



DESIGN AND ANALYSIS OF HYBRID COMPOSITES FOR INDUSTRIAL HELMETS

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Abstract

The paper discusses the numerical studies on industrial helmet that can effectively withstand high impact load, light weight, thermal insulated, surface quality and dimensional precision. The use of natural resources such as Aloe Vera, cotton and hemp fibers, these fibers are high strength, light and easily withstand heat and salt water. The Aloe Vera is stemless plant and has the ability to carry higher load than that of existing Acrylonitrile butadiene styrene (ABS) plastic helmet. In this paper, the helmet model is designed by BSEN 397:1995 by Solid Edge v19 software and analyzed by Ansys 14.0 to test the capability of a material to withstand high impact load. At last, the comparisons of displacements and Von-mises stress are done for different volume proportions of a given composite fibers to know their mechanical properties.

KEY WORDS: Aloe Vera Root, hemp fibre, cotton fibre, Helmet.

1. Introduction

The main aim of this project is to analyze industrial safety helmets with natural fibers which will withstand high load at different conditions with high surface quality and with more dimensional precision and heat resistant when compared to synthetic fibers and these natural fibers absorb moisture. By using these naturally occurring fibers such as hemp, cotton, aloe vera in different suitable volume proportions which have high strength, light weight and they are resistant to heat and salt water. The capacity of these materials is higher when compared to Acrylonitrile butadiene styrene (ABS) which is in use at present. In this paper we

are using BSEN 397:1995 standards for designing a model of industrial helmet in Solid edge V19 software and it is analyzed by Ansys 14.0 software and finally comparisons of Displacements and Vonmises stress are done for different volume proportion of a given composite fibres to know their mechanical properties.

The writing towards the outline methodologies, Investigation strategies recommended by diverse creators is gathered Also exhibited in the resulting passages.

Franklin, Glen An.

The reason for this examine might have been with identify the affect for head cap utilization ahead tolerant conclusions Also indulge about hospitalization, done a state for a compulsory cap theory. Patients admitted following head crashes starting effective with July 1996 to Oct 2000 were checked, which includes demographics also, damage seriousness data, length from claiming stay, parts injured, result outcomes, cap uses, healing centers expense data, and also protection data. considerable examination might have been performed thinking about helmeted on helmeted patients utilizing Investigation of variance, Student's test, Also relapse investigation. Out of Admitted total number was 216 patients, among them 174 wore helmets Furthermore 42 didn't. Damage seriousness data associated for both period of remain protect of hospitalization. Mortal sin might have been not essentially distinctive in whichever bunch. Disappointment to wear An cap altogether expanded occurrence about head wounds (Student's t test, $p < 0.02$), However not different damages. Cap utilization diminished intend protect for hospitalization Eventually Tom's perusing more than \$6,000 for every tolerant. Disappointment to wear a cap includes of the monetary load made by motorcycle-related wounds. Therefore, people who don't wear helmets ought to pay higher protection operator premiums.

G m Ginsberg and his teammate encountered with urban decay because of deindustrialization, engineering imagined, government lodgin Silverberg enactment requiring motor riders and cycle riders to wear helmets it was done by israel, through An helmet's 5-year span (assuming 85% compliancy, 83.2% cap effectiveness to morbidity, and 70% cap effectiveness for deaths), roughly 57 exists Also bring about pretty nearly 2544 fewer hospitalizations; 13,355 and 26,634 smaller number crisis room Furthermore walking visits, respectively; Furthermore 832 Also 115 fewer short-term Furthermore long haul restoration cases, individually. Aggregate reductions (USD \$60.7 million) starting with diminishments previously, wellbeing administration utilization (USD \$44.2 million), worth of effort absences (USD \$7.5 million), Furthermore mortal sin (USD \$8.9 million) might surpass project expenses (USD \$20.1 million), bringing about a benefit-cost proportion about 3.01:1.

Syrotuik, daniel g. Reid, david c. There is absence of agreement "around pre-hospital staff (athletic therapists, paramedics, game physiotherapists) concerning particular parts of starting consideration Furthermore evaluation about harmed players displaying indications What's more indications of a cervical spine damage (CSI).

Previously, instances of genuine harm directing, including those mind or spine, convoluted Eventually Tom's perusing modified levels for consciousness, protective supplies for example, such that helmets What's more shoulder pads might provide An prevention will prompt, safe, Also proficient administration. Specifically, there is difference concerning the requirement or fitness from claiming uprooting protective leader gear, Concerning illustration on account from claiming football What's more hockey players. Utilizing those technobabble about fluoroscopy, those cervical spine uprooting about 21 male football Also hockey. Industrial safety helmet is fabricated using natural fibers such as Aloe Vera, cotton and hemp fibers, these fibers are high strength, light and easily with stand heat and salt water. From the comparison we require high compressive strength and impact load to deform the hemp and cotton fiber helmet compare to the other type of combinations of helmet. The natural fiber helmet has high strength to weight ratio compare to the existed helmet. These conclusions are obtained from various testing such as displacement conditions and vonmises stress condition. From the above tabular columns and graphs we can conclude that displacement is less in case

of Hemp and Cotton when compared to other two combinations. From the above tabular columns and graphs we can conclude that vonmises stress has more range in case of Hemp and Cotton when compared to other two combinations. So we can recommend the natural fiber of hemp and cotton to make the industrial safety helmet.

2. Experimental setup and procedure

2.1 Industrial Safety Helmet:

In various modern effort places, for a instance, mining, development, mining and ranger examination, the risk of a laborers is always there. The most valid threat are bodily wounds, which be able to be accordingly of the consequence of a falling item or collapse with settled items at the work site surroundings. Because the method of these work movements, it is not always generally conceivable to wash out such chance with simply suitable reliable arrangements or collective protective hardware. therefore, the finest technique to guarantee the safety of expert is by utilizing safety defensive caps. The kind of defensive cap will rely on upon the particular way of the bodily threat that have been recognized in the vulnerability assessment grip for the society. Every last bit helmets endeavor to secure the user's head Eventually mechanical vitality Furthermore securing against infiltration. Their structure also protective limit would modified done high-thickness lipoprotein effects. By their energy-absorption capability, their volume Furthermore weight would likewise have issues, since higher volume and more weight increase the damage danger for those user's head.



Fig 1: Basic model of industrial safety helmet

2.2 DIMENSIONS OF THE HELMET ACCORDING TO BSEN 397:1995

Sl. No.	Parts	Dimensions
1	External vertical distance	Lesser than 80 mm
2	Internal vertical distance	Lesser than 50 mm
3	Horizon distance	More than 5mm
4	Wearing height	80mm for helmets mounted on head form
5	Cradle	Width should be more than 15mm
6	Chin strap	More than 10mm

2.3 COMPLETE DESCRIPTION OF INDUSTRIAL SAFETY HELMET:

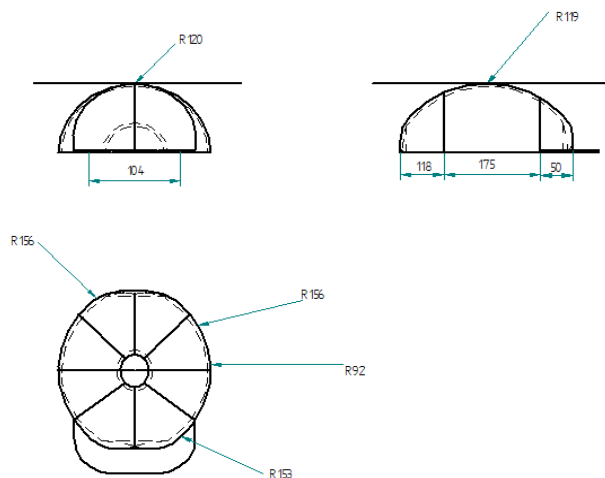


Fig 2 : Diagram of industrial safety helmet

2.4 STEPS FOR CREATING INDUSTRIAL HELMET IN 3D USING SOLID EDGE:

- Open solid edge v19
- Create solid part -tools-edgebar-feature path finder-top plan(xy).
- Draw the 2d drawing -draw line-select area-goto-return-finish.
- Select-top plane xy-select protrusion-select plane-select line.
- Draw-figure-goto-return-select centre axis-go to return.
- Give the angle-180-finish.
- Select-the cutout-select top plane-draw line-return finish.
- Click on the edge chain-give the radius- preview.
- File-save-by name-then take cut section-ok

Design of industrial Helmet in 3D model:

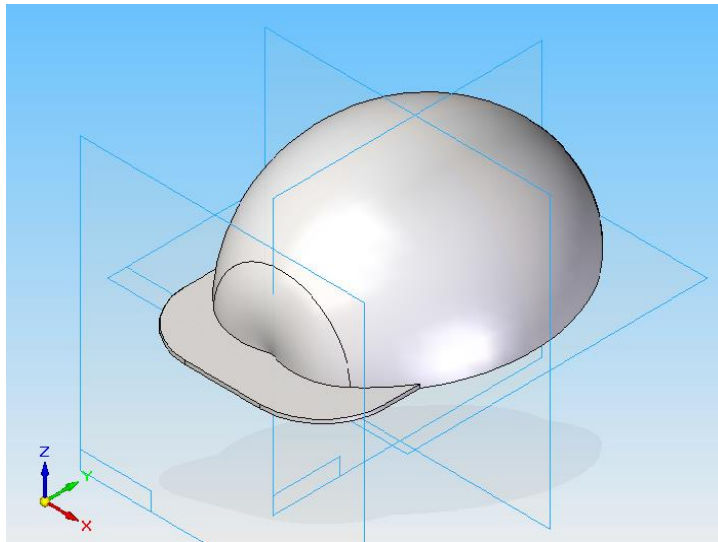


Fig 3 : solid model of a safety helmet

2.5 STEPS TO ANALYZE THE DEISGNEED MODEL

Step1: After importing the pro-e model into the pro-e analysis page, bottom surface of the helmet is kept fixed.

Step2: 25N load is applied on the helmet at left side. The applied is approximately equal to one brick.

Step3: Material properties are given to the material assignment (1. Nylon, 2. Natural fiber) as shown in the table.

Step4: Mesh the entire surface of the helmet

Step5: Then analyze the model using analyzing structure.

Step6: Then obtain the results from the result review page

Step7: Properties to be required is entered on the displaying menu.

Step8: Then required result is displayed in separate menu.

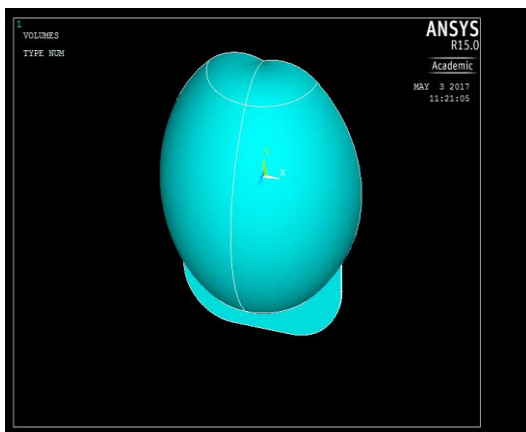


Fig 4: BASIC MODEL

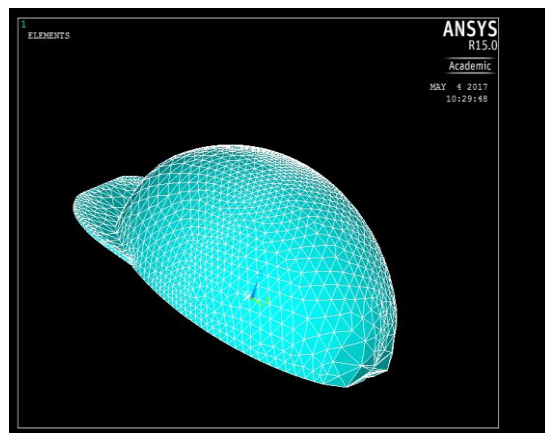


Fig 5: MESHED MODEL

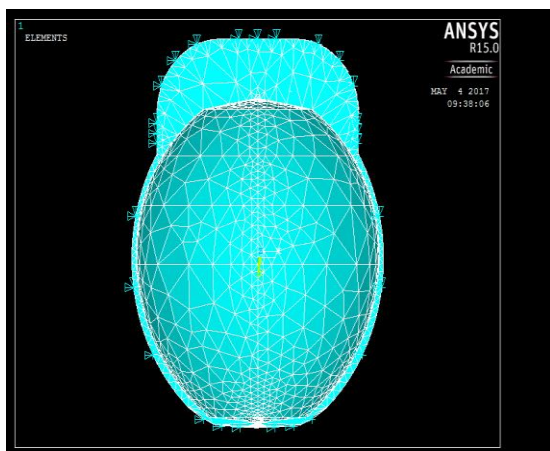


Fig 5:D.O.F. APPLIED MODEL

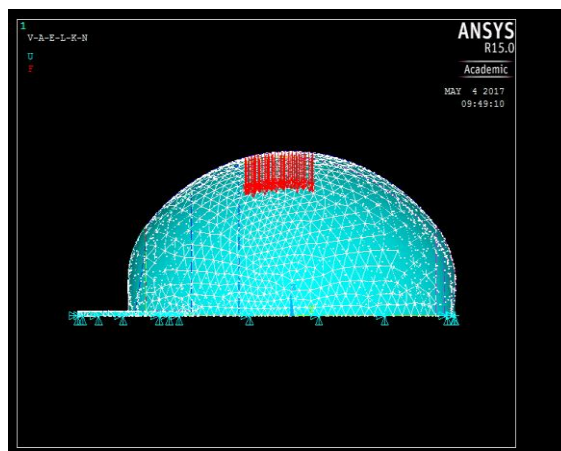


Fig 6 :Load APPLIED MODEL

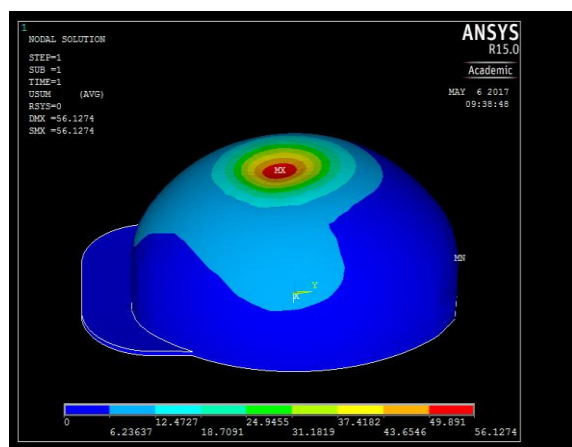


Fig 8:DISPLACEMENT CONDITION

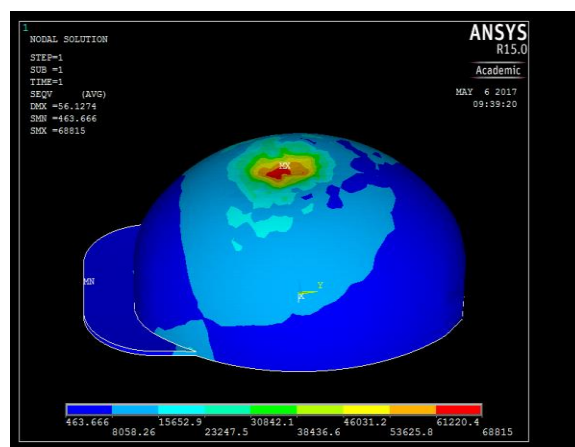


Fig 7 :VON MISES STRESS CONDITION

3. RESULTS AND DISCUSSIONS:

3.1.1 Analysis of Hemp and Cotton fibre:

SL NO.	VOLUME PROPORTION							
	DENSITY ρ	N in %		YOUNG'S MODULUS E	POISSON'S RATIO	DISPLACEMENT STRESS	VONMISES STRESS σ	
		HEM	COTTON				MIN	MAX
Kg/m3	P	N	Gpa	ν	mm			
1	1520	30	70	19.32	0.2973	8.58756	434.36	69753.3
2	1510	40	60	21.56	0.2864	7.7317	400.652	70069
3	1500	50	50	23.8	0.2755	7.04889	404.707	70232.5
4	1490	60	40	26.04	0.2646	6.32671	381.991	69507.3
5	1480	70	30	28.28	0.2537	5.86105	379	69971.3

3.1.2 Analysis of Hemp and Aloe vera fibre:

SLNO.	DENSITY	VOLUME PROPORTION in%		YOUNG'S MODULUS		POISSON'S RATIO	DISPLACEMENT STRESS	VONMISES STRESS σ		
		HEM P	ALOE VERA	Gpa	ν			mm	MIN	MAX
1	1388.4	30	70	15.4	0.2763	10.7789	392.324	69937.2		
2	1397.2	40	60	18.2	0.2684	9.2077	391.035	70360.9		
3	1406	50	50	21	0.2605	7.94927	397.425	70108.4		
4	1414.8	60	40	23.8	0.2526	7.70428	445	74776.5		
5	1423.6	70	30	26.6	0.2447	6.51724	379.469	71937.1		

3.1.3 Analysis of Hemp cotton and Aloe vera fibre:

SL N O.	DENSIT Y ρ	VOLUME PROPORTION in%		YOUNGS MODULUS E	POISSO N'S RATIO	DISPLACEME NT STRESS	VONMISES STRESS σ	
	Kg/m3	HEMP	COTTON &ALOEV	Gpa	ν	mm	MIN	MAX
1	1454.2	30	70	17.36	0.2868	9.51293	414.	6888
2	1453.6	40	60	19.88	0.2774	8.37862	842.	7008
3	1453	50	50	22.4	0.268	7.49298	946.	7038
4	1452.4	60	40	24.92	0.2586	6.73096	374.	7039
5	1451.8	70	30	27.44	0.2492	6.0382	554.	7004
							054	7.5

3.2 Graphical analysis:

3.2.1 Displacement conditions:

Graphs for Displacement v/s Density :

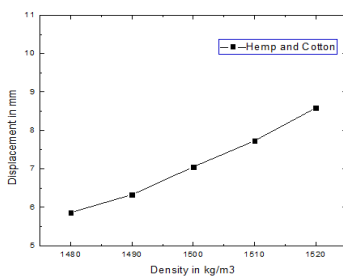


Fig 8 Hemp & Cotton

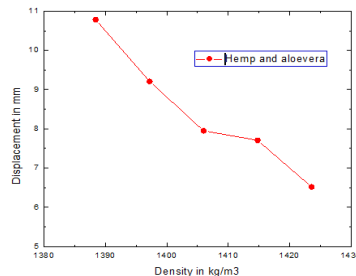


Fig 9: Hemp & Aloe vera

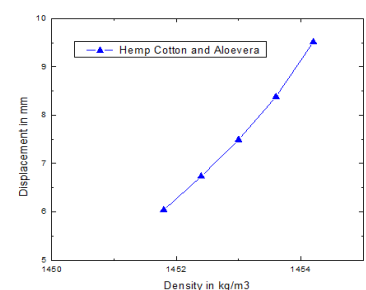


Fig10: Hemp & Cotton & Aloe vera

From the above tabular columns and graphs we can conclude that displacement is less in case of Hemp and Cotton when compared to other two combinations.

3.2.2 Von mises conditions:

Graphsfor Vonmises v/s Density:

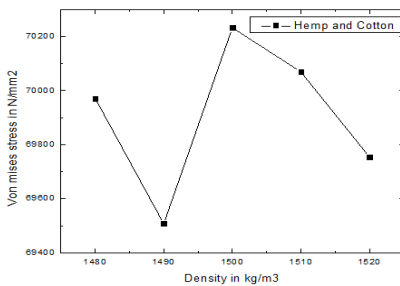


Fig 11: Hemp & Cotton

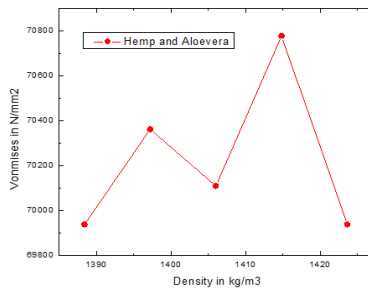


Fig 12: Hemp & Aloe vera

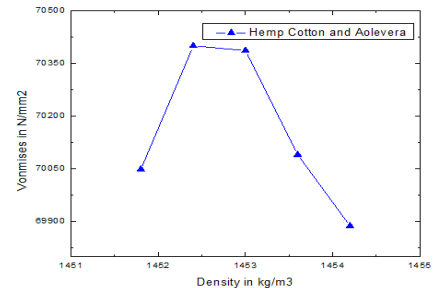


Fig 13: Hemp & Cotton & Aloe vera

From the above tabular columns and graphs we can conclude that vonmises stress has more range in case of Hemp and Cotton when compared to other two combinations.

3.3 Comparasion between the above three composite Industrial Helmet models:

For Displacement conditions :For Von mises conditions:

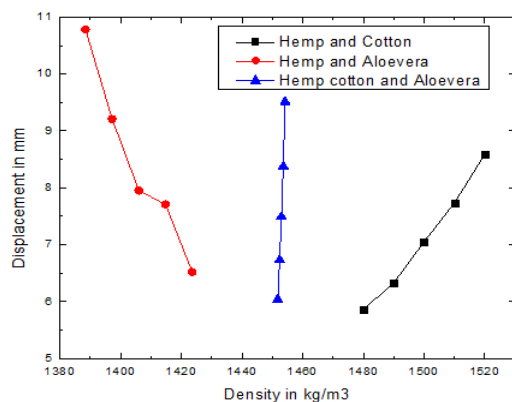


Fig 14: comparison graph for different displacements

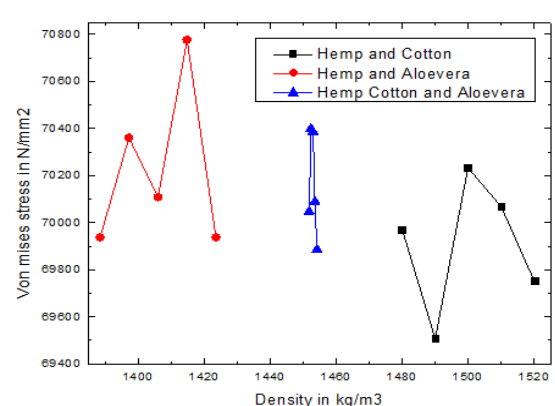


Fig 14: comparison graph for different displacements

4.Conclusion and References:

Industrial safety helmet is fabricated using natural fibers such as Aloe Vera , cotton and hemp fibers, these fibers are high strength, light and easily with stand heat and salt water. From the comparison we require high compressive strength and impact load to deform the hemp and cotton fiber helmet compare to the other type of combinations of helmet. The natural fiber helmet has high strength to weight ratio compare to the existed helmet. These conclusions are obtained from various testing such as displacement conditions and vonmises stress condition. From the above tabular columns and graphs we can conclude that displacement is less in case of Hemp and Cotton when compared to other two combinations. From the above tabular columns and graphs we can conclude that vonmises stress has more range in case of Hemp and Cotton when compared to other two combinations. So we can recommend the natural fiber of hemp and cotton to make the industrial safety helmet.

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