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DEVELOPMENT OF ECO FRIENDLY MICROFIBRIAL WET WIPES

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ABSTRACT

A product categorised under the category of medical textiles is wet wipes. A wet wipe is a cloth-like product that has been moistened and is intended for a variety of cleaning tasks and it can also used to cure rashes and skin allergy. They are frequently used to clean surfaces and other things that require the gentle touch of a cloth that is typically tenderer. They are constructed of soft constituents, with variety of functions, including as baby wipes and facial tissues. Materials like cotton, viscose, polyester, polyethylene, and others are used to make them. The choice of substrate for wet wipes is made depending on durability and price. Synthetic fibres have a significant drawback in that they are non-degradable, which means they never actually decompose leads to pollution in land and water. Commercially available wet wipes may flushable or disposable, making them simple to use. This study discusses adopting an environmentally friendly product and switching to wet wipes made of natural fibres sugarcane bagasse and wood pulp as a way to get around this. Sugarcane bagasse (*Saccharum officinarum*) is a natural fibre that is sustainable and has several advantageous qualities, including being soft, light, breathable, and cellulosic. The fundamental benefit of employing bagasse is that it is a pure waste product that can be used in any application with just a few straightforward treatments. A variety of paper-based products are made from wood pulp, which is a type of material produced by processing wood that has been harvested from trees. The wood is processed through a variety of steps to produce paper products, such as disposable paper plates, paper towels, baby wipes, and other typical home items, as end product. *Acalypha indica* leaf powder is used in Siddha medicine to treat various diseases. It is said to have anti-inflammatory and antioxidant properties. Moreover, herbal finishes are put on the tissues. The plant is then combined to create the medicinal textiles, which may also have antimicrobial characteristics.

Keywords: Wet wipes, Sugarcane bagasse, Wood pulp, *Acalypha indica*

1.INTRODUCTION

The wetting solution and the absorbent cloth are the two major components of wet wipes. Typically, components consist of mixtures of synthetic fibres, primarily polyester, polyamide, polyethylene, polypropylene, poly vinyl alcohol, and bicomponent fibres, and wood pulp or cellulosic fibres. Wet wipes can also be made from bamboo, jute, silk, ramie, linen, and jute. Because of the comparatively high surface energy of viscose rayon, viscose fibres are a popular component of fibre blends because they give good wettability for most cleaning liquids when they are utilised as a component of a nonwoven fabric. The absorbent fabrics of wet wipes are made of spunlace (which accounts for almost half of the market), airlaid, carded, wet laid, needle punched, and composite nonwoven materials. Spunlace technology is a popular technique for creating supple, flexible webs with the best cross-direction modulus, which provides insight into the amount of force necessary to crumple the fabric.

In the contemporary world, sugar cane is a plant with numerous significant applications. Tropical nations plant sugar cane (Saccharum officinarum) in large numbers. The manufacture of sugar is one of the most well-known. Nevertheless, sugar mills are unable to utilise all of the fibrous waste products, known as "bagasse," that are left over after the sugar cane has been processed. Bagasse, a byproduct of the sugar cane industry, is useful for making paper, serving as a feedstock for the manufacturing of biofuels, and serving a variety of other purposes. Bagasse from sugarcane is classified as biomass since it primarily consists of cellulose. It is only occasionally utilised since it is seen as an unfavourable byproduct of the sugar cane production and is hence not commonly employed. Since it includes a considerable amount of cellulose, this cellulose can be removed and used for many purposes. The fibrous material doesn't require any specific changes in order to be used; it may also be used as fibre in the textile and civil engineering industries. The technique still yields a very affordable product, and it will undoubtedly be totally or mostly biodegradable, which is a significant factor in today's society. Bagasse cellulose can be converted into nanoparticles or regenerated textile fibres. Also, it's one of the few cellulose sources that is both economical and sustainable.

Wood pulp has been used as an absorbent and cleaning agent since the early 1800s. Wood pulp was used back then to clean surfaces and clear up spills. Despite finding usage in numerous other applications, wood pulp is still utilised today for these same uses. Paper is made from wood pulp, which is also a component of several building materials and an ingredient in some cosmetics. The most typical source of fibre used to make paper and hygiene goods is tree pulp, often known as wood fibre. The process of making wood pulp begins with the breakdown of the wood chips, followed by the pulping processes of chemical and mechanical. A variety of pulp-based products are made from wood pulp, which is a type of substance produced by processing wood obtained from trees such as pine and eucalyptus.

Herbal medicine is used in the Ayurveda, Unani, and Siddha medical systems to address a variety of physiological conditions. This is because herbal therapies are quite powerful and contain a wide variety of active ingredients that are recognised to relieve a variety of illnesses. An upright herb known as Acalypha indica (Linnaeus) (Euphorbiaceae) can be found in tropical Africa, Bangladesh, India, Sri Lanka, the Philippines, and Sri Lanka. Indian Acalypha is the common name for this plant. It is a typical annual plant that has been seen in the waste areas and backyards of homes across the Indian plains. According to records from an ancient text that stated the juice of its leaves is beneficial in treating chronic bronchitis and asthma, Acalypha indica has long been used in the treatment of bronchitis and asthma. It is claimed to have antioxidant and anti-inflammatory properties.Acalypha indica (Kuppaimeni) leaf powder is used in Siddha medicine to treat respiratory illnesses. They use various plant parts for a variety of therapeutic applications, including anthelmintic, ulcer, bronchitis, asthma, wound healing, and anti-bacterial properties.

In tropical and subtropical areas of the world, coconut oil from the coconut tree (Cocos nucifera) is widely used for industrial and culinary uses. The copra used to make coconut oil was traditionally crushed and pressed to extract the oils. Large mills are used for this, and the oil is readily available on the market. Coconut oil, sometimes referred as as coconut butter, is produced from the meat, milk, and wick of the coconut palm fruit.Below about 25 °C (77 °F), coconut oil is a white solid fat; in warmer temperatures, it is a transparent, thin liquid oil. The unrefined varieties smell strongly like coconut. It is employed in the production of detergents and cosmetics, as well as as a cooking oil.Numerous health organisations advise restricting its usage as a food due to its high levels of saturated fat.

2. MATERIALS AND METHODS

2.1 Selection of fibre and fibrils

2.1.1 Sugarcane Bagasse and Wood Pulp

A fibrous substance containing cellulose as its main component, bagasse is formed from sugarcane. It is made in great numbers all throughout the world. It is a form of waste material that comes from the sugar industry.

The cellulose fibres in wood, fibre crops, are separated chemically or mechanically to create pulp. Pulp is the main raw material used in the industrial production of other pulp based products.

2.2 Collection of fibre and fibrils

2.2.1 Sugarcane Bagasse and Wood Pulp

Bagasse and wood pulp which is collected from Tamil Nadu Newsprint Limited (TNPL), Karur, is especially processed and formed as fine pulp material.

Fig1:Sugercane bagesse pulp

Fig2:Wood pulp

2.3 Selection of fabrication process

2.3.1 Hydroentangle (Spunlace) Nonwoven Fabric

Spunlace, also known as hydroentanglement, is a bonding method for wet or dry fibre webs that is accomplished through either carding or air laying, with the bonded fabric produced being a nonwoven. It employs tiny, high-pressure water jets that penetrate the web, strike the conveyor belt, and rebound back, tangling the fibres.

Fig3:Sugarcane bagasse wipes

Fig4:wood pulp wipes

2.4. Selection and collection of Herb

2.4.1. Acalypha indica

Acalypha indica is well known for its analgesic and anti-inflammatory properties. The leaves possess potent anthelmintic qualities. Moreover, the plant has been shown to exhibit bactericidal action against significant Gram positive and Gram negative microorganisms that invade wounds, and this characteristic has been indirectly linked to its capacity to cure wounds. It was gathered from the village of Kanathankudi in the Thanjavur region.

2.4.2 Finishing of nonwoven fabric

1. Leaves of *A. indica* are selected, collected and air dried for 4-7 days. Once dried the leaves were grinded into powder.
2. Heat the coconut oil on stove.
3. Once it is in boiling condition, add the powder to the oil and let it boil on low flame for about 5 to 10 minutes.
4. As you can see the change in the colour of oil you can turn off the stove.
5. Once the extract was cooled down, it was filtered
6. Strain the residue to get the clear oil.
7. The dosage concentrations is taken as (10-500ug/mL)
8. Dip the wipes in the oil for 30 mins and dry it.

Fig5:Acalypha indica oil

Fig 6(a):Sugercane bagesse wipes dip in oil Fig 6(b):Wood pulp wipes dip in oil

2.5. Padding Mangle Process:

- Dipping the fabric in the oil for treatment to speed up the diffusion and penetration of the oil into the fabric.
- It mostly aids in moistenting and swelling textile material while also removing air from them.
- Mangling the fabric between the two bowls to compress it at the nip and froced the alcohol into it by applying pressure to it.
- The simutaneous forward movement to the fabric.

Fig 7(a):sugarcane bagasse wipes after oil coated

Fig 7(b):woodpulp wipes after oil coated

3.RESULT AND DISCUSSION

3.1.FTIR result

3.1.1. Sugarcane Bagasse Herbal Wipes

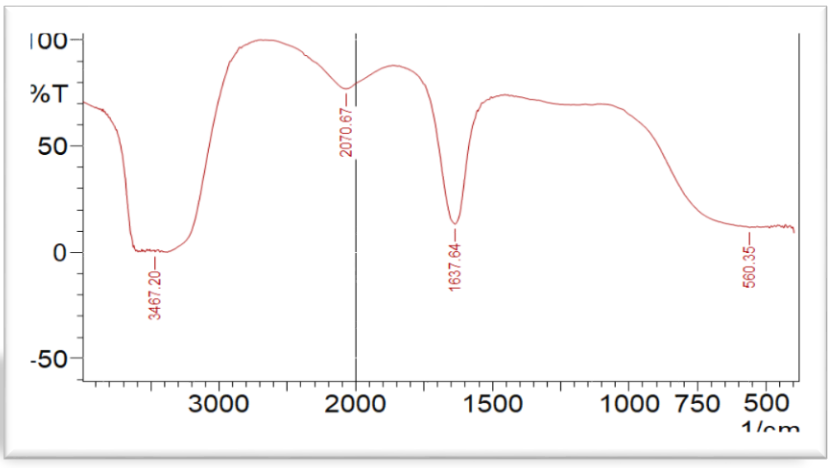

Fig 8: FTIR spectrum for herbal finished sugarcane bagasse wipes.

Table1: Relative intensity (%) of main absorption peak for sugarcane bagasse wipes.

S No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)
1	560.35	11.75	0.22	576.74	**554.56**
2	1637.64	13.3	56.16	1831.49	**1565.3**
3	2070.67	76.9	0.64	2341.68	**2061.03**
4	**3467.2**	**0.18**	**0.99**	**3472.98**	**3452.73**

As per above table and fig FTIR spectrum for wipes was analysed between wave number 500 to 4000 cm−1. Extract absorbed IR light at different wave number in cm−1. The FTIR spectrum obtained from Sugarcane bagasse Herbal finished wipes is shown in Fig8.The peaks observed at 3467.20cm-1 are assigned to the presence of superficially absorbed water and the stretching mode of the OH/NH group, respectively. The bands that observed at 2070.67cm-1 correspond to the stretching vibration of ketenimine C=C=N bonds. The peak at 1637.64cm-1 is identified as the strong C=C stretching vibration in the alkene linkage of the plant protein. The band observed at 560.35cm-1 is due to the strong C-I stretching halo compound.

3.1.2. Wood Pulp Herbal Wipes

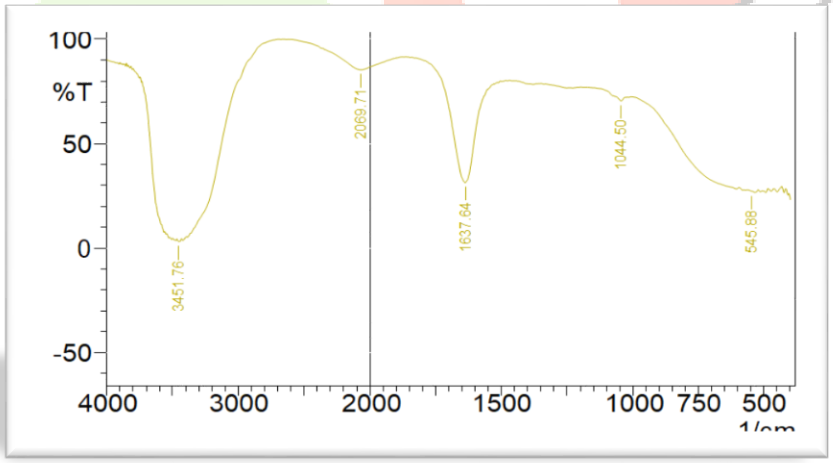

Fig 9: FTIR spectrum for herbal finished Wood pulp wipes.

Table 2: Relative intensity (%) of main absorption peak Wood pulp wipes.

S.No.	Peak	Intensity	Corr. Intensity	Base (H)	Base (L)
1	545.88	27.2	0.12	560.35	**542.98**
2	1044.5	70.55	1.82	1064.75	**1029.07**
3	1637.64	85.4	49.33	1819.92	**1553.73**
4	2069.71	85.4	0.05	2072.6	**2059.1**
5	**3451.76**	**3.05**	**0.52**	**3467.2**	**3445.98**

The FTIR spectrum obtained from Wood pulp Herbal finished wipes is shown in Fig9.The peaks observed at 3451.76 cm-1 (strong broad O-H stretching alcohol). The peak at 2069.71cm-1 correspond to the stretching vibration of ketenimine C=C=N bonds. The peak at 1637.64 cm-1 (strong C=C stretching alkene) The peak at 1044.50 cm-1 (strong broad CO-O-CO stretching anhydride)..The Final peak at 545.88cm^{-1} (strong C-I stretching halo compound).

3.2. Analysis of Antimicrobial efficacy

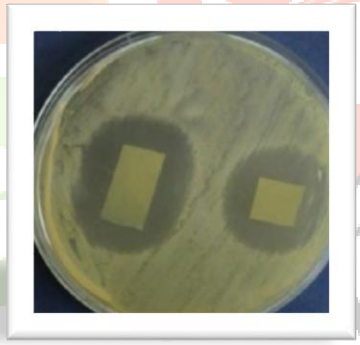

Plate1: *Aspergillus niger*

Table3: Anti Fungal testing of Sugarcane Bagasse Pulp and Wood pulp herbal Wipes for *Aspergillus Niger* As per American Standard (AATCC 30)

Nonwoven herbal fabrics	Standards	Fungai name	Measurement (Cm)	
			Standard (Fluconazole)	Treated
Sugarcane bagasse pulp	AATCC 30	*Aspergillus niger*	1.0	0.8
Wood Pulp			1.0	0.7

4.CONCLUSION

Overhydration and the presence of irritants from urine and faeces are the main causes of skin irritation in the diapered area. Skin health can be improved by ensuring that urine and faeces residues are effectively removed, keeping gentle contact with skin, utilising products free of potential irritants and pollutants, and supporting the acid mantle of the skin. Significant improvements have been achieved in baby wipe production recently, including getting rid of chemicals that could cause allergies or irritability. In reality, a number of clinical investigations have shown that, even on premature skin, correctly prepared baby wipes can be superior to the use of water and cloth. Understanding all the elements that may cause skin irritation and perhaps lead to dermatitis is crucial when caring for infant skin. It's also vital to be picky about the diapering products you put on a child's skin. It's crucial to remember that not all baby wipes are created equal. Considering their safety profile, allergenicity, and tolerance, industry experts should carefully choose the ingredients for baby wipes. In order to prevent contamination of the wipes before or after usage, production procedures for wipes should also adhere to quality standards established by reputable scientific organisations. In order to assure tolerance, low irritation potential, and skin sensitivity to the product, safety testing must also be carried out taking into account the special characteristics of infant skin.

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