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# Composites of Polypropylene and Natural Fibers: A Review

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***Abstract****: The current development of fiber composite have precipitate interest in exploration and progression field owing to outstanding higher formability, copious, renewable, moneymaking and eco-friendly look. At the current they're superseding efficiently fiber based mostly composites in several engineering usages. Generation of natural fibers not in any manner spoil the living organisms and their setting. Plants, that ar the inspiration of natural fibers, recycle the acid gas. This review reveals a delineate on natural fibers and compositions applied as a ingredient for business as well as engineering utilization. While examination, diverse articles were related to the uses of fiber synthetic plastic matrix. Helps to generate offered precise data regarding the feasible utilization of natural fibers and its matrix materials, mechanical, physical properties as well as fewer of their uses in engineering domain. The paper evident the define on fiber and plastic composite that currently a days is with success utilized in numerous business and engineering applications.*

***Keywords****: Polypropylene, Natural Fiber, Applications*

## I- INTRODUCTION

The progress in industrial sector usually depends on improvement within the grassland of engineering materials. Divergently in any ground of endeavor, the ultimate impediment, facing expected advancement is with materials. These indicate with the intention of great scope to minify the kind of atmosphere flow and augment the potential by means that of natural fibers. In heterogeneous applications increasing demand of natural fiber expected to rise the world natural fiber composites market is with the CAGR of regarding ten.6% throughout the forecast amount 2017-2024[1]. to fulfill up indispensable demand of wear , storage , construction material and for belongings of everyday use like ropes and fishing nets conventionally natural fibers utilized in all cultures globally. Varied varieties of natural fibers utilized in prehistoric era by folks betting on the native availaibility. but over the sooner amount, with the "go green" and "organic" realization fascinating in Republic of India , natural fibers turn out to be conspicuous and valuable within the enlargement of analysis and in novel applications . Remarkable insist from the automotive business, environment-friendly nature, and rigorous rules against the employment of contamination inflicting artificial materials the worldwide natural fibre reinforcement materials business is formidable by its step-up in demand. Additionally, user attentiveness regarding environmental protection additionally as fuels the event of natural fibers. [2]. efflux thanks to artificial material, insufficiency in crude oil resource and new-fangled environmental policy and rules led to thinking of the employment of environmentally agreeable materials [3]. natural fibre as a filler in thermoplastics is in deepening demand in extensive applications owing to denseness, superior thermal insulation and mechanical properties, fewer injury to process instrumentation, unbounded accessibility, dumpy value, increased surface end of shaped elements composite, renewable resourced , organic structure extensive and problem-free clearance and additionally this pliant options natural fiber become superior alternatives in way over the traditional fillers like aramid and glass fibers [4]. Fibers area unit relegated as natural fibers and manmade (synthetic)

fiber. In composite business "natural fibers" is often refers to agro predicated bast, leaf, seed, and stem fibers. In composite domain Natural fibers may be a redundant by product of agricultural. it's a lignocellulosic fibers covers a in depth amassment of plant fibre, animal product and mineral fiber. plant fibre area unit ordinarily compromised of polysaccharide embrace cotton , jute, flax, hemp. Amongst of these, natural fibre bolstered chemical compound has paid a huge interest towards automotive sector as a result of its denseness and surroundings theme. These lignocellulosic fiber area unit deliquescent and polar in character encompass helically wound small fibrils in a very matrix of polymer and hemicellulose. typically 60-80% polysaccharide , 5-20% polymer and upto 2 hundredth wet. This fiber reinforced chemical compound certain the surroundings profit. These lignocelluloses fiber tender social compensation and chief reason behind financial gain to communities in nascent countries wherever {they area unit they're} cultivated and are less expensive than the artificial counterparts [5]. as a result of deliquescent in nature and copious polar hydroxide teams natural fibre voluntarily attract wet that consequence in a very elevated wet natural action level of natural fibre reinforced chemical compound matrix composites and area unit major encumbrance for preventing in depth application of those material [6]. Lignocellulosic fibre composite cause less instrumentation wears and promotes superior furnishing of shaped parts in distinction to fiber any. therefore natural fibre as filler in PP these days in growing insist. Management analysis and market practice indicated that PP witnessed forceful intensification through finish decade and additionally to forecasted that stipulate of PP is feasible to crossover its 4-5% average annual enlargement rate of past decade within the about to future [7]. Plastic is prevalently being employed in numerous sectors of business like Chemical, Electrical, Automotive, domestic, Textile, Agriculture, protecting material, shipping and plenty of a lot of. encircled by all the, thermoplastic plastic will be effortlessly mix with alternative material for enhancing the properties as a result of its key options. various chemical treatments like alkali cure, silane action, acylation, benzoylation and peroxide treatment area unit wont to recover the wet resistance of composites . For this change of fiber surface properties is obligatory by chemical treatment, coupling agent like new on the market maleic-anhydride-grafted polyolefin's and acylation to develop their adhesion with dissimilar matrices and vital enhancements within the properties of those composites [8]. Thermal constancy of plant fibre plays a significant responsibility in process thanks to its low degrading temperature as compared to polyolefin's [9]. Treatment is a very important issue that has got to be think about whereas process natural fibers. As deliquescent nature of natural fibers and hydrophobic nature of chemical compound matrix may be a main drawback in compatibility. Incompatibility refers to underprivileged interface bonding linking natural fibre and chemical compound which ends into scale back in composite strength.

## II- LITERATURE REVIEW

**Shailesh Kumar singh *et al* (2015)** Proved that the Hand layup techniques productively acceptable for preparation of composite of sunnhemp fibre twenty percent ,epoxy sixty four percent and sixteen percent hardener with ease and exactly. The chemical compositions used for drenched time showed high tensile properties down with best acceptable for automotive applications were ready by mistreatment hand lay performance. The properties were checked by Tensile check, compression check , impact check , flexural check as per ASTM commonplace were approved out on UTM.

**Haydar U Zaman *et al* (2013)** stated totally different treatments like as untreated, alkali treated and alkali silane treated coir fiber reinforced in Polypropylene and composite be organized in compression moulding. The splintered tensile tested composite analyzed on Scanning electron microscope of JEOL 6400. Well-tried alkali – silane treated coir fiber composite with thirty weight percent has superior mechanical properties and water absorption properties attributable to proper adhesion. Alkali – silane treated coir fiber enlarged the interfacial properties due to chemical bonding and mechanical interlocking. Water amalgamation was tested as per ASTM D 579-99. The Izod impact Test according to ASTM D-256. The interfacial properties were intended by Kelly –Tyson, Drzal equation and Micro bond test. The coir fiber as a filler used for reinforcement in diverse wt % i.e ten, twenty, thirty, forty percent. Tensile strength and Tensile modulus of virgin PP and composite were experienced according to ASTM D-638-03 customary on universal Testing Machine( Model AG-1 Japan) through a load of five KN.

**E. F. Cerqueira *et al* (2011)** reported the tensile, impact strength , Flexural properties enhanced of the synthesized composite of cellulose preheated sugarcane bagasse fibers and PP in which bio filler used in 5 to 20 wt% as compare to the virgin polymer material. The material were mixed in the thermo kinetic mixer for preparing bio composite . For the strength and microimages of the composite for correlation study

Mechanical properties, FTIR, Morphological test were carried out. Hence the composites of PP with one of the constituents as biomaterial efficiently increment in Mechanical properties which is evident by Scanning electron microscope.

**Troung *et al* (2009)** quoted five density measurement methods according to ASTM. Out of this three methods meticulously reported according to time utilization in test, result accuracy, and cost usefulness. The researcher reported Linear density and diameter calculation method as per ASTM D1577-0 and ASTM –D2130, Archimedes (buoyancy) method as per ASTM-D3800-99 and Helium pycnometry method, gradient column ASTM-1505-03 and Liquid pycnometry . Test were carried by using Flax fiber. From this five density measurement method three methods analyzed in detail for comparative result i.e. Linear density and diameter calculation method, Archimedes method and helium pycnometry method .Proved Archimedes method by using canola oil as a solvent gives exactness , less cost, and less time intense for test and helium pycnometry method for repeatability effort.

**Shailesh Kumar singh *et al* (2015)** Proved that the Hand layup techniques productively appropriate for preparation of composite of 20% sunnhemp fibre and 64% epoxy and 16% hardener with ease and precisely. The chemical compositions used for drenched time showed high tensile properties down with best appropriate for automotive applications were geared up by using hand lay performance. The properties were checked by Tensile test, compression test , impact test , flexural test as per ASTM standard were approved out on UTM.

**Gao Hua *et al* (2008)** discussed PP/PE blend (80/20) and wood fiber composites geared up using co-rotating twin screw extruder. Wood fiber have numerous advantages over conventional reinforcing materials such as profusion, stumpy cost , low density. MAH and dicumyl beroxide be used as compatibiliser (10:1).The adding together of MAH resulted in the expansion of mechanical properties. Improvements in mechanical properties were noticed.

**Dr. H . K . Shivanand *et. al* (2010)** reported more the filler elevated the strength .Coupling agent helps in enhancing properties. Cost of HEMP is inferior than PP, Cost effective solution. Abridged equipment abrasion and consequent drop in retooling cost.

**A.P. Gupta *et al* (2014)** reported biopolymer in the appearance of potato starch was measured as individual constituents and the accomplish of potato starch occurrence on motorized. Structural property of polypropylene - starch blends enfold been analyzed. Researchers suggested that by means of maleic anhydride grafted PP as coupling agent improve the bond force linking starch and base polymer matrix. Since interfacial force in the midst of the two i.e. reinforcement material and polymeric base material has from side to side effect on the properties of blend mixture. In this experimentation the composition of starch is varied from 15 to 30% additionally interface bonding mediator (i.e. PP-g-MA) be used as 10% in proportion . Co-rotating twin screw extruder was used for compounding the blends. An assortment of mechanical properties were evaluated. Study stated that the tensile and impact strength remained more or less identical, however flexural strength of the blend better by 45%, and diminish in entitlement strain amid rising starch contented in the blend was noticed.

**H.Essabir *et al*(2013)** explained the blend of PP and Nut shell of Argan be synthesized with a compatabilising agent based on styrene and butadiene in three diverse sizes with dissimilar NA particle wt%. The Compatibilized PP be extruded in a twin screw extruder and the compatibilized PP matrix was compounded with NA particles at diverse fibers content by means of a two roll mill. The Properties SEM, FTIR, Thermal Analysis, Mechanical Testing were premeditated. Hence enlarged in tensile strength while escalating particle loading. Thermal properties shows that the PP based NA particles composites were fewer thermally steady than the neat PP. Decomposition decreases with raise of particle loading.

**Anshu Anjali Singh *et al*(2014)** reported the composite of coconut fiber and polypropylene . The coir fiber is of a length of 4-5 mm and reinforced in PP in wt % of 5% and 10% with a 2% maleic anhydrite used as a coupling agent for appropriate adhesion. Pellets were prepared in Haake Rheocord and specimen for testing purpose made in injection moulding . Tensile properties evaluated according to ASTM D638 on UTM. Morphological investigation was done by Scanning Electron Microscope by gold sputtering. Thermal properties were done by Differential Scanning Calorimeter under heating rate $10^{o}$C/min. Proved from the morphological images coconut fiber entrenched in the PP due to 2% MAPP. Adhesion and uniformity in stress which augmented the Tensile Strength and Tensile Modulus as compare to Neat PP the thermal property proved the melting temperature of PP and composite is near about similar of neat PP due to coupling agent appropriate interfacial

**Hisham A.Maddah (2016)** reviewed lowest density and high applications in wide fields be evidence for the beauty of PP. Polypropylene is only one of its kind in the midst of other thermoset and thermoplastic polymers. It have adaptable in nature and effortlessly blend with

supplementary material by the side of with natural fibers. Owing to its superfluous features the global market consumption is 2/3 as contrast to other material. Its low density features attracts the automobile company for using PP extensively. Its forbearance in processing, compounding and reinforcement shows the market demand of 19% which is elevated than other materials. Recycling of PP achieved optical characteristics along with uncomplicated and astonishing mechanical, physical properties & Chemical properties in end user product

**Nadir Ayrilmis *et al* (2011)** reported the significance of coir fiber as a filler in Polypropylene .The composite were synthesized by using coir fiber in diverse wt% i.e. 40,50,60,70 % which be reinforced in dissimilar wt% i.e. 57,47,37,27% in Polypropylene by means of keeping coupling agent Maleic anhydride-grafted PP (MAPP) invariable i.e. 3 wt %. The composite panel were manufacture in mat by cold press and hot press .Thickness swelling (TS) and water absorption (WA) tests were conceded out according to EN 317.Flexural strength and elastic modulus were conceded out according to EN 310. Tensile Strength test were conceded out according to ASTM D 1037-06a.Internal bond (IB) tests were carried out according to EN 319 .Janka hardness were conceded out according to ASTM D 1037-06a. Limiting Oxygen Index (LOI) Test was conceded out according to ASTM D 2836-10 .Data analysis were completed by using regression analysis method. Statistical analysis was completed by INNOVA method modeling to assess the fiber loading level on the Physical and Mechanical properties. Differences obtained from the average values were determined by Duncan's multiple test range. Proved that low content of cellulose and hemicelluloses in coir fiber has superior dimensional constancy as compared to other natural fibers evident by Statistical analysis of TS and WA . 60 wt % fiber in PP composition has higher Flexural Strength, elastic modulus and Tensile strength as compared to other wt % due to elevated aspect ratio, escalating cellulose and proper transferring of the stress from polymer matrix to coir fiber. Internal bond strength is inversely proportional to fiber loading as fiber loading is on rising side it reduce the internal bond proved by the disparity in coupling agent wt%. Lignin in coir fiber plays a constructive role as lignin increases the surface hardness property increased as wt % of fiber increased .Composition of 60 wt % the coir fiber, 37 wt % the PP powder, and 3 wt % the MAPP proved better for Composite panel formulation for automotive interior applications and mostly for fractional substitute of high-cost and heavier glass fibers.

**Amy Ellen Langhorst *et al* (2018)** reported two types of blue agave fibers wherever one is treated by means of $85^0$C water subsequent to agave nectar extraction and a further one is steam treated earlier than agave extraction reinforced in polypropylene by using PP-g-MA as a coupling agent . Both fibers were mixed with PP at levels of 10% , 20%, 30% in the presence and absence of 5 wt % coupling agent. Pellets synthesized in twin screw extruder and specimen prepared in injection moulding machine. Mechanical properties , Microscopy , water absorption test were conceded out . Statistical analysis were done by INNOVA tool. Proved that the enhancement of agave fiber in percentage which reduses the impact strength , % elongation but enhanced the stiffness. Compatibilizer increased the tensile and flexural properties of nectar extraction fiber and steam treated fiber slightly superior due to the surface chemistry which too resulted by micrograph. Water absorption rate of blue agave composites enhanced with fiber percentage as well as captivation time but compatibilization has no effect on absorption. Overall properties proved blue agave PP composite have prospective to substitute talc – filled PP composite.

**M. Khalid et. al (2008)** reported the tensile strength and Flexural modulus of cellulose is much higher than EFBF composite. The cellulose is potentially eye-catching thermoplastic filler compared to long-established oil palm fibers filled PP .PP- cellulose composite show higher degree of impact strength .SEM micrograph of PP cellulose composite shows superior adhesion between PP matrix and cellulose fiber. SEM micrograph of higher cellulose 50% composite shows more effectual cellulose matrix adhesion.

## III- CONCLUSION

The unpredictability of application of natural fiber and its matrix are studied in this paper . The above revealed evaluation possesses studied with the intensity to concentrate the capability of the fiber PP composite and to study the mechanical and material properties of different composites. In sort to accomplish the hydrophilic nature of the natural fiber surface treatment, it is awfully significant to progress the adherence and mechanical properties . The review gives the outcome that the natural fiber composites from/form one of the thriving areas in material science which is effectual in research for an assortment of application. Natural fiber composite is used for varieties of purposes such as parcel shelf, door panels, instrument panels, armrests, headrests and seat shells where as matrix of Plastic and wood fiber was use on a large scale in decks and molded panel components. The corollary of the above

examination is that composite of natural fiber is one of the prospering segment in material science gives us copious information that it can be applied in a variety of usages.

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