materials, where the orientation of fibre's impacts the properties**.** And which has made from different ways it has been developed in woven as well nonwoven to give a unique idea on the development

Selection of Natural fiber

Euphorbia tirucalli fiber

Euphorbia tirucalli L. is a flowering shrub or tiny tree, indigenous to temperate regions. It is useful in the treatment of whooping cough, asthma, dyspepsia, colic, jaundice and some more ailments. Aim of the present investigation was to study pharmacognostical and physico- chemical screening of E. tirucalli stem-bark.

Cannabis sativa ssp.sativa

Cannabis sativa is an annual herbaceous flowering plant indigenous to Eastern Asia, but now of cosmopolitan distribution due to widespread cultivation. It has been cultivated throughout recorded history, used as a source of industrial fibre, seed oil, food, recreation, religious and spiritual moods and medicine.

Gossypium Herbaceum

Gossypium herbaceum, commonly known as Levant cotton, is a species of cotton native to the semi-arid regions of sub-Saharan Africa and Arabia, where it still grows perennially in the wild as a shrub.

Extraction of *Euphorbia tirucalli* fiber

Sun Drying of *Euphorbia tirucalli* fiber

Sun drying is the evaporation of water from products by sun or solar heat, assisted by movement of surrounding air.To be successful, it demands a rainless season of bright sunshine and temperatures above 98° F coinciding with the period of product maturity. Sun drying requires considerable care. So, the research has taken to ratio of 5:5:5 in sun dry for a week to check its properties of Euphorbia tirucall

Hot Air Drying of *Euphorbia tirucalli* fiber

Hot air drying (HAD) is the most commonly employed commercial technique for drying vegetables and fruits,

in which heat is transferred from the hot air to the product by convection, and evaporated water is transported to the air also by convection.
Few ratios have done for trying with Hot Air dry to know how it takes this fiber because it's a few creations of developing with Euphorbia tirucalli

Freeze Drying of *Euphorbia tirucalli* fiber
Freeze drying, also known as lyophilization or cryodesiccation, is a low temperature dehydration process that involves freezing the product and lowering pressure, removing the ice by sublimation. This is in contrast to dehydration by most conventional methods that evaporate water using heat. Freeze-drying causes less damage to the substance than other dehydration methods using higher temperatures. Nutrient factors that are sensitive to heat are lost less in the process as compared to the processes incorporating heat treatment for drying purposes.
Freeze-drying is a process in which water is sublimated by the direct transition of water from solid (ice) to vapor, thus omitting the liquid state, and then desorbing water from the "dry" layer. This process has been taken out of Euphorbia tirucalli. To hence, the strength of fiber and it has to remora latex from the fiberFreeze Drying is a process in which a completely frozen sample is placed under a vacuum in order to remove water or other solvents from the sample, allowing the ice to change directly from a solid to a vapor without passing through a liquid phase Freeze drying (also known as lyophilization) is a water removal process typically used to preserve perishable materials.

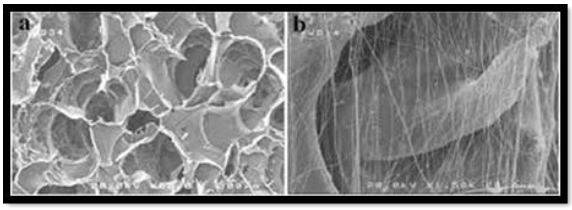


Figure- 3
After Freeze Drying of *Euphorbia tirucalli*

Dielectric Drying of *Euphorbia tirucalli* fiber
Dielectric properties of textile materials are orchestrated by their internal components has far-reaching implications. For the development of textile-based electronics, which have gained ever-increasing attention for their uniquely combined features of electronics and traditional fabrics, both performance and form factor are critically dependent on the dielectric properties.
The knowledge of the dielectric properties of textile materials is thus crucial in successful design and operation of textile-based electronics. While the dielectric properties of textile materials could be estimated to some extent from the compositional profiles, recent studies have identified various additional factors that have also substantial influence.

Boiling in Temperature of *Euphorbia tirucalli* fiber
The most general reason for heat setting is to achieve the dimensional stability of a yarn or fabric containing thermoplastic fibers. Heat setting is a heat treatment by which shape retention, crease resistance, resilience and elasticity are imparted to the fibers.These changes are connected with the structural and chemical modifications occurring in the fibre. Heat setting is carried out at high temperature, usually with hot water, steam, or dry heat. The selection of the heat setting method depends on the textile material fibre is carried out. it takes around 1 hr of boiling of Euphorbia tirucalli.

Retting(water) of *Euphorbia tirucalli* fibe
In retting process, the fiber is taken for two weeks in soaking in water because of the fiber level in the ration It shows high level of removing the latex in the fiber once it is soaked in the water.
After thee two weeks it was easily to remove the latex for the fiber content but compared with freeze method this was 20% higher than latex level in the fiber. So, only freeze method is been taken for the removal of the fiber.

Cutting of *Euphorbia tirucalli* fiber
For most growers, straight combining is the preferred method of harvesting Euphorbia tirucalli and commercial hemp for blending both with same ration and measurement of the fiber. The combine header is lifted to cut the crop just below the head, which typically is the top one-third of the plant (top 60 to 90 cm or 23 to 35 in.). After cutting them into the measurement they will be blended with Gossypium Herbaceum.
Blending of *Euphorbia tirucalli* fiber and Gossypium Herbaceum.

Table 1-Fiber Blending for fabrication

Fiber	*Euphorbia tirucalli*	*Gossypium Herbaceum*
Ratio	50	50
Fiber	*Cannabissativa ssp.sativa*	*Gossypium Herbaceum*
Ratio	50	50

From the table, the ratio has taken for blending process accordingly of;

Euphorbia tirucalli,and Gossypium Herbaceum 50:50

*Cannabissativa ssp.sativa, and Gossypium Herbaceum.*50:50

Carding process of *Euphorbia tirucalli* fiber and Gossypium Herbaceum.

Carding is a mechanical process that disentangles, cleans and intermixes fibers to produce a continuous web or sliver

suitable for subsequent processing. In carding process the ratio

selected was taken above and the Gossypium Herbaceum and the ratio of Euphorbia tirucalli has laid top of the it and it has been ruined Then the sliver is been taken for the next process with the ration of fiber then all sliver is been taken to drawing process.

Selection of fabric formation

Fiber Blending for fabrication

Fabric	*Cannabissativa ssp.sativa + Gossypium Herbaceum*	*Euphorbia tirucalli + Gossypium Herbaceum*
Composition	50:50	50:50

After the drawing process decided to make woven and nonwoven but the first preference was woven because nonwoven should be learned. In future nonwoven process will be decided and done for technical textiles. And the project was about yarn to fabrication.

Yarn processing

Yarn production is a process of converting fiber's into yarn. It consists of different processes. There are two main processes of making fabric from yarn are weaving and knitting. Weaving. Weaving is the process of taking threads and making them into cloth. Weaving is the process of arranging two sets of yams together to make a fabric. It is most often done on looms.

So, the fiber has converted into sliver then sliver to rotor spinning is selected for yarn formation. Yarn count is 20s. And yarn is taken for weaving process for fabrication

Weaving

Weaving is a method of textile production in which two distinct sets of yarns or threads are interlaced at right angles to form a fabric or cloth. When it comes to weaving the yarn of

Euphorbia tirucalli .

Fiber Characterization

Fiber Composition

A fabric's fiber composition is the percentage by weight of each fiber making up that fabric. And the amount of fiber which is take into ratio has developed accordingly to the fiber combination on the base of Fabric characterization, Structural properties, Mechanical properties, Moisture properties. Fiber consists of non-starch polysaccharides and other plant components such as cellulose, resistant starch, resistant dextrins, inulin, lignins, chitins (in fungi), pectins, beta-glucans, anoligosaccharides. It required the content of cellulose, hemicelluloses, lignin, pectin, and wax.The composition of fibers depends on the geographic location where the plants are grown up.

Cytotoxicity (fiber)

Cytotoxicity is defined as the toxicity caused due to the action of chemotherapeutic agents on living cells. Cytotoxicity tests are very important in nanoparticles as they help in the determination of the proposed biomedical use. Accordingly, to the fiber as per ISO-10993- 5 the given sample Euphorbia Triucalli showed Mild to severe cytotoxicity to L929 cells after 24 hrs. Control showed none cytotoxicity as expected. In the method of MTT Assay and Incubation of 37o c with 5% CO2 (Direct method)

Cytotoxicity (Latex)

Cytotoxicity is defined as the toxicity caused due to the action of chemotherapeutic agents on living cells. Cytotoxicity tests are very important in nanoparticles as they help in the determination of the proposed biomedical use.

Accordingly, to the fiber as per ISO-10993-5 the given sample Euphorbia Triucalli showed Mild to severe cytotoxicity to L929 cells after 24 hrs. cytotoxicity as expected. In the method of MTT Assay and Incubation of 37°C with 5% CO2 (Direct method)

Cell Viability

Cell viability is a measure of the proportion of live, healthy cells within a population. Cell viability assays are used to determine the overall health of cells, optimize culture or experimental conditions, and to measure cell survival following treatment with compounds, such as during a drug screen.Accordingly, to the fiber as per ISO-10993-5 the given sample Euphorbia Triucalli showed Mild to severe cytotoxicity to L929 cells after 24 hrs. Control showed none cytotoxicity as expected. In the method of MTT Assay and Incubation of 37°C with 5% CO2 (Direct method)

Moisture content & Regain

The amount of moisture present in a textile fabric is expressed in terms of moisture regain or moisture content. Moisture regain is defined as the weight of a material expressed as a percentage of the oven dry weight. The weight of water of a material is expressed to its total weight is the moisture content, (Jewel 2005). Moisture absorption characteristics play an important feature for comfort and warmth retention behaviour of clothing. Moisture absorption causes swelling of the fibres which eventually changes size, shape, bending stiffness, strength, elasticity and fabrics The amount of moisture in a fibre strongly affects many of their most important physical properties such as dimensional, mechanical and electrical properties. Each sample was weighted (W1) to an accuracy. The sample were dried in an oven at a temperature of 120°C until the weight is constant between the two successive weighting made at an interval of not less than 1 hour. The final oven dry weight of the sample was recorded and moisture content and regain was calculated as below

- Moisture content = A – B/B x 100
- Moisture regain = A – B/A x 100
- Were, A – Original mass in g of the test

PLATE- I Invitro Cytotoxicity-Direct method Cell Line: L929 of *Euphorbia Triucalli fibre*

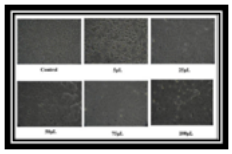


PLATE-II Invitro Cytotoxicity-Direct method Cell Line: L929

Fiber Extraction and Processing of *Euphorbia Tirucalli*

PLATE III Fiber of *Euphorbia Tirucalli*

PLATE VI Raw Fiber of *Euphorbia Tirucalli*

PLATE V Freeze Drying of *Euphorbia Tirucalli*

PLATE IV Sunlight Drying *Euphorbia Tirucalli*

III. RESULTS AND DISCUSSION

The results and discussion pertaining to the work entitled "Extraction of *Euphorbia tirucalli* and Development of woven fabric using *Euphorbia tirucalli, Cannabis Sativa ssp. Sativa and Gossypium Herbaceum*" are discussed underthe following headings.

Characterization for *Euphorbia tirucalli* fabric

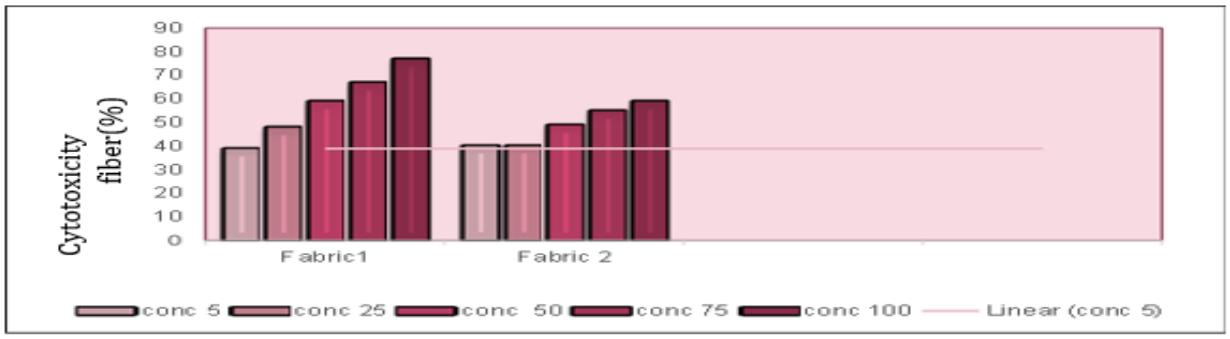
- Fiber Composition
- Cytotoxicity (fiber)
- Cytotoxicity (Latex)
- Cell Viability
- Moisture content & Regain

Fiber Composition for *Euphorbia tirucalli, Cannabis Sativa ssp. Sativa and GossypiumHerbaceum.*

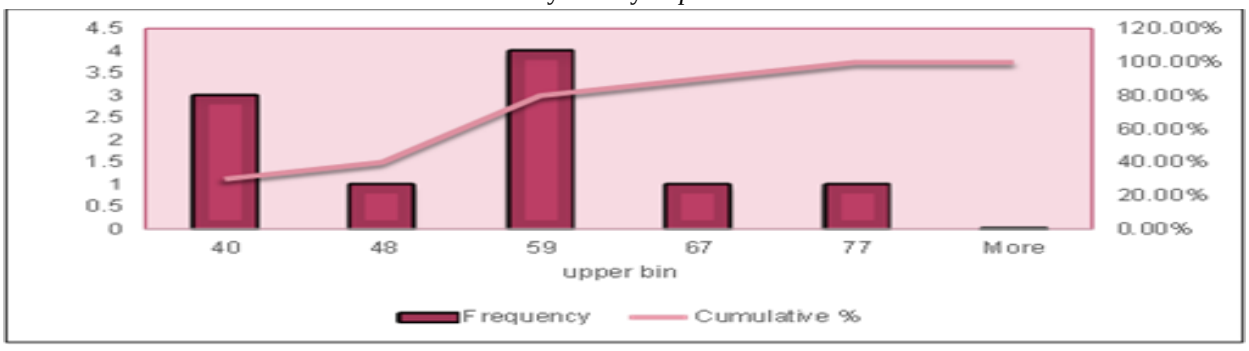
A fabric's fiber composition is the percentage by weight of each fiber making up that fabric. And the amount of fiber which is take into ratio has developed accordingly to the fiber combination on the base of Fabric characterization, Structural properties, Mechanical properties, Moisture properties. So, it developed the fire in the ratio and done with freeze method. It required the content of cellulose, hemicelluloses, lignin, pectin, and wax. The composition of fibers depends on the geographic location where the plants are grown up

S.NO	Fiber Composition-50:50	
01	Euphorbia tirucalli	Gossypium Herbaceum
	Fiber Composition-50:50	
02	Cannabis Sativa ssp. Sativa	Gossypium Herbaceum

Cytotoxicity for *Euphorbia tirucalli* fiber



Concentration for Cytotoxity *Euphorbia tirucalli* Fiber



Percentile for Cytotoxity of *Euphorbia tirucalli* Fiber

Percentiles	Percentage	Cytotoxicity
P10	10%	39.9
P25	25%	48.75
P50	50%	59
P75	75%	69.5
P100	100%	77

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