PricewaterhouseCoopers

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JUTE ECOLABEL

ANNEXURES TO LIFE CYCLE ASSESSMENT STUDY

Annexure 1: Data Collection Format for Primary Data Collection from Different Jute Mills/ Jute Manufacturing Units

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THE GOLDEN NATURAL FIBRE

March 2006

Data Collection for the whole unit:

Unit Name:	PwC person Visited:
Address:	
Email:	Date of Visit:

Product Name:

1.
2.
3.

Data Source: -

Person Name –
Designation –
Contact Details –

Unit Accreditation:-

☐ ISO 14001 ☐ ISO 9000 ☐ others mention

No of employees employed:

Permanent employee:

Contract employee:

Regulatory Compliance required under:

Air Act: ☐ Water Act: ☐ Hazardous waste ☐ Factory Act ☐

Any other mention bellow:

.

Provide a detail process flow diagram of the whole unit

Any other information:

Provide the following information for the whole unit for the financial year 03-04 (If for other financial year please do mention. But all the data should be for the same financial year)

Sl. No.	Input	Quantity	Comment
1	**Raw Material** (e.g. Raw Jute Tonnes/annum) Unit: 1 Bag = 50Kg.		
	b)		
	c)		
	d)		
	e)		
2	**Water used in process**		**Source:**
3	**Electricity consumed in process (**Mwh / annum)		
4	**Chemical** (please specify the chemical name) (tonne /annum)		

Sl. No.	Input	Quantity	Comment
5	**Fuel Used in process**		

. No.	Output	Quantity	Comment
1	**Product** (Please specify the product name) (both in nos. or sq. meter/annum and in tonnes per annum)		
	a)		
	b)		
	c)		
	d)		
2	**Solid Waste generated (**mention the solid waste type name) (type per annum)		
	a)		
	b)		
	c)		
	d)		
	e)		
	Total		
3	**Hazardous waste generated (**mention the hazardous waste type name) (Tonnes per annum)		
	a)		
	b)		
	c)		
	d)		
	e)		
4	**Point source Emission**		
	a) Annual Avg. of SPM (mg/ Nm3)		
	b) Annual Avg. of NOx(mg/ Nm3)		
	c) Annual Avg. of SOx(mg/ Nm3)		
	d) Annual Avg. of VOCs(mg/ Nm3)		
	f) Total Volume of flue gas at NTP (Nm3)		
5	**Effluent Discharged**		
	a) Annual Avg. of BOD (mg/ lit)		
	b) Annual Avg. of COD(mg/ lit)		
	c) Annual Avg. of TDS(mg/ lit)		
	d) Annual Avg. of TSS(mg/ lit)		
	e) Annual Avg. of O&G(mg/ lit)		
	f) Annual Avg. of Total Nitrogen(mg/ lit)		
	g) Annual Avg. of Others(mg/ lit)		
	h) Total volume of effluent discharged (KL/ annum)		
6	**Spillage to Soil/ Soil contamination** (Mention the name of the chemicals/ fuels/		

. No.	Output	Quantity	Comment
	Oils etc. spillage with their quantity)		
	a)		
	b)		
	c)		
	d)		
7	**Noise**		
	a) Avg. workplace noise level in Decibel		
	b) Avg. Ambiant air noise level in Decibel		
8.	Mention the name and quantity of any heavy metal or toxic chemicals used in any of the process		
	a)		
	b)		
	c)		
	d)		
10	Avg. Dust concentration in the work environment in mg/cubic meter; mention the work area to whcih the data refers		
11	Total Tonne KM travelled for each product and the mode of transporte		
	a)		
	b)		
	c)		
	d)		
12.	Total tonne KM travelled for Major raw materials and the mode of transporte		
	a)		
	b)		
	c)		
	d)		
12.	Whether any occupational health hazard reported in the past by any employee ? Please do mention the type of disesase and the reference for the person.		
13.	Whether any child labour employed in the factory premises ? Please mention the no. If any		

Mention all the standards used for product specification; raw material specification and any other in-house or third party monitoring and analysis below.

DATA COLLECTION FORMAT FOR PRODUCT WISE DETAIL DATA COLLECTION

Data collection format

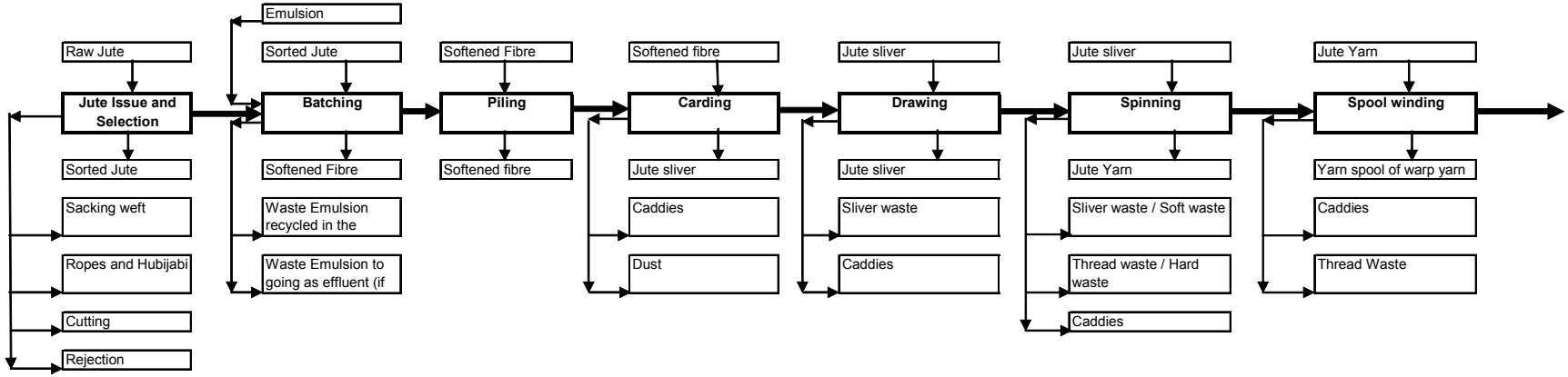
The data collection format for different jute products during gate to gate phase of life cycle are developed by considering the different elementary flow (that is, both material and energy input and output flow) throughout different unit processes. For each product category, data was tried to capture unit process wise to draw an overall process balance sheet. Based on the primary data collection, detailed data collection format has been designed as follows:

PROCESS FLOW DIAGRAM:

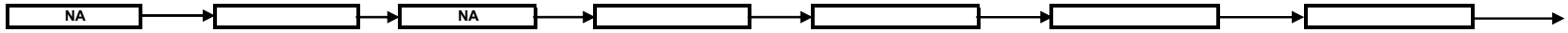
Please provide process balance sheet. Following is an example of process balance sheet for Jute Hessian

PROCESS BALANCE FOR HESSIAN

Product Specification: IS 2818-I-VI
9x10;45 inch;9 ounce

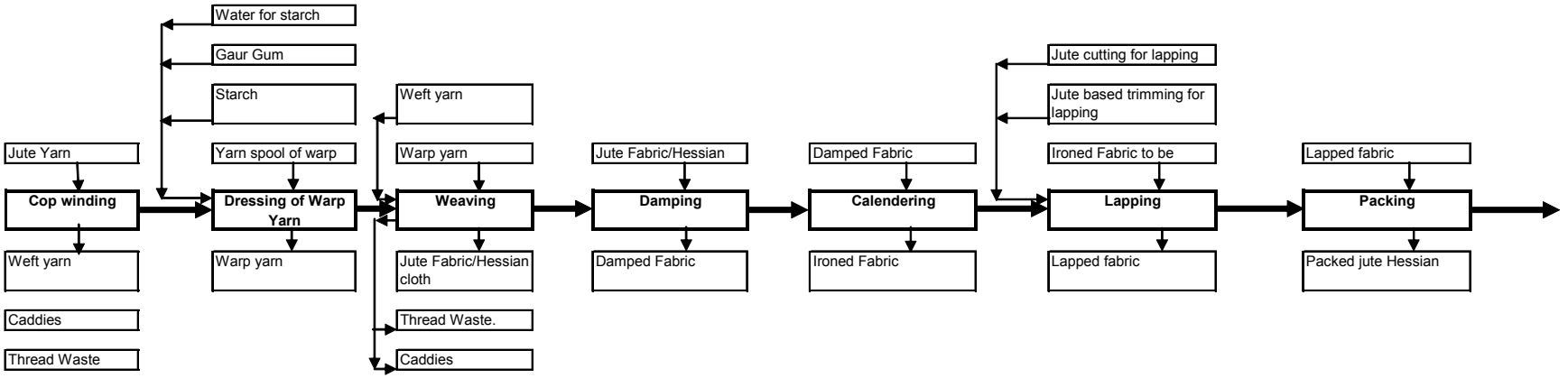


Power consumption (in KwH) per tonne of finished out put in each process [calculation based on rated HP of attached motor; Machine utilisation (%) and machine productivity per shift]:



PROCESS BALANCE FOR HESSIAN (contd.)

Product Specification: IS 2818-I-VI
9x10;45 inch;9 ounce



:onsumption (in KwH) per tonne of finished out put in each process [calculation based on rated HP of attached motor; Machine utilisation (%) and machine productivity per shift]:

DATA COLLECTION AND COLLATIONS SHEET:

For each product system data sheet has been generated to capture unit process wise material and energy inputs and outputs. An example of Hessian process data balance sheet is enclosed for reference.

PROCESS BALANCE

Product Specification: IS 2818 I-IV

UNIT PROCESS: SELECTION

MATERIAL BALANCE

Input				Dry Weight (bone dry weight of the fibre)		Output				Dry Weight	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit
1	Raw Jute (_% MR)		tonne		tonne	1	Sorted Jute (_% MR)		tonne		tonne
						2	Rejected (with ___% MR) used for other product.		tonne		tonne
	Total	100	tonne		tonne		Total		tonne		tonne

ENERGY BALANCE NA

UNIT PROCESS: BATCHING PROCESS (SOFTENING PROCESS)

MATERIAL BALANCE

Input				**Dry Weight**		**Output**				**Dry Weight**	
Sr. No.	**Name**	**Quantity**	**Unit**		**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**
1	Sorted Jute Fibre (% MR)		tonne		tonne	1	Softened Fibre (% MR)		tonne		tonne
2	Emulsion applied;		tonne		tonne	2	Emulsion to Sorted Jute fibre		tonne		tonne
						3	waste emulsion generated is recycled		tonne		tonne
						4	Dropage (with _% MR)		tonne		tonne
	Total		tonne		tonne		Total		tonne		tonne

ENERGY BALANCE

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total Kwh/process	Total Kwh
1	Emulsion Plant							
2	Softener							

Composition of Emulsion

Emulsion		kg
jbo		kg
soap/ saponifying agent		kg
Water		kg
Total		kg

Water consumption for Batching

UNIT PROCESS: PILING AND CONDITIONING

MATERIAL BALANCE

Input				Dry Weight		Output				Dry Weight	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**
1	Softened Fibre (_% MR)		tonne		tonne	1	Softened fibre (with __% MR)		tonne		tonne
						2	Moisture loss		tonne		
	Total		tonne		tonne		Total		tonne		tonne

ENERGY BALANCE NA

UNIT PROCESS: CARDING

MATERIAL BALANCE

Input				Dry weight		Output				Dry weight	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**
1	Softened fibre (with _% MR)		tonne		tonne	1	Jute sliver (_% MR)		tonne		tonne

						2	Dropage (with __% MR)		tonne		tonne
						3	Moisture loss		tonne		
	Total		tonne		tonne		total		tonne		tonne

ENERGY BALANCE

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total Kwh/tonne	TotalKwh
1	Breaker Card							
2	Inter card							
3	Finisher card							

UNIT PROCESS: DRAWING (INCLUDING FIRST, SECOND AND THIRD DRAWING)

MATERIAL BALANCE

Input				**Dry Weight**		**Output**				**Dry Weight**	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**unit**	**Quantity**	**Unit**
1	Jute sliver (__% MR)		tonne		tonne	1	Jute sliver of the required length, weight and flexibility (with __ % MR)		tonne		tonne

						2	Total dropage including caddies etc. with __% MR		tonne		tonne
						3	Moisure loss		tonne		
	total		tonne		tonne		total		tonne		tonne

ENERGY BALANCE

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total Kwh/tonne	Total Kwh
1	1st drawing							
2	2nd drawing							
3	3rd drawing							

UNIT PROCESS: SPINNING

MATERIAL BALANCE

Input				**Dry Weight**		**Output**				**Dry Weight**	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**
1	Jute sliver of the required length, weight and flexibility (with __ % MR)		tonne		tonne	1	Jute Yarn (with __% MR)		tonne		tonne

						2	Total loss due to gropage with __ % MR		tonne		tonne
						3	Moisture loss		tonne		
						4	SPM (suspended particulate matter)		tonne		
	TOTAL		tonne		tonne		TOTAL		tonne		tonne

ENERGY BALANCE

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total Kwh/tonne	TotalKwh
1	Spinning (100 spindle basis)							

UNIT PROCESS: SPOOL WINDING OR WARP WINDING

MATERIAL BALANCE

Input				Dry Weight		Output				Dry Weight	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**U**
1	Jute Yarn (with __ % MR)		tonne		tonne	1	Yarn in spool form (with __ % MR)		tonne		to

						2	Thread Waste (with ____% MR)		tonne		to
						3	Moisture loss		tonne		
	Total		tonne		tonne		Total		tonne		to

Energy Balance:

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	TotalKwh
1	spool winding						

UNIT PROCESS: COP WINDING OR WEFT WINDING

MATERIAL BALANCE

Input				**Dry Weight**		**Output**				**Dry Weight**	
Sr. No.	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**	**Sr. No.**	**Name**	**Quantity**	**Unit**	**Quantity**	**Unit**
1	Jute Yarn (with __% MR)		tonne		tonne	1	Yarn in cop form (with __ % MR)		tonne		tonne

						2	Thread Waste with __% MR		tonne		tonne
						3	Moisture loss		tonne		
	Total		tonne		tonne		Total		tonne		tonne

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	TotalKwh
1	Cop winding						

UNIT PROCESS: SIEZING AND DRESSING FOR SPOOL YARN OR WARP YARN

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit

1	Yarn spool of warp yarn (with ___ % moisture		tonne		tonne	1	Warp yarn		tonne		tonne
2	Starch (tonne)		tonne		tonne	2	Starch recycled		tonne		tonne
3	Gaur Gum (tonne)		tonne		tonne	3	SO2 emission from Stack				
4	Na silico fluoride		tonne		tonne	4	SPM emission from stack				
5	Water for starch solution		KL			5	NOx emission from stack				
	total		tonne		tonne		total		tonne		
	Steam required for dressing		tonne								
	Coal requirement for generating steam for dressing		tonne								
	Caddies requirement for generation of steam for beaming		tonne								

ENERGY BALANCE

Sl. No.	Machine used in unit process	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	KWH for total process out put	Total energy for the total process output in KWH
1	Beaming							

Fuel Utilisation:

Caddies consumption		tonne/day
Coal consumption		tonne/day

Water Calculation

Sr. No.	Name	Quantity	Unit
1	Water for steam		KL
2	Water for starch solution		KL

Steam consumption:

Steam generation per day:		tonne
Steam for dressing		tonne

Steam for dyeing & bleaching		tonne
Quantity of yarn spool dressed per day; (considering production per shift per machine)		tonne
Steam required tonne of yarn dressed		tonne

	Fuel Consumption per day for steam generation	**Calorific value supplied by the client (Kcal/kg)**	**total fuel energy consumed per day for steam generation(in GJ)**	**Energy contribution for Beaming per day(GJ)**	**Energy contribution for dying and bleaching per day(GJ)**	**energy requirement per tonne of sized warp yarn produced (in GJ)**	**CO2 emission per tonne of hessian beamed/ sized produced (tonne)**
Caddies consumption							
Coal consumtion							
Total							

UNIT PROCESS: WEAVING

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit

1	Warp yarn (including ___% MR		tonne		tonne	1	Jute Fabric/Hessian cloth (with _% MR)		tonne		tonne
2	Weft yarn (with % moisture)		tonne		tonne	2	Thread Waste		tonne		tonne
						3	Caddies		tonne		tonne
						4	Moisture loss		tonne		
	Total		tonne		tonne		Total		tonne		tonne

ENERGY BALANCE

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	KWH for total process out put	Total energy for the total process output in KWH
1	loom							

UNIT PROCESS: DAMPING

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit

1	Jute Fabric/Hessian cloth (with __% MR)		tonne		tonne	1	Jute Fabric/Hessian cloth (with ___% MR)		tonne		tonne
	Total				tonne		Total				tonne

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total energy for the total process output in KWH
1	Damping						

UNIT PROCESS: CALENDERING

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit
1	Jute Fabric/Hessian cloth (with _% MR)		tonne		tonne	1	Ironed Fabric With ___% MR		tonne		tonne
						2	Moisture loss		tonne		
	Total		tonne		tonne		Total		tonne		tonne

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total energy for the total process output in KWH
1	Calendaring machine						

UNIT PROCESS: LAPPING AND FOLDING

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit
1	Ironed Fabric With __% MR		tonne		tonne	1	Lapped fabric (__% MR)		tonne		tonne
	total		tonne		tonne		total		tonne		tonne

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonne/8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne	Total energy for the total process output in KWH
1	Lapping machine						

UNIT PROCESS: PACKING

MATERIAL BALANCE

Input				**Dry weight**		**Output**				**Dry weight**	
Sr. No.	Name	Quantity	Unit	Quantity	Unit	Sr. No.	Name	Quantity	Unit	Quantity	Unit
1	Lapped fabric (__% MR)		tonne		tonne	1	Packed jute Hessian		bales		tonne
2	Hoofs and buckles and pins:@ kg/ bale		tonne		tonne	2	Hoofs and buckles and pins: @ kg/ bale				
3	Pack sheet and hand swing thread: @ kg/bale		tonne		tonne	3	Pack sheet and hand swing thread: @ kg/bale				
	Total		tonne		tonne		total		bales		tonne

Note: Please mention the bale weight

Sl. No.	Machine	Basic Machine utilisation%	Rated HP per M/c	Machine output tonnes of finished hessian /8 hr	Kwh per M/c per 8 Hr. at UF	KWh/tonne of finished hessaian packed	Total energy for the total process output in KWH
1	Hydraulic press						

One bale composition for Hessian:	
	tonne
Fabric	
Hoofs and buckles and pins:@kg/ bale	
Pack sheet and hand swing thread: @ kg/bale	
Total	

Bailing Capacity of Hydraulic press for Hessian		
Production /day		tonne
Water requirement/day(considering the make up water every day)		tonne
Water requirement for baling above production		

INVENTORY ANALYSIS DATA COLLECTION SHEET

Total Raw Jute consumption **tonne**
Total Production of Finished Hessian with ___% MR **tonne**
Total packed weight of the above quantity of finished Hessian **tonne**

INPUT

Sr. No.	Parameter	Total Quantity	Unit	Input per tonne of finished hessian produced and transported	Unit
1	Total water Water consumption for preparation of applied emulsion, sizing chemical and hydraulic press		tonne		tonne/tonne of finished Hessian
2	Raw jute consumption (____% MR)		tonne		tonne/tonne of finished Hessian
3	Coal consumption for steam generation		tonne		tonne/tonne of finished Hessian
4	Caddies consumption for steam generation		tonne		tonne/tonne of finished Hessian
5	JBO consumption for preparation of applied emulsion		tonne		tonne/tonne of finished Hessian
6	Soap/ detergent for preparation of applied emulsion		tonne		tonne/tonne of finished Hessian
7	Starch uptake		tonne		tonne/tonne of finished Hessian

8	Gum		tonne		tonne/tonne of finished Hessian
9	Energy (considering the power contribution from DG set during power failure as negligible)		KwH		KwH/tonne of finished Hessian
10	Pack sheet and hand swing thread		tonne		tonne/tonne of finished Hessian
11	Hoofs and buckles and pins		tonne		tonne/tonne of finished Hessian
10	Manpower		hands		Hands/tonne of finished Hessian

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water:					
1	Effluent treated (considering the effluent contribution from batching process only)		KL		KL/tonne of finished Hessian
2	pH				

3	BOD		Tonne		tonne/tonne of finished Hessian
4	COD		Tonne		
5	TSS		Tonne		tonne/tonne of finished Hessian
6	TDS		Tonne		
7	O&G		Tonne		tonne/tonne of finished Hessian
8	Cr				

Solid waste generation					
	Total jute waste (at different % MR)generated in the whole process		Tonne		tonne/tonne of finished Hessian
	Jute waste reused in other products (at Diff. %MR); mainly non export items(Other than Geo Textiles)		Tonne		tonne/tonne of finished Hessian
	Jute caddies and dust (out of total waste) with diff. MR % used in boiler		Tonne		tonne/tonne of finished Hessian
	Coal ash		Tonne		tonne/tonne of finished Hessian

Emission to Air from Stack:					
	SPM		Tonne		tonne/tonne of finished Hessian
	RSPM		Tonne		
	Sox		Tonne		tonne/tonne of finished Hessian
	Nox		Tonne		tonne/tonne of finished Hessian
	VOC (FROM jbo)		Tonne		
	CO2 (From fossil fuel)		Tonne		tonne/tonne of finished Hessian
	CO2 (From freight)		Tonne		tonne/tonne of finished Hessian transported
	CO2 (From purchased electricity)		Tonne		tonne/tonne of finished Hessian

Effluent parameters data

Parameters	Final discharge point
pH	
BOD	
COD	
TSS	
O&G	
Cr	

Emission parameters data:		
Parameter	**with 12% CO2 correction**	**Unit**
SPM		mg/Nm3
SO2		mg/Nm3
NOx		mg/Nm3
CO		%
emission flow rate		Nm3/Hr
Avg. Boiler run hr./day		Hr./day

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ANNEXURES TO LIFE CYCLE ASSESSMENT STUDY

Annexure 2: Details of Mill wise Data collection

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THE GOLDEN NATURAL FIBRE

March 2006

Sr. No.	Mill	Data collected on Products
1	Gloster Jute Mills Ltd., West Bengal	Jute Yarn, Hessian, Hydrocarbon Free quality jute Hessian and sacking, Jute Floor covering , Jute Geotextiles – Woven type (both rot proof and fire retardant), Jute Geotextiles-(without any chemical treatment)
2	The Ganges Manufacturing Co. Ltd., West Bengal	Jute Yarn, Hessian, Hydrocarbon Free quality jute Hessian and sacking
3	Hastings Jute Mills, West Bengal	Jute Yarn, Hessian, Hydrocarbon Free quality jute Hessian and sacking
4	Champdany Industries Ltd., West Bengal	Floor covering, Jute yarn, Hessian, Hydrocarbon Free Jute Hessian or sacking
5	Birla Corporation Limited, West Bengal	Jute yarn, Hessian, Hydrocarbon Free Jute Hessian and sacking, Non woven jute geotextile
6	The East India Natural Goods Co., West Bengal	Shopping bag
7	Asim Kar (Export Division), West Bengal	Dyeing and Bleaching Process
8	Nuage (A house of diversified jute products), West Bengal	Dyeing and Bleaching Process
9	Ratna Handlooms, Warangal, AP	Floor covering
10	The Balaji International, Warangal, AP	Floor covering
11	Ramchander Motilal Enterprises, Jaipur	Shopping bag, Floor covering
12	Art India, Jaipur	Jute rugs, Floor covering
13	The Hans, Panipat	Floor covering
14	R.K. Dyeing Industry, Panipat	Dyeing and Bleaching Industry

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JUTE ECOLABEL

ANNEXURES TO LIFE CYCLE ASSESSMENT STUDY

Annexure 3: Qualitative and Quantitative Description of Unit processes

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THE GOLDEN NATURAL FIBRE

March 2006

Life cycle Assessment of Jute- detailed system boundary

Environmental Life-Cycle Assessment (LCA) provides a framework for identifying and evaluating environmental burdens associated with the life cycles of jute in a "cradle-to-grave" approach. In other words, life cycle assessment aims at identifying the environmental impacts associated with the manufacturing and use of jute products right from the stage of extraction of raw materials to the final disposal. LCA for jute would consider various life cycle stages right from growing jute, to the final disposal, when the fibers after use in one form or the other are disposed.

Therefore the entire life cycle of jute can be categorized into three phases:

Phase I:

Production of raw jute; a cradle to gate approach, comprising of the following sub-phases

- Cultivation and production of fibre
- Transportation from farm to mill

Phase II:

Processing of fibre into finished product by mills, a gate to gate approach; processing within the mills premises

Phase III:

Use and disposal of the product; a gate to grave approach, comprising the following sub-phases

- Transportation from production end to consumer end
- Use and disposal of jute products by the ultimate consumers

Phase I: Cultivation and production of fibre:

Jute fibre is obtained from the tiliaceous plant species, viz. Corcorus capsularis and Corchorus olitorius . the fibres from two species, capsularis and olitorius are popularly known as white and tossa respectively. White jute is traditionally grown in low and mid land thriving under waterlogged conditions. Tossa jute is mainly grown in mid and high land area and cannot withstand water stagnation, particularly at the early stage of growth.

The cultivation of jute is practiced in the eastern and north eastern states, namely Assam, Bihar, Meghalaya, Orissa, Tripura and West Bengal. The state of West Bengal alone accounts for 63%of the area and 67% of production of jute in the country. Three districts in West Bengal, viz. Murshidabad, Paschim Dinajpore and Cochbihar accounts for 27 % of the total coverage of jute in the country.

The cultivation of jute involves the following steps:

Agricultural Phase:

Land preparation:

To prepare the soil for jute sowing, five to six deep ploughings, alternatively followed by laddering are required. Weeds and stubbles of previous crop are removed. If the soils are acidic in nature then soil amelionent has to be applied. Lime or dolomite at the rate of 1 to 4 ton per ha depending upon the soil type and extent of soil acidity has to be applied at least six weeks before sowing and once in three years depending upon the soil test result.

Seed treatment is sometimes undertaken particularly to avoid the infection of diseases to the crop. Seed treatment is usually done with organo mercurial fungicide like Agrosan GN or Ceresan at the rate of 5gm per kg of seed or Dithane M at the rate of 2gm per kg of seed.

Sowing:

The seeds are mostly spread crosswise and after germination the excess plants are thinned out to maintain the spacing of 10 cm apart from plant to plant. Sowing time differs from area to area on the basis of pre-monsoon showers, availability of the residual moisture and variety. Accordingly sowing starts in middle March and may be staggered up to May.

Manuring

Both organic and inorganic manures are applied to the crop in cultivation in order to obtain higher yield of the crop. At least 4 to 7 ton of organic manure, i.e. compost or farmyard manure is applied per hector. The organic manure is mixed with the soil during land preparation. Depending upon the soil nutrient status and quantum of organic manure applications, the following quantity of nutrients through inorganic fertilizers are applied in jute:

N: 20-80 kg/ha

P2O5: 20-40 kg/ha

K2O: 20-60 kg/ha

Weeding and thinning of jute crop is undertaken once at 2-3 weeks after sowing and the second at 5-6 weeks after sowing.

Irrigation:

Jute requires about 50 cm water for its growth and development. In India about 15 % jute area is irrigated and the remaining once is rain fed. If the rainfall is not sufficient, the water requirement is supplemented through irrigation. At sowing time, if the soil moisture is not sufficient, then pre-sowing irrigation is to be given. After sowing, usually one or two irrigation at an interval of about 20 days is required at the initial stages of growth. Thereafter monsoon rains supplement the irrigation.

Intercultural Operations:

Weeding, thinning and weed hoeing are the important intercultural operation in jute cultivation. Weedicides like Dalapon and MSMA (Mono Sodium Methane Arsenate) are used @3-4 kg/ha of each to control grasses and sages.

Pest Control:

Jute is attacked by a number of pests during different stages of growth. The major pests are indigo caterpillar, thrips, burrowing or field cricket, stem-weevil, red mite, semilooper. Hairy caterpillar, yellow mites and nematodes. These are treated by different types of pesticides

Sometimes, however, jute growers instead of facing one pest problem, come across a number of pests which occur one after another forming a pest complex in jute crop. The sequence pf such jute crops is often repeated every year. For the effective management of such pest complex formation, expert recommends the following chemical control schedule in which four sprays of endosulfan of 0.075 % at 15 days interval. The first spray is adjusted according to the occurrence of pests from place to place and year to year and species of the jute.

Spray	Approx time for application	Pest complex	Quantity of pesticide (per ha)	Volume of water per ha	
				HV	LV
First	Early to mid June	Stem-weevil, yellow mite	1.0 litre endosulfan 35 EC	500	50
Second	End of June to early July	Stem-weevil, yellow mite, semilooper, hairy caterpillar	1.2 litre endosulfan 35 EC	600	60
Third	Mid to third week of July	semilooper, hairy caterpillar	1.4 litre endosulfan 35 EC	700	70
Fourth	Mid August	semilooper, hairy caterpillar	1.6 litre endosulfan 35 EC	800	80

Jute Retting Phase:

Jute crop can be /harvested any time between 100-150 days. Early harvested gives less yield but finer fibre. After harvesting the jute bundles are kept in the field for 2-3 days to allow leaf shredding. The bundles of jute stems after defoliation are placed in retting tank in “Jak” and weighed down under water at a depth of 10 cm.

Retting is done best in free flowing water. However in India particularly the entire retting operation is carried out in stagnant pools of water like ponds, ditches, roadside canals, depression and similar water bodies.

Retting is carried out by a complex enzyme action of microbes dwelling naturally in the retting tank. Retting is a microbial process by which the fibre from the wood core (stick) is loosened. Bacteria (both aerobic and anaerobic) and fungi act upon the soft tissues of the stem, which on dissolution makes it easy to separate fibre from core (stick). Retting is complete when the fibre separates easily from the inner woody core of the stem. After washing, the fibre bundles are dried up in mild sun over a bamboo frame. A normal temperature of 340C it takes generally 8-12 days for complete ratting. The fibre bundles are then graded and made into “morahs”.

Transportation of Jute from Farm to Mill:

The movement of jute from the field to the mill takes place in three distinct stages. In the initial stage jute moves in cycle vans and bullock carts from villages to the primary assembling markets, which are small rural markets. In next stage jute is transported mostly by tracks from the rural markets to the secondary markets, which are baling centre. In the third and final stage jute moves in the form of “kachcha bales” from the upcountry balling centres to the terminal market in city, press houses of “pucca bales” and jute mills.

Jute is sold in upcountry markets in generally unassorted condition. The kutcha balers in the secondary markets prepare the unassorted jute for sales to terminal markets and jute mills after selecting the unassorted jute into the generally recognized commercial grades and subsequently packing such material into kachcha bales.

Phase II: Processing of fibre into finished product by mills, a gate to gate approach; processing within the mills premises

Processing of jute fibre into finished goods:

Processing of raw jute into finished jute products involves different unit processes. Some of the unit processes are common to many products and some are product specific.

The unit processes can be described as follows:

Selection:

The process consists of opening the new jute bales, inspecting each morah to fid out the defect, removing the defective portion from the morah and placing the morahs into a handcart or on the ground . selection is purely visual and carried out by experienced worker.

Softening:

The rigid jute fibres and the fibre joints in the meshy jute seeds are treated with an oil-water emulsion in order to make the material suitable for subsequent machine processing. During this process the jute fibres are also cleaned from loosely adhered - extraneous matter. The nature of emulsion varies with the type of end products that are manufactured. Mineral oil is used as the softening medium for all standards jute products. The emulsion of oila nd water and the pressure of fluted rollers through which it is passed makes the fibre damp and pliable. However, for subsequent production of Hydrocarbon Free jute bags and cloth as well as decorative jute fibre required for manufacture of diversified jute products, softening is done with rice bran oil and suitable additives.

Piling/Conditioning

Jute seeds added with emulsion are piled under a close cover for a period between 1-3 days, facilitating softening of jute seeds by biological action. This process is known as piling.

Carding:

Carding is mainly a combing operation and is carried out to convert the long and meshy jute seeds into spinnable fibre of desired linear density known as slivers. Carding is usually carried out in 2 or 3 stages. After 2 to 3 days this meshy structure of jute is passed through a sense of carding machines, which are arranged in an increasing order of fineness. The Breaker Card as the machine is so termed breaks down the meshy structures into individual long entities of filaments as far as possible and also removes dust and other impurities.

The product now becomes finer, softer and cleaner in appearance. It is then passed through the Inner and Finishing Cards where the stands are further cleaned and become much more finer and softer. The sliver as it comes out from the Finisher Card is only moderately uniform, while the fibres of which it is composed are somewhat mixed up, far from being straight or parallel.

Drawing:

In this process the sliver width and thickness are reduced in order to facilitate spinning of sliver. The operation is normally carried out in 3 stages. The sliver after being successfully passed through each of the Drawing Frame now becomes more uniform and also reduced to a more suitable length for the Spinning Frame. The general appearance of the resultant product at this stage is soft, pliable, dry and straight.

Spinning:

The operations carried out to produce yarn from sliver, which is subjected to elongation to the specified linear density and then twisting for developing necessary yarn strength. Spinning Frame consists of 4 ¼" and 5 ½" Slip Draft Spinning Frame, where the sliver is drawn out to the required count of Yarn.

Winding:

The operation provides yarn as spool and cops for the requirement of succeeding operations of beaming and weaving. The sliver is twisted to the degree for the purpose for which the yarn is intended, and ultimately wounded to a Bobbin (twisting increases tensile strength of the fibre). Several of these Bobbins are run in succession and the yarn is wound to form a bigger package. The winding is referred to as roll winding.

The finished yarn as it now may be termed is finally twisted on a Twist Frame. Twisting Frames are of various types and any one may be used depending upon the ply of the twine desired. The yarn from the roll winder is run down on to the twisting frame in opposite direction to that of the component yarns to prevent untwisting and maintain strength in finished twine. The warp and weft are spun to to similar bobbins in Cop winding and spool winding machines.

Beaming:

The operation follows spool winding. Warp Yarn is beamed in a beaming machine by moistening along with water heavily and winding hem onto loom beam in a compact and hard matter covering the entire space. The main purpose of beaming is to supply beams with yarn wound on them and having proper width and correct number of ends for weaving a specified cloth.

Weaving:

The operation is the interfaces between wrap and waft yarns to produce the fibre of desired specification. The fabric may be for use as Hessian, sacking or geotextiles. In the weaving section these are separate looms for Hessian and sacking. Quality fabrics are woven on modern looms. e.g. Dornier, Sulzer etc.

Damping:

In this stage the rolled woven cloth is unrolled and water is sprinkled on it continuously in order to make it moist prior to calendering operation.

Calendering

This operation consists of ironing the cloth in order to produce better cover and surface finish.

After this stage separate operations are carried out for manufacture of hessian and bags.

Cutting:

The cloth is cut to the required length for sacking or bag.

Hemming:

The stitching is provided at new edges after folding of the fabric to prevent fraying of yarns.

Seaming:(for bags)

The seam is provided along the selvedge to manufacture a bag.

Branding (for bag)

Bags are branded manually by screen-printing method.

Bundling: (for bag)

Bundles of 25 bags are made prior to baling.

Packing (For bags)

Bales are formed with theses bundles with the help of a baling press. For A twill 400 bags (16 bundles), for B twill 300 bags (12 bundles) whereas for 50 kg bags, 500 bags (20 kg) are packed in each bale. The collected bags are suitably baled in Hydraulic Press before they are shipped.

Lapping or folding (for Hessian):

A lapping machine folds the cut of Hessian into sizes suitable for packing and baling by means of hydraulic press.

Packing (for Hessian):

The operation is similar to those for bags.

Manufacturing of jute shopping bag:

The manufacturing of shopping bag begins with the procurement of Hessia n.After procurement the jute fabric is transported to Bleaching and dyeing unit for further processing.

Scouring: In scouring stage the grey jute fabric is loaded into the Jiggar machine. This process is carried out to get rid of oil, grease and dirt from fabric, so that the bleaching and dyeing process can be optimized.

Washing:

A number of intermediate washings are there to ensure that a smallest amount of excess chemicals are not there on the jute fabric.

Bleaching:

Washed grey fabric has been bleached with hydrogen peroxide in presence of sodium silicate, caustic soda and acetic acid. Soft water re generally used for this process.

Steam Generation:

The fossil fuel are generally used to generate steam., which is used during bleaching, dyeing and washing processes.

Dyeing:

For dyeing of Jute fabric, generally solophenyl dyes (Azo free dyes) are used.

Lamination:

Generally the bleached and dyed fabric are laminated with LDPE granules.

Cutting and Screen printing (for shopping bag):

the laminated fabric are cut to the desired size for shopping bag. Then by process of screen printing the design is printed on the fabric. The screen printing is a solvent based process.

Fitting and packing of Jute bags:

Then the panels are stitched together. Handles and chain/ zippers are then fitted. The finished products are packed in cartons. one container of 20 ft contains 220 No. of 21x19x18 curtain box, each box containing 50 shopping bags and each bag weighs 240 gm.

Manufacturing of jute Floor covering:

Floor covering manufacturing can be sub-divided into unit processes like selection, batching, piling, carding , drawing, spinning, spool winding, twisting, precision winding, seizing, cop winding, weaving, bailing and packing.

Phase III: Use and disposal of the product; a gate to grave approach

After manufacturing, Jute products are transported to export market through sea

Manually a jute bag undergoes ten handlings from the stage of procurement to its final stage of distribution. For example the entry of a gunny bag in FCI's operation starts at the time of procurement in a mandi (unregulated market). At this stage food grains are filled in, bagged, stitched manually or by machines, loaded into trucks, transported, unloaded and stacked in a surplus state. Subsequently, after some storage and preservation of food grains and sugar, it is dispatched, loaded into trucks/wagon, moved and again unloaded and stacked and finally dispatched for issue under PDS in a deficit state. The average transport load varies from 1200 to 1500 kms. Jute bags are also used for packing items like potato, cement and fertilizer.

After the jute bags are emptied of their contents, they are repaired and sent for re use on an average a jute bag undergoes six reuses. Finally rag pickers and ultimate disposal pick up the jute bag by decomposition in the soil.

Power looms use the jute yarn, which is sold by the jute mills, and handlooms for conversion into fabric for use by manufactures of jute diversified products. Also the carpet weaving mills use the yarn for manufacture of carpets.

Hydrocarbon Free jute bags are used mainly for packing cocoa beans in the export markets, which are major growers of cocoa. The major importers of cocoa beans are located in Europe and USA and in these developed countries empty jute bags, unless reused for food aid packaging meant for developing countries, will be subjected to normal disposal procedures, mostly incineration.

Geotextiles are mainly used for arresting soil erosion and undergo decomposition in the soil. Jute geotextile finds its application in the following area also:

- Protection of river bank
- Strengthening of road when used as an intervening layer between sub grade and sub base
- Agro plant mulching
- Rural road pavement construction
- Filtration by retaining soil particles on the one hand and ensuring permeability of water through and along it on the other hand.

PricewaterhouseCoopers

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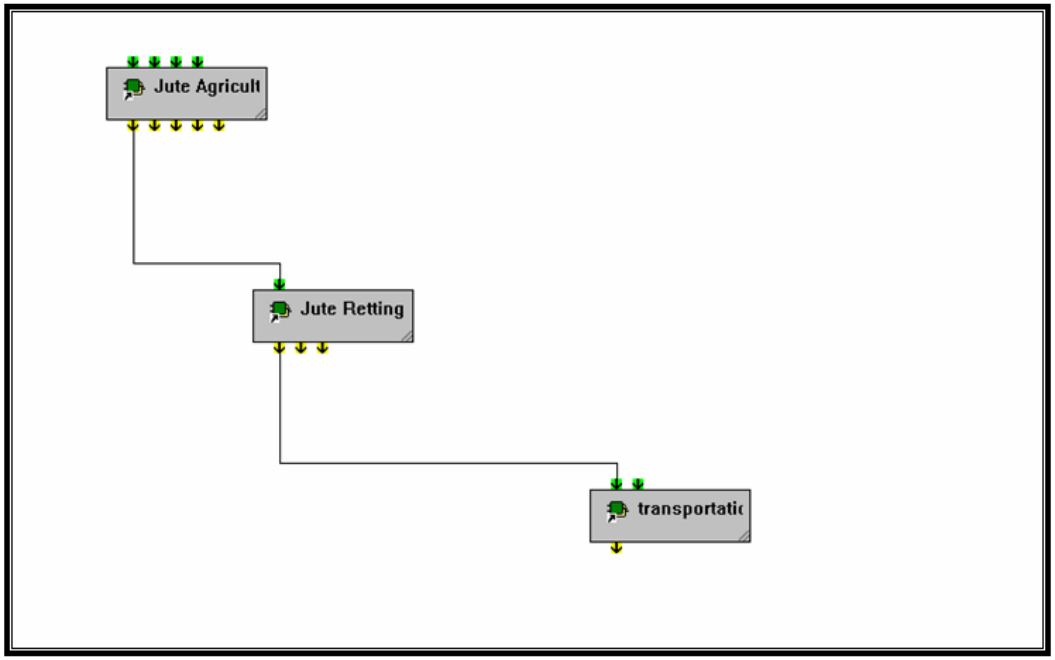
JUTE ECOLABEL

ANNEXURES TO LIFE CYCLE ASSESSMENT STUDY

Annexure 4: Modeling of Jute Life Cycle Processes in TEAM

www.jute.com/ecolabel
THE GOLDEN NATURAL FIBRE

March 2006


Jute Agricult
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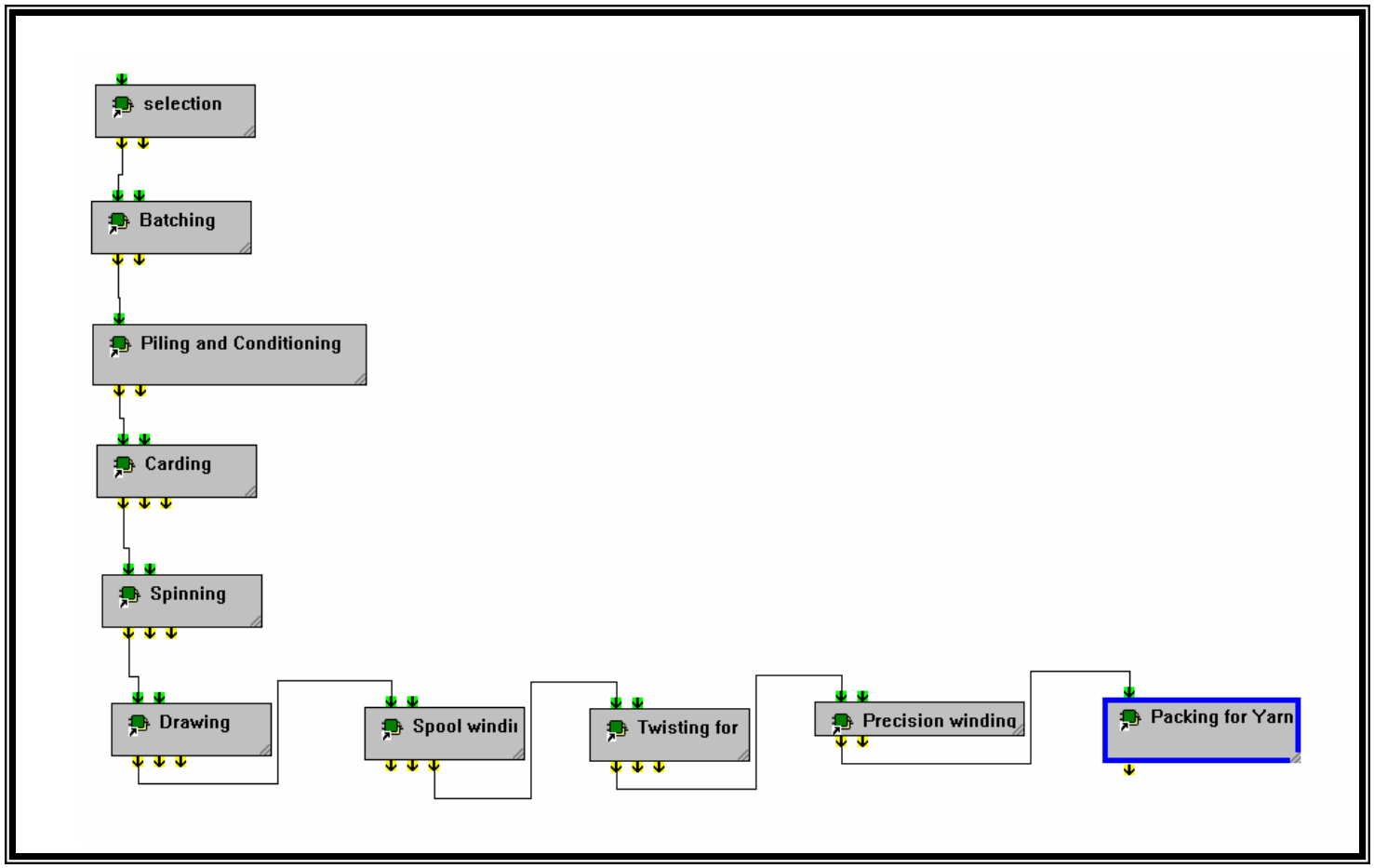
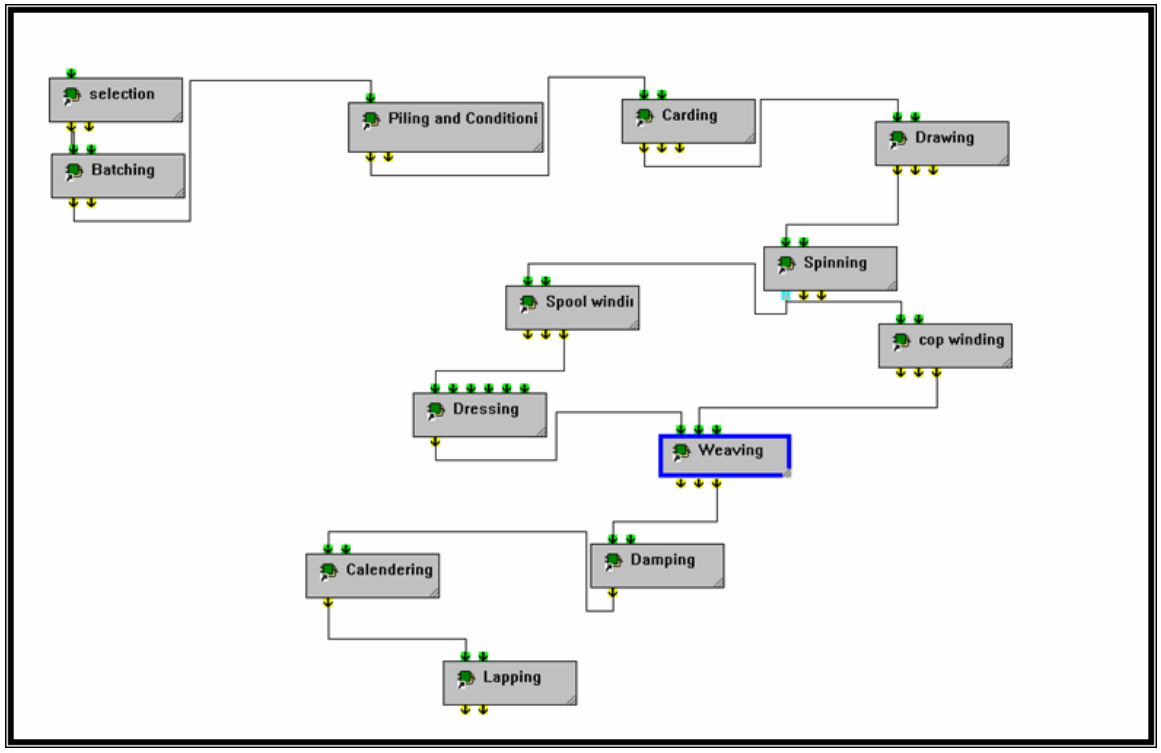
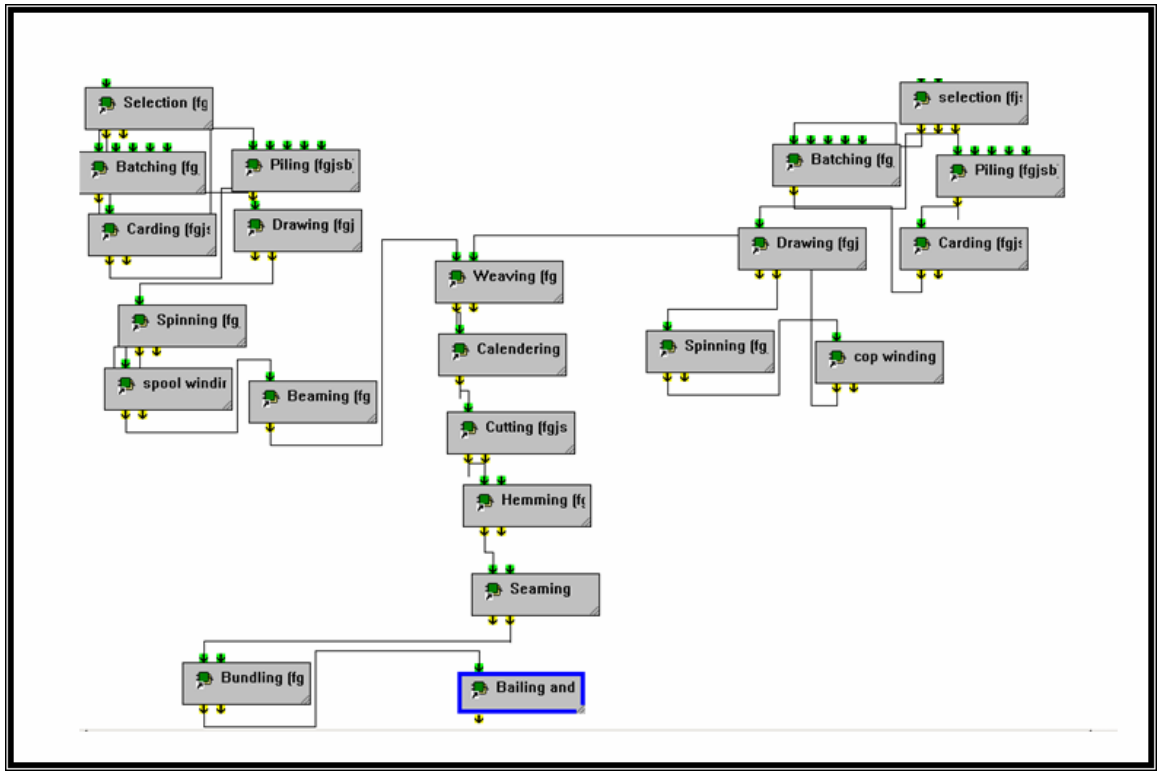
Modelling for Gate to Gate Phase of Jute Yarn



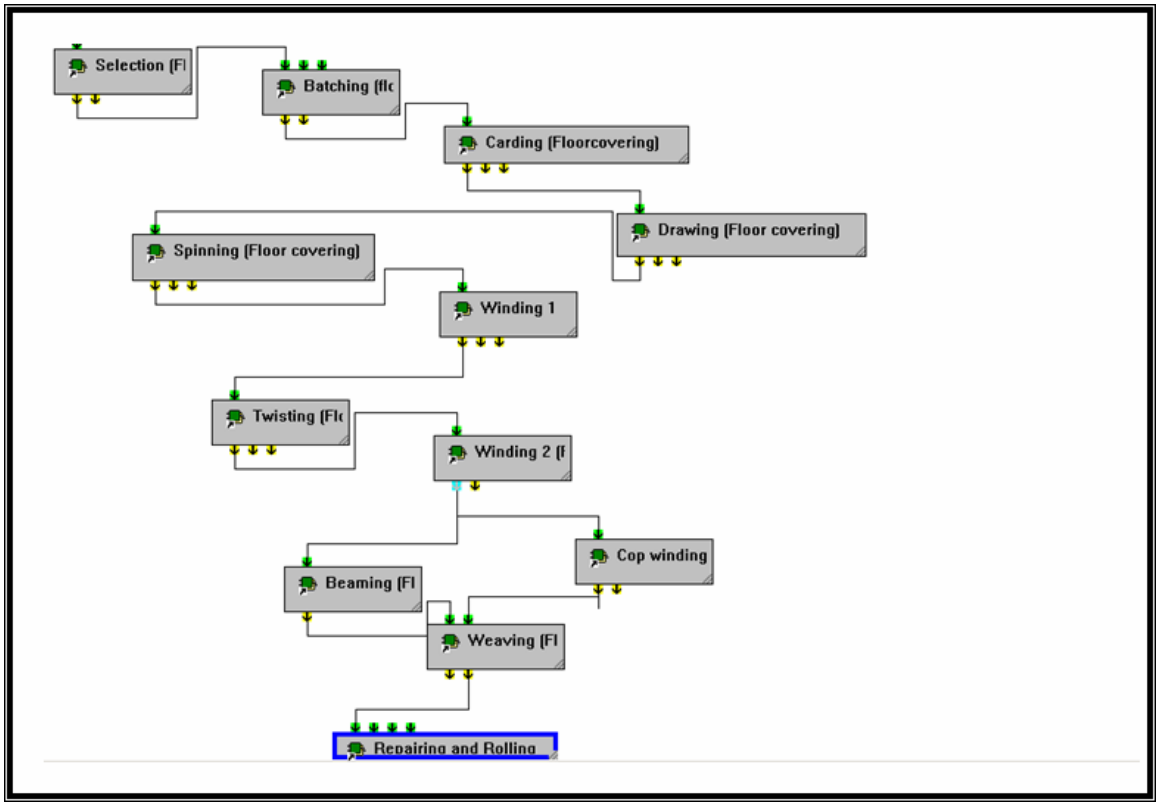
Modelling for Gate to Gate Phase of Jute Hessian



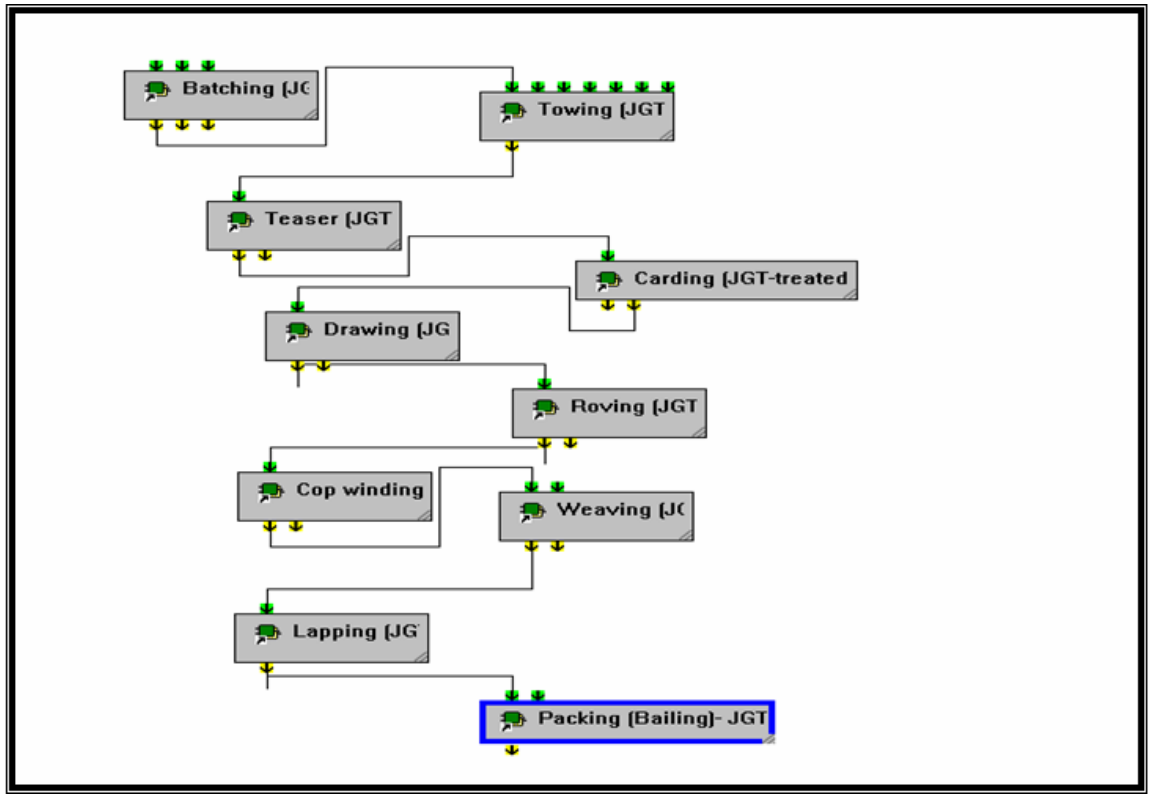
Modelling for Gate to Gate Phase of Jute Hydrocarbon Free Jute Bag



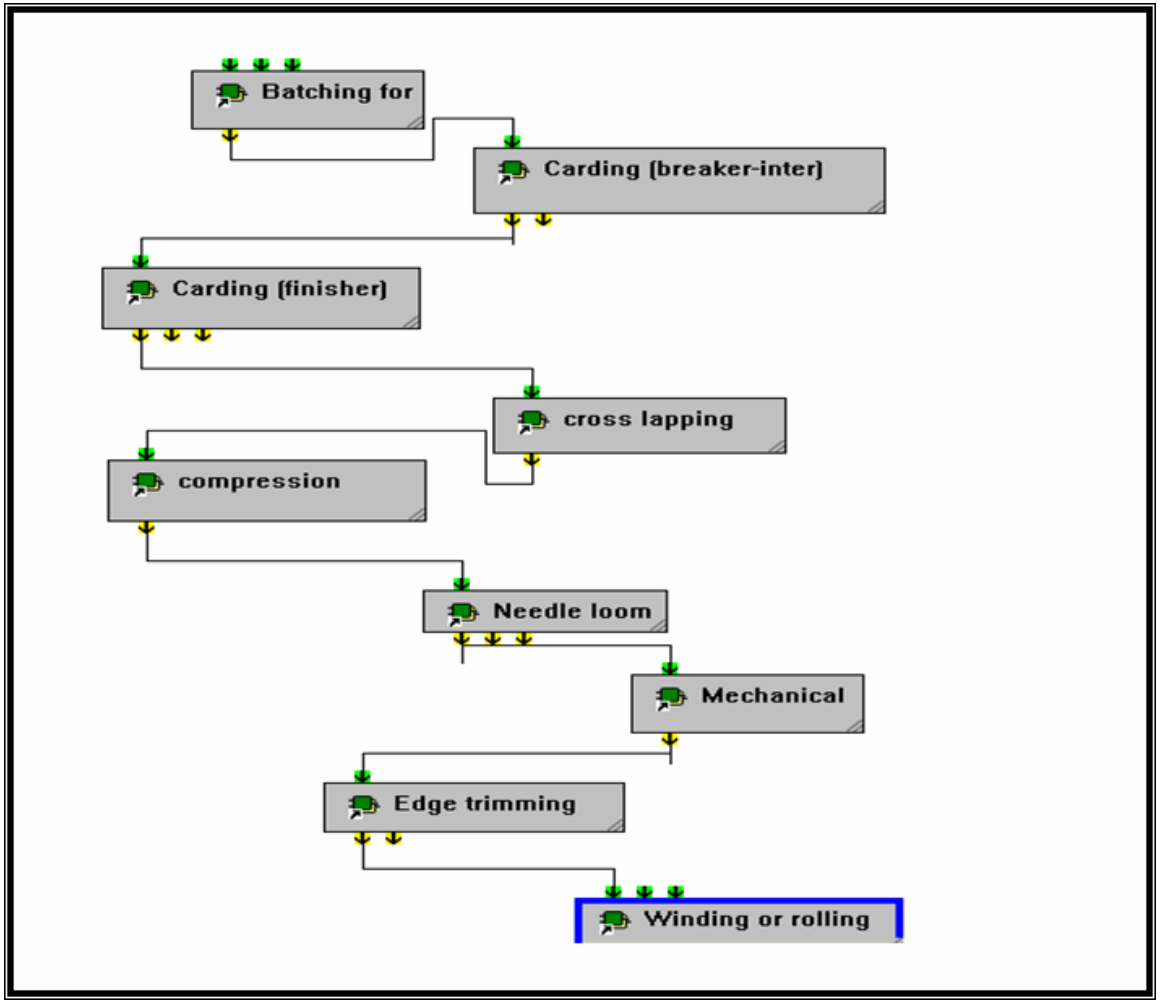
Modelling for Gate to Gate Phase of Jute Floor covering

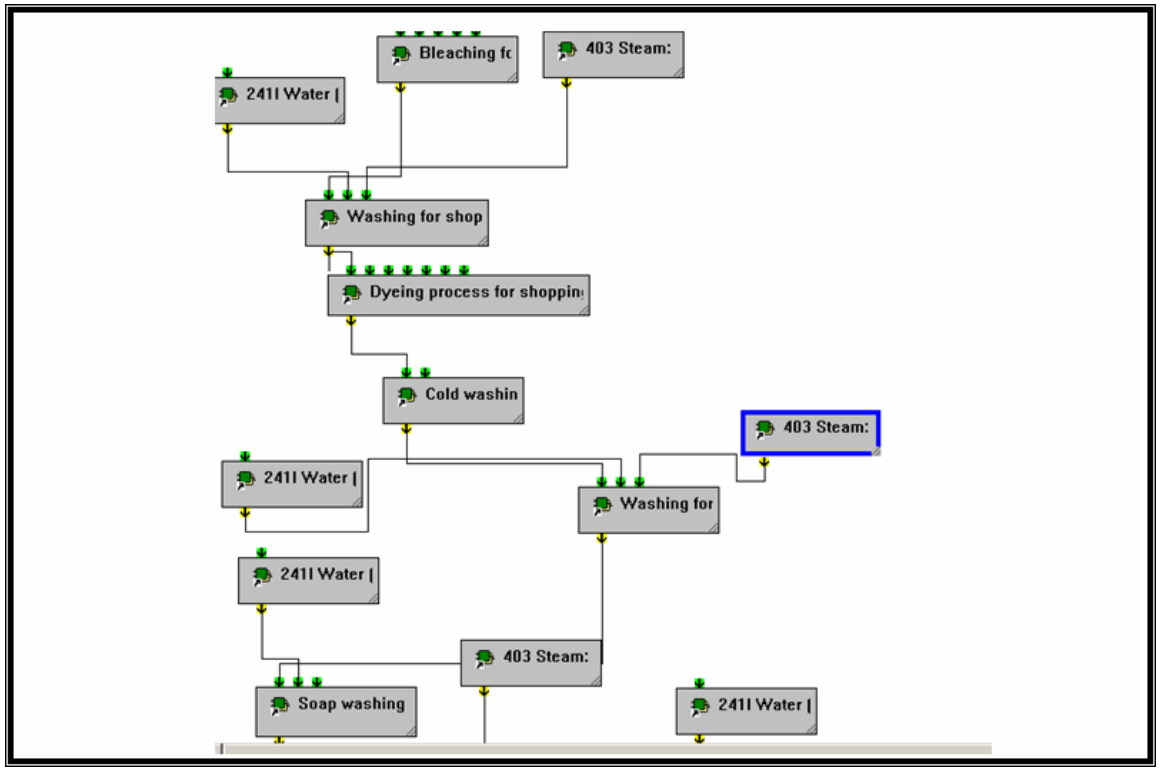


Modelling for Gate to Gate Phase of Jute Geotextiles (Woven)

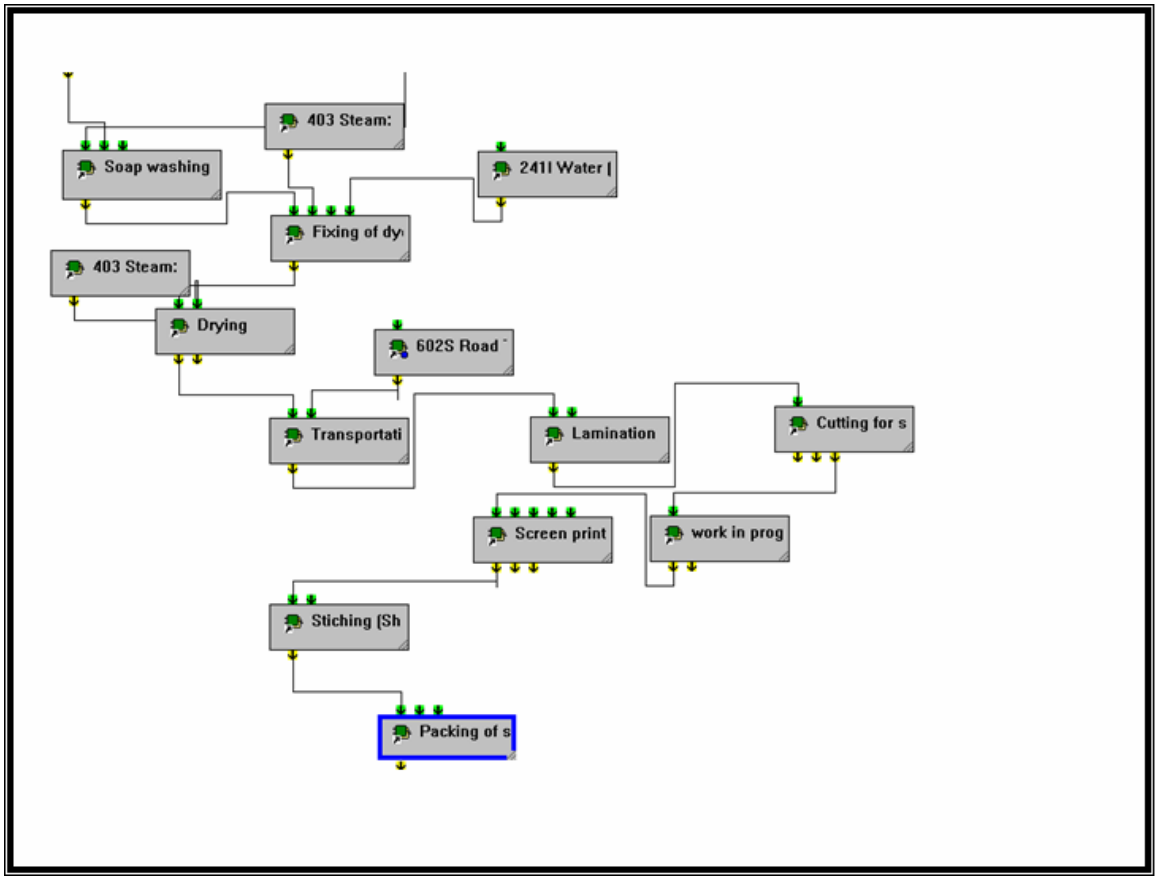


Modelling for Gate to Gate Phase of Jute Felt

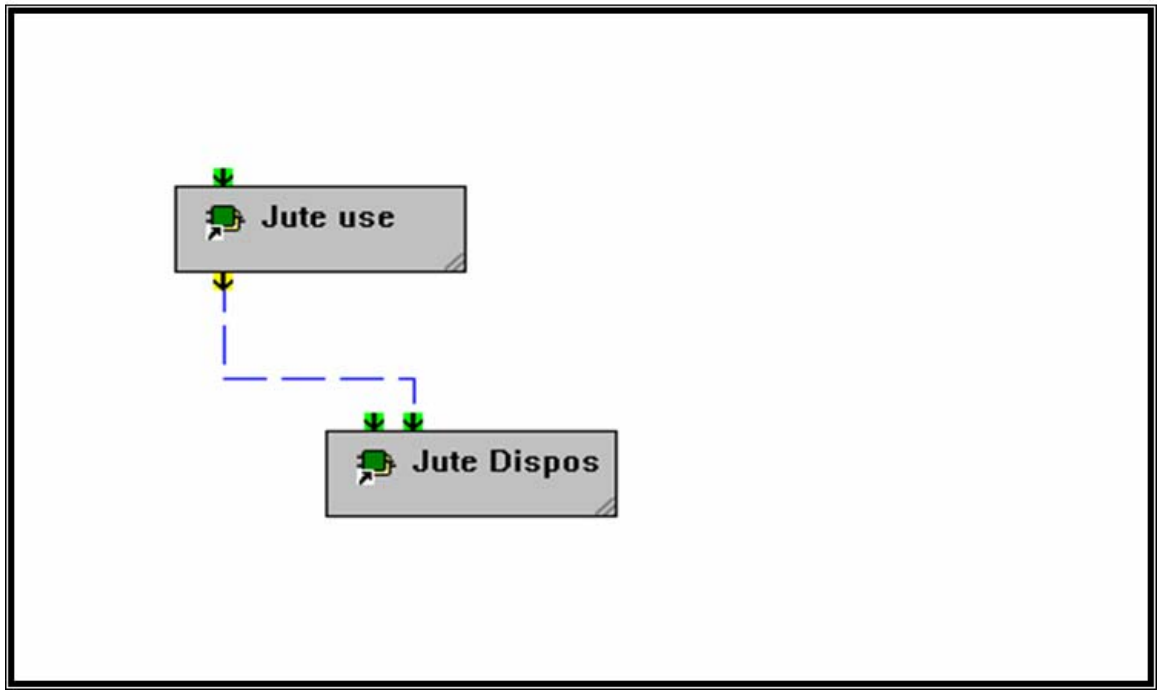



Bleaching fc
403 Steam:
2411 Water |
Washing for shop
Dyeing process for shoppin
Cold washin
403 Steam:
2411 Water |
Washing for
2411 Water |
403 Steam:
Soap washing
2411 Water |

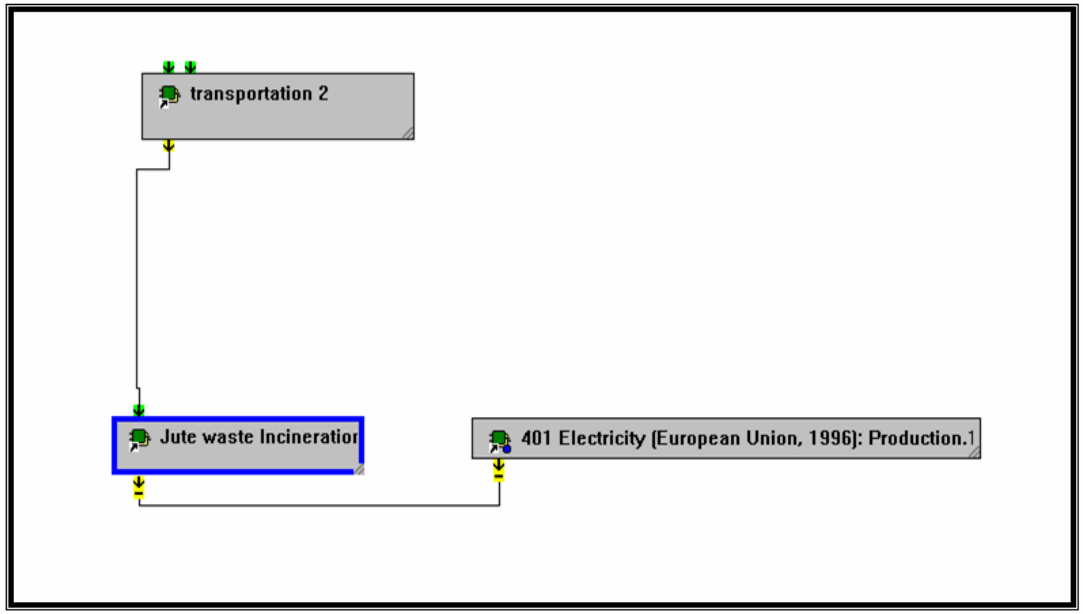
Modelling for Gate to Gate Phase of Jute Shopping Bag (contd.)



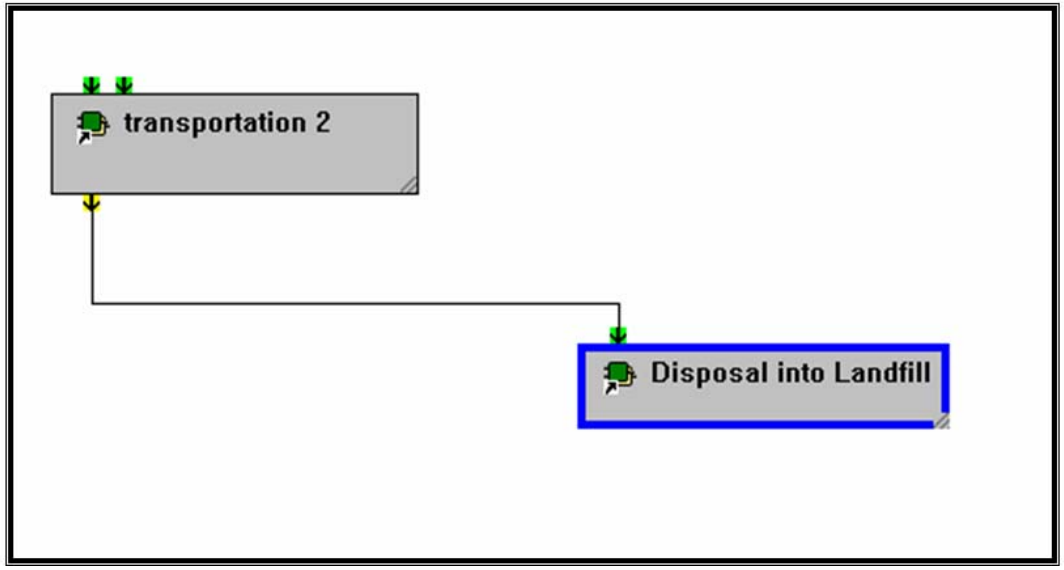
Modelling for Gate to Grave Phase of Jute Products (other than Jute Geotextile)

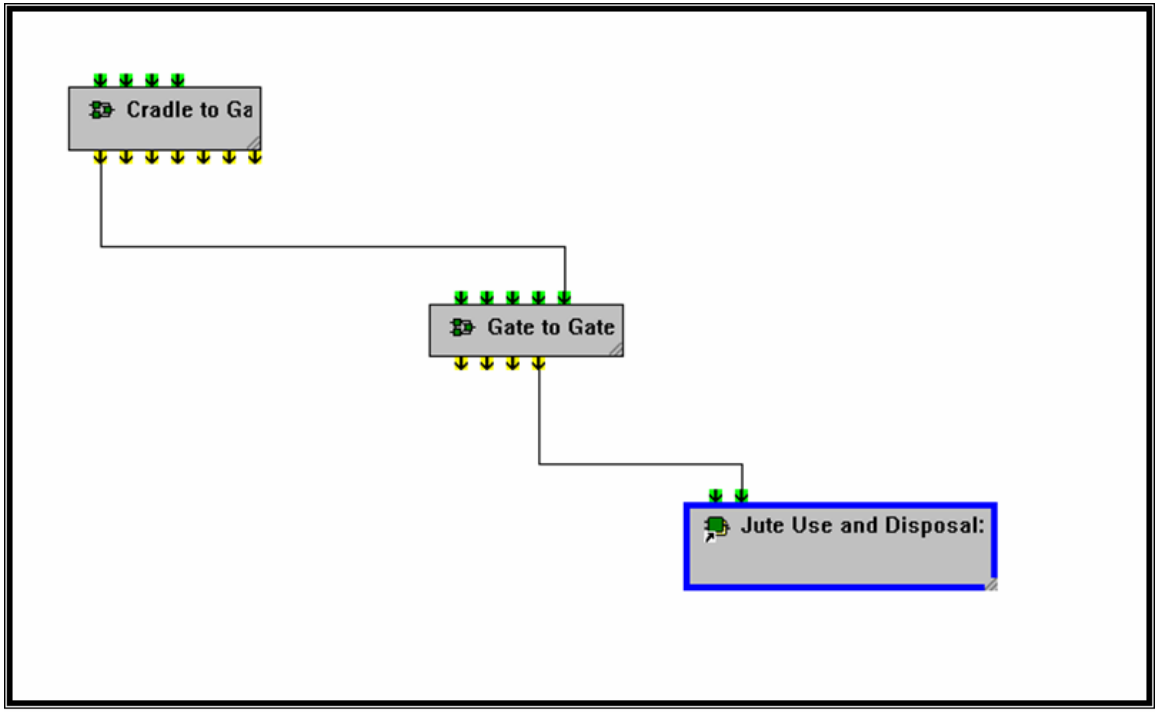


Modelling for Jute Disposal Part of Gate to Grave Phase of Jute Products: Through waste to energy Incineration process



Modelling for Jute Disposal Part of Gate to Grave Phase of Jute Products: Through disposal into Managed Landfill with Methane capture facility




Cradle to Ga
Gate to Gate
Jute Use and Disposal:

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JUTE ECOLABEL

ANNEXURES TO LIFE CYCLE ASSESSMENT STUDY

Annexure 5: Inventory data for Jute Life Cycle

March 2006

Life Cycle Inventory data for Yarn:

Phase I: Agricultural phase or Cradle to Gate Phase:

	Green		Dry		Moisture	N		P2O5		K2O	Carbon Fixation		CO2 fixation	
	kg/ha	kg/kg of Raw Jute fibre	kg/ha	kg/kg of Raw Jute fibre	%	kg/ha	kg/kg of Raw Jute fibre	kg/ha	kg/kg of Raw Jute fibre	kg/kg of Raw Jute fibre	kg/ha	kg/kg of Raw Jute fibre	kg/ha	kg/kg of Raw Jute fibre
Inputs														
Manure			6000	2000		30	0.01	9.375	0.00313	0.01438				
Fertiliser,						50	0.0167	25	0.00833	0.01667				
Total Input (Including manure)						80	0.0267	34.375	0.01146	0.03104				
leaves	6000		1473	0.491	75.45	44.2	0.0147	5.523	0.00184	0.0108				
Ribbon	20000		5742	1.914	71.29	24.4	0.0081	10.623	0.00354	0.03158				
Wood	24000		7920	2.64	67	16.6	0.0055	7.247	0.00242	0.0198				
Total Input (in terms of carbon and nutrient)	50000		15135	5.045	69.73	85.2	0.0284	23.393	0.0078	0.06218	6205	2.068333	22755	7.585
Pesticide used : Pyrethroid Cypermethrin @2 gm/l in 750 l for 1 ha	1.5	0.001												

Water consumed at diffrernt stages														
Stages	water (m3)/ha	water (m3)/kg of raw jute fibre												
Land preparation	770	0.257												
Sowing	0	0												
Growing, Thinning and weeding	4180	1.393												
Retting	421	0.14												
Total	5371	1.79												
Output			3000			12.8	0.0043	5.55	0.00185	0.0165	1230	0.41	4510	1.503333
Jute			5944	1.98133		12.5	0.0042	5.439	0.00181	0.01486	2437	0.812333	8937	2.979
Sticks			1473	0.491		44.2	0.0147	5.523	0.00184	0.0108	604	0.201333	2214	0.738
Leaves			2537	0.84567		10.8	0.0036	4.694	0.00156	0.01396	1040	0.346667	3815	1.271667
Ribbon			1953	0.651		4.1	0.0014	1.787	0.0006	0.00488	801	0.267	2937	0.979
Wood			95	0.03167							39	0.013	143	0.047667
COD			23	0.00767		0.92	0.0003	0.4	0.00013	0.00118	9	0.003	35	0.011667
TSS			110	0.03667							45	0.015	165	0.055
Biogas			15135	5.045		85.2	0.0284	23.393	0.0078	0.06218	6205	2.068333	22755	7.585
Total Jute														
Emission Agriculture						80	0.0267	34.375	0.01146	0.03104				
Input						85.2	0.0284	23.393	0.0078	0.06218				

Output						-5.22	-0.0017	10.982	0.00366	-0.03114				
Emissions Agriculture														
Emissions to soil due to pesticide (pyrethoid cypermethrion) activity	1.5	5E-04												
Emissions Retting (considering effective emission)	mg/l	kg/kg of raw jute fibre												
COD	495	0.069												
BOD	172	0.024												
Phenolics	25	0.004												
KJN	100	0.014												
TAN	187	0.026												
TSS	120	0.017												
TVS	60	0.008												
TDS	187	0.026												
Phosphate	45	0.006												
Biogas, Methane (kg/ha)	54.9	0.018												
Biogas, Carbon dioxide (kg/ha)	53.8	0.018												
Biogas, Hydro sulphate (kg/ha)	1.1	4E-04												

Phase II: Gate to Gate Phase or Manufacturing Phase:

INPUT

Sr. No.	Parameter	Total Quantity		Unit	Input per tonne of finished yarn produced and transported	Unit
1	Water consumption for preparation of applied emulsion	292.2655		tonne	0.4372	tonne/tonne of finished yarn
2	Raw jute consumption (16% MR)	1000		tonne	4.91798	tonne/tonne of finished yarn
3	Coal consumption for steam generation	0		tonne	0	tonne/tonne of finished yarn
4	Caddies consumption for steam generation	0		tonne	0	tonne/tonne of finished yarn
5	JBO consumption for preparation of applied emulsion	18.95652		tonne	0.02836	tonne/tonne of finished yarn
6	Soap/ detergent for preparation of applied emulsion	1.410718		tonne	0.00694	tonne/tonne of finished yarn
7	Polymer (Z 66)	0.634823		tonne	0.00312	tonne/tonne of finished yarn

8	Zycryl 88	4.143984		tonne	0.02038	tonne/tonne of finished yarn
9	Energy (Purchased Electricity from Grid with 80% thermal) (considering the power contribution from DG set during power failure as negligible)	273861.4		KwH	409.666	KwH/tonne of finished yarn
10	Woodent pellete for packing	11.86379		tonne	0.01775	tonne/tonne of finished yarn
11	Plastic sheet for packing	1.031634		tonne	0.00154	tonne/tonne of finished yarn

OUTPUT

Sr. No.	Parameter	Total Quantity		Unit		
1	Finished and packed Jute product	681.3941		tonne		

Emission

Sr. No.	Parameter	Total Quantity		Unit	Emission per tonne of finished Yarn produced and transported	Unit
Emission to water						
1	Effluent treated (considering the effluent contribution from	0		KL	0	KL/ tonne of finished

	batching process only)					yarn
2	pH	6.5			NA	
3	BOD	0		Tonne	0	tonne/tonne of finished yarn
4	COD	0		Tonne	0	
5	TSS	0		Tonne	0	tonne/tonne of finished yarn
6	TDS	Not monitored		Tonne		
7	O&G	0		Tonne	0	tonne/tonne of finished yarn
8	Cr	BDL				
Solid waste generation						
1	Total jute waste (at different % MR)generated in the whole process	316.1151		Tonne	0.47287	tonne/tonne of finished yarn
2	Jute waste reused in other products (at Diff. %MR); mainly non export items(Other than Geo Textiles)	291.9951		Tonne	0.43679	tonne/tonne of finished yarn
3	Jute caddies and dust (out of total waste) with diff. MR % used in boiler	24.12		Tonne	0.03608	tonne/tonne of finished yarn
4	Coal ash	0		Tonne	0	tonne/tonne of finished yarn
Emission to Air:						

1	SPM	0		Tonne	0	tonne/tonne of finished yarn
2	RSPM	Not monitored		Tonne		
3	Sox	0		Tonne	0	tonne/tonne of finished yarn
4	Nox	0		Tonne	0	tonne/tonne of finished yarn
5	VOC (FROM jbo)	Not monitored		Tonne		
6	CO2 (From fossil fuel)	0		Tonne	0	tonne/tonne of finished yarn
7	CO2 (From freight)	197.6588		Tonne	0.29568	tonne/tonne of finished yarn transported
8	CO2 (From purchased electricity)	332.2979		Tonne	0.49708	tonne/tonne of finished yarn

Phase III: Gate to Grave Phase or Use and Disposal Phase:

For disposal into Landfill:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Yarn	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.028357

Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(s) Carbon (C)	g	0.2
	(s) Nitrogen (N)	g	0.065
	(s) Oils (unspecified)	g	0.001
	(s) Phosphorus (P)	g	0.00399
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00003
	(w) Metals (unspecified)	g	0.00048
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002

For Incineration:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Yarn	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.028357
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons (except methane)	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00103
	(w) Metals (unspecified)	g	0.00168

	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002
	Energy	GJ	18.6

Life Cycle Inventory data for Hessian

PHASE I: Same as for Yarn

PHASE II:

INPUT

Sr. No.	Parameter	Total Quantity	Unit	Input per tonne of finished hessian produced and transported	Unit
1	Total water consumption for preparation of applied emulsion, sizing chemical and hydraulic press	136.5347037	tonne	1.810711746	tonne/tonne of finished Hessian
2	Raw jute consumption (16% MR)	100	tonne	1.326191582	tonne/tonne of finished Hessian
3	Coal consumption for steam generation	7.361785997	tonne	0.097631386	tonne/tonne of finished Hessian
4	Caddies (Biomass) consumption for steam generation	9.202232496	tonne	0.122039233	tonne/tonne of finished Hessian

5	unspecified oil (Jute Batching Oil)	1.6	tonne	0.021219065	tonne/tonne of finished Hessian
6	Soap/ detergent for preparation of applied emulsion	0.0096	tonne	0	tonne/tonne of finished Hessian
7	Starch uptake	0.63605831	tonne	0.008435352	tonne/tonne of finished Hessian
8	Gum	0	tonne	0	tonne/tonne of finished Hessian
9	Energy (Purchased Electricity from Grid) (considering the power contribution from DG set during power failure as negligible)	33701.85565	KwH	446.9511724	KwH/tonne of finished Hessian
10	Pack sheet and hand swing thread	0.199481182	tonne	0.002645503	tonne/tonne of finished Hessian
11	Hoofs and buckles and pins	0.598443547	tonne	0.007936508	tonne/tonne of finished Hessian

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	**76.2018116**	tonne		

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water:NA					

1	Effluent treated (considering the effluent contribution from batching process only)	0	KL	0	KL/tonne of finished Hessian
2	pH	6.5		NA	
3	BOD	0	Tonne	0.00000	tonne/tonne of finished Hessian
4	COD	0	Tonne	0.0000	
5	TSS	0	Tonne	0.00	tonne/tonne of finished Hessian
6	TDS	Not monitored	Tonne		
7	O&G	0	Tonne	0.00	tonne/tonne of finished Hessian
8	Cr	BDL			

Solid waste generation					
1	Total jute waste (at different % MR)generated in the whole process	23.96637946	Tonne	0.317840107	tonne/tonne of finished Hessian
2	Jute waste reused in other products (at Diff. %MR); mainly non export items(Other than Geo Textiles)	20.71598528	Tonne	0.274733653	tonne/tonne of finished Hessian
3	Jute caddies and dust (out of total waste) with diff. MR % used in boiler	3.250394183	Tonne	0.043106454	tonne/tonne of finished Hessian
4	Coal ash	2.208535799	Tonne	0.029289416	tonne/tonne of finished Hessian
Emission to Air :					
	SPM	0.769094633	Tonne	0.010199668	tonne/tonne of finished Hessian
	RSPM	Not monitored	Tonne		

	Sox	0.39814654	Tonne	0.005280186	tonne/tonne of finished Hessian
	Nox	0.137520232	Tonne	0.001823782	tonne/tonne of finished Hessian
	VOC (FROM jbo)	Not monitored	Tonne		
	CO2 (From fossil fuel)	14.72357199	Tonne	0.195262772	tonne/tonne of finished Hessian
	CO2 (From freight)	21.8731595	Tonne	0.29008	tonne/tonne of finished Hessian transported
	CO2 (From purchased electricity)	40.8931576	Tonne	0.542321614	tonne/tonne of finished Hessian

PHASE III:

For disposal into Landfill:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Hessian	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.0212
Output:			
Note: a:			

emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(s) Carbon (C)	g	0.2
	(s) Nitrogen (N)	g	0.065
	(s) Oils (unspecified)	g	0.001
	(s) Phosphorus (P)	g	0.00399
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00003
	(w) Metals (unspecified)	g	0.00048
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002

For disposal through Incinerator:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Hessian	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.0212
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons (except methane)	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05

	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00103
	(w) Metals (unspecified)	g	0.00168
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002
	Energy	GJ	18.6

Life Cycle Inventory data for Hydrocarbon Free Jute bag

PHASE I: SAME AS FOR YARN

PHASE II:

INPUT

Sr. No.	Parameter	Total Quantity	Unit	Input per tonne of finished hessian produced and transported	Unit
1	Water consumption for preparation of applied emulsion and other unit process including beaming/ bailing & packing etc.	19.73108	tonne	0.243768917	tonne/tonne of finished F.G. Jute bag
2	Raw jute consumption (16% MR)	100	tonne	1.235456339	tonne/tonne of finished F.G. Jute bag

3	Coal consumption for steam generation	0	tonne	0	tonne/tonne of finished F.G. Jute bag
4	Caddies consumption for steam generation	0	tonne	0	tonne/tonne of finished F.G. Jute bag
5	RBO consumption for preparation of applied emulsion	1.183188	tonne	0.014617777	tonne/tonne of finished F.G. Jute bag
6	Soap/ detergent for preparation of applied emulsion	0.013311	tonne	0.00016445	tonne/tonne of finished F.G. Jute bag
7	Zycril – 66	0	tonne	0	tonne/tonne of finished F.G. Jute bag
8	ME4 (SOAP)	0	tonne	0	tonne/tonne of finished F.G. Jute bag
9	Starch	0	tonne	0	tonne/tonne of finished F.G. Jute bag
10	Gum	0	tonne	0	tonne/tonne of finished F.G. Jute bag
11	Energy (Purchased Electricity from W.B. Grid) (considering the power contribution from DG set during power failure as negligible)	29326.45	KwH	362.3154914	KwH/tonne of finished F.G. Jute bag

12	Hoofs and buckles and pins @ 3 kg kg/ bale	0.793547	tonne	0.009803922	tonne/tonne of finished F.G. Jute bag
13	Hydrocarbon Free packing hessian @ 2 kg per pack	0.529031	tonne	0.006535948	tonne/tonne of finished F.G. Jute bag

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	82.26433	Tons		

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water: NA					
1	Effluent treated	0	KL	0	KL/ tonne of finished F.G. Jute bag
2	pH	NA		NA	
3	BOD	0	Tonne	0	tonne/tonne of finished F.G. Jute bag
4	COD	0	Tonne	0	
5	TSS	0	Tonne	0.00	tonne/tonne of finished F.G. Jute bag
6	TDS	Not monitored	Tonne		
7	O&G	0	Tonne	0.00	tonne/tonne of finished F.G. Jute bag

8	Cr	BDL			
Solid waste generation					
	Total jute waste (at different % MR)generated in the whole process	18.40142	Tonne	0.227341467	tonne/tonne of finished F.G. Jute bag
	Jute waste reused in other products (at Diff. %MR); mainly non export items(Other than Geo Textiles)	15.32203	Tonne	0.189296989	tonne/tonne of finished F.G. Jute bag
	Jute caddies and dust (out of total waste) with diff. MR % used in boiler	3.079387	Tonne	0.038044478	tonne/tonne of finished F.G. Jute bag
	Coal ash	0	Tonne	0	tonne/tonne of finished F.G. Jute bag
Emission to Air					
	SPM	0	Tonne	0	tonne/tonne of finished F.G. Jute bag
	RSPM	Not monitored	Tonne		
	Sox	0	Tonne	0	tonne/tonne of finished F.G. Jute bag
	Nox	0	Tonne	0	tonne/tonne of finished F.G. Jute bag
	VOC (FROM jbo)	Not monitored	Tonne		
	CO2 (From fossil fuel)	0	Tonne	0	tonne/tonne of finished F.G. Jute bag

	CO2 (From freight)	23.47958	Tonne	0.29008	tonne/tonne of finished F.G. Jute bag
	CO2 (From purchased electricity)	35.58413	Tonne	0.439626371	tonne/tonne of finished F.G. Jute bag

PHASE III:

DISPOSAL INTO LANDFILL:

Inputs:			
	Parameter	**Unit**	**Value**
	FGJB	tons	1.0000
	Water Used (total)	litre	0.0010
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(s) Carbon (C)	g	0.2
	(s) Nitrogen (N)	g	0.065
	(s) Phosphorus (P)	g	0.00399

	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.0043726
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163

DISPOSAL THROUGH INCINERATOR:

Inputs:			
	Parameter	**Unit**	**Value**
	FGJB	tons	1.0000
	Water Used (total)	litre	0.0010
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056

	(w) BOD5 (Biochemical Oxygen Demand)	g	0.0000228
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.0043726
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	Energy	GJ	18.6

Life Cycle Inventory data for Floor Covering

PHASE I: SAME AS FOR YARN

PHASE II:

INPUT					
Sr. No.	**Parameter**	**Total Quantity**	**Unit**	**Input per tonne of finished Floor covering produced and transported**	**Unit**
1	Water consumption	15.05498	tonne	0.212117777	tonne/tonne of finished Floor covering
2	Raw jute consumption (16% MCR)	100	tonne	1.408954232	tonne/tonne of finished Floor covering
3	Coal consumption for steam generation	0	tonne	0	tonne/tonne of finished Floor covering
	Caddies consumption for steam generation	0	tonne	0	tonne/tonne of finished Floor covering
4	JBO	1.394803	tonne	0.019652136	tonne/tonne of finished Floor covering

5	Soap	0.0084212	tonne	0.000118651	tonne/tonne of finished Floor covering
6	Starch	0	tonne	0	tonne/tonne of finished Floor covering
7	Gum	0	tonne	0	tonne/tonne of finished Floor covering
8	Energy (Purchased Electricity from Grid)	39676.456	KwH	559.023103	KwH/tonne

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	**80.486792**	tonne		

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished Floor covering produced and transported	Unit
Emission to water (NA, considering zero discharge)					
1	Effluent treated	0	KL	0	KL/ tonne of finished Floor covering
	Ph				
	BOD	0	Tonne	0	tonne/tonne of finished Floor covering

	COD	0	Tonne	0	
	TSS	0	Tonne	0	tonne/tonne of finished Floor covering
	TDS	0	Tonne	0	
	O&G	0	Tonne	0	tonne/tonne of finished Floor covering
Solid waste generation					
	Total Jute waste including caddies and dust	28.193509	Tonne	0.397233636	tonne/tonne of finished Floor covering
	Recycled Jute waste	23.468359	Tonne	0.330658443	tonne/tonne of finished Floor covering
	Jute caddies and dust, input to boiler (including dropage)	4.7251494	Tonne	0.066575193	tonne/tonne of finished Floor covering
	Coal ash	0	Tonne	0	tonne/tonne of finished Floor covering
Emission to Air					
	SPM	0	Tonne	0	tonne/tonne of finished Floor covering
	RSPM	0	Tonne	0	tonne/tonne of finished Floor covering
	SOx	0	Tonne	0	tonne/tonne of finished Floor covering
	NOx	0	Tonne	0	tonne/tonne of finished Floor covering
	VOC (FROM jbo)	0	Tonne	0	tonne/tonne of finished Floor covering
	CO2 (From fossil fuel)	0	Tonne	0	tonne/tonne of finished Floor covering
	CO2 (From freight)	20.58832	Tonne	0.29008	tonne/tonne of finished Floor covering Transported

	CO2 (From purchased electricity)	48.142618	Tonne	0.67830745 3	tonne/tonne of finished Floor covering

PHASE III:

FOR DISPOSAL INTO LANDFILL

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Floor covering	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.0195
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340

	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(s) Carbon (C)	g	0.2
	(s) Nitrogen (N)	g	0.065
	(s) Oils (unspecified)	g	0.001
	(s) Phosphorus (P)	g	0.00399
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00003
	(w) Metals (unspecified)	g	0.00048
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002

DISPOSAL THROUGH INCINERATOR

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Floor covering	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
	Oil (unspecified)	tons	0.0195
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			

Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a) Hydrocarbons (except methane)	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	2.28E-05
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00103
	(w) Metals (unspecified)	g	0.00168
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.004373
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002
	Energy	GJ	18.6

Life Cycle Inventory data for Jute Geotextiles:

Phase I: Same as for Yarn

Phase II:

FOR JUTE GEOTEXTILES (TREATED)

INPUT					
Sr. No.	**for 2.8485 tonnes of finished soil saver packed in required no.s of bales**	**Quantity**	**Unit**	**Input per tonne of finished Geo textile produced and transported**	**Unit**
1	Water consumption	105.696052	tonne	0.436112361	Tonne per tonne of finished geotextile
2	Root Cutting (15% MR)	100	tonne	0.412609886	Tonne per tonne of finished geotextile
	Mill waste (20% MR)	128.5	tonne	0.530203703	Tonne per tonne of finished geotextile

3	Coal consumption for steam applied in the whole process	0	tonne	0	Tonne per tonne of finished geotextile
4	JBO	4.85565801	tonne	0.020034925	Tonne per tonne of finished geotextile
5	Non ionic detergent	0.02931636	tonne	0.000120962	Tonne per tonne of finished geotextile
6	Starch	0	tonne	0	Tonne per tonne of finished geotextile
7	Gum	0	tonne	0	Tonne per tonne of finished geotextile
8	Cu in Tow	2.57	tonne	0.010604074	Tonne per tonne of finished geotextile
9	Borax in tow	4.626	tonne	0.019087333	Tonne per tonne of finished geotextile
10	DAP in Tow	2.12025	tonne	0.008748361	Tonne per tonne of finished geotextile
11	Mono sodium Phosphate in Tow	3.1611	tonne	0.013043011	Tonne per tonne of finished geotextile
12	Boric acid in tow	3.084	tonne	0.012724889	Tonne per tonne of finished geotextile

13	Energy	21848.9168	Kwh	90.15079054	kwh per tonne of finished geotextile

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	**242.35968**	tonnes		

Emission

Sr. No.	for 2.8485 tonnes of finished soil saver packed in required no.s of bales	Quantity	Unit	Emission per tonne of finished geo textile produced and transported	Unit
Emission to water					
1	WASTEWATER	0	KL	0	Tonne per tonne of finished geotextile
	BOD	0	tonne	0	Tonne per tonne of finished geotextile
	COD	0	tonne	0	Tonne per tonne of finished geotextile
	TSS	0	tonne	0	Tonne per tonne of finished geotextile

	TDS	0	tonne	0	Tonne per tonne of finished geotextile
Solid waste generation					
	Total jute waste (at different % MR)generated in the whole process	8.55556596	tonne	0.035301111	Tonne per tonne of finished geotextile
	Waste reused in the same product.	8.55556596	tonne	0.035301111	Tonne per tonne of finished geotextile
	Jute caddies and dust, input to boiler	0	tonne		Tonne per tonne of finished geotextile
	Coal ash	0	tonne		
Emission to Air					
	SPM	0	tonne	0	Tonne per tonne of finished geotextile
	RSPM	0	tonne	0	Tonne per tonne of finished geotextile
	Sox	0	tonne	0	Tonne per tonne of finished geotextile
	Nox	0	tonne	0	Tonne per tonne of finished geotextile

	VOC (FROM jbo)	0	tonne	0	Tonne per tonne of finished geotextile
	CO2 (From fossil fuel)	0	tonne	0	Tonne per tonne of finished geotextile
	CO2 (From freight)	73.1058346	tonne	0.301641901	Tonne per tonne of finished geotextile
	CO2 (From purchased electricity used only in the process)	23.7060747	tonne of CO2	0.097813608	Tonne per tonne of finished geotextile

FOR JUTE GEOTEXTILES (NON-WOVEN)

INPUT

Sr. No.	Parameter	Total Quantity for production of above quantity of finished goods	Unit	Input per tonne of finished feltproduced and transported	Unit

1	Water consumption for preparation of applied emulsion	192.5144	tonne	0.191956117	tonne/tonne of finished felt
2	Raw jute (root cuttings) consumption (16% MR)	1070	tonne	5.255778808	Do
3	Coal consumption for steam generation	0	tonne	0	Do
4	Caddies consumption for steam generation	0	tonne	0	Do
5	JBO used	21.4	tonne	0.021337941	Do
6	Soap/ detergent used	0.0856	tonne	0.000420462	Do
7	Starch	0	tonne	0	Do
8	Gum	0	tonne	0	Do
9	Energy consumed	456807.507	KwH	455.4827851	KwH/tonne of finished felt
10	Paper core @ of 3.5 kg/role	33.4302797	tonne	0.033333333	tonne/tonne of finished felt
11	Plastic sheet @ 0.5kg/ role	4.77575424	tonne	0.004761905	tonne/tonne of finished felt

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit	
1	Finished and packed Jute product	**1041.11443**	tonne	

Emission

Sr. No.	Parameter	Total Quantity for production of above quantity of finished goods	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water: NA (as there no process effluent generated and discharged during the production process)					
1	Volume of process effluent treated	0	KL	0	KL/ tonne of finished felt
2	pH	NA		NA	
3	BOD	0	Tonne	0	tonne/tonne of finished felt
4	COD	0	Tonne	0	tonne/tonne of finished felt
5	TSS	0	Tonne	0	tonne/tonne of finished felt
6	TDS	Not monitored	Tonne	Not monitored	tonne/tonne of finished felt
7	O&G	0	Tonne	0	tonne/tonne of finished felt
8	Cr	BDL		BDL	
Solid waste generation					

	Jute waste including caddies and dust etc. generated at different unit process	94.695	Tonne	0.094420389	tonne/tonne of finished felt
	Part of Waste (from selection process) reused in other products	0	Tonne	0	tonne/tonne of finished felt
	Dust generated - dumped on ground	25.68	Tonne	0.025605529	tonne/tonne of finished felt
	Part of Waste (from other than selection process) recycled back in the same product	69.015	Tonne	0.338997733	tonne/tonne of finished felt
	Coal ash	159.537741	tonne	0.159075089	
Emission to Air:					
1	SPM	0.82657242	Tonne	0.000824175	tonne/tonne of finished felt
2	RSPM	Not monitored	Tonne	Not monitored	
3	SOx	0.45157935	Tonne	0.00045027	tonne/tonne of finished felt
4	NOx	Not monitored	Tonne	Not monitored	tonne/tonne of finished felt

5	VOC (FROM jbo)	Not monitored	Tonne		
6	CO2 (From fossil fuel) - for own power generation	54.8381424	Tonne	0.054679114	tonne/tonne of finished felt
7	CO2 (From freight)	302.006472	Tonne	0.301130667	tonne/tonne of finished felt transported
8	CO2 (From purchased electricity)	0	Tonne	0	tonne/tonne of finished felt

FOR PHASE IIII:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute GEOTEXTILES	Tons	1.0000
	Water Used (total)	Litre	0.0010
	Water: Unspecified Origin	Litre	0.0010
	Oil (unspecified)	Tons	0.0212
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	G	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	G	0.0001
	(a) Benzene (C6H6)	G	0.0001
	(a) Carbon Dioxide (CO2, biomass)	G	0.2500
	(a) Carbon Monoxide (CO)	G	0.0826
	(a) Hydrocarbons	G	0.1030

	(a) Nitrogen Oxides (NOx as NO2)	G	0.0110
	(a) Nitrous Oxide (N2O)	G	0.0012
	(a) Particulates (unspecified)	G	0.0340
	(a) Sulphur Oxides (SOx as SO2)	G	0.0800
	(s) Carbon (C)	G	0.2
	(s) Nitrogen (N)	G	0.065
	(s) Oils (unspecified)	G	0.001
	(s) Phosphorus (P)	G	0.00399
	(w) Ammonia (NH4+, NH3, as N)	G	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	G	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	G	2.28E-05
	(w) COD (Chemical Oxygen Demand)	G	0.000738
	(w) Copper (Cu+, Cu++)	G	96
	(w) Metals (unspecified)	G	0.00048
	(w) Nitrogenous Matter (unspecified, as N)	G	0.000539
	(w) Oils (unspecified)	G	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	G	0.004373
	(w) Salts (unspecified)	G	0.153
	(w) Suspended Matter (unspecified)	G	0.0163
	(w) Water: Chemically Polluted	litre	0.00068

Life Cycle Inventory data for Jute Shopping bag:

Phase I: Same as for Yarn

Phase II:

INPUT

Sr. No.	Parameter	Total Quantity	Unit	Input per tonne of finished hessian produced and transported	Unit
1	Total water consumption for preparation of applied emulsion, sizing chemical and hydraulic press	136.5347037	tonne	1.810712	tonne/tonne of finished Hessian
2	Raw jute consumption (16% MR)	100	tonne	1.326192	tonne/tonne of finished Hessian

3	Coal consumption for steam generation	7.361785997	tonne	0.097631	tonne/tonne of finished Hessian
4	Caddies (Biomass) consumption for steam generation	9.202232496	tonne	0.122039	tonne/tonne of finished Hessian
5	unspecified oil (Jute Batching Oil)	1.6	tonne	0.021219	tonne/tonne of finished Hessian
6	Soap/ detergent for preparation of applied emulsion	0.0096	tonne	0	tonne/tonne of finished Hessian
7	Starch uptake	0.63605831	tonne	0.008435	tonne/tonne of finished Hessian
8	Gum	0	tonne	0	tonne/tonne of finished Hessian
9	Energy (Purchased Electricity from Grid) (considering the power contribution from DG set during power failure as negligible)	33701.85565	KwH	446.9512	KwH/tonne of finished Hessian

10	Pack sheet and hand swing thread	0.199481182	tonne	0.002646	tonne/tonne of finished Hessian
11	Hoofs and buckles and pins	0.598443547	tonne	0.007937	tonne/tonne of finished Hessian

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	**76.2018116**	tonne		

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water:NA					
1	Effluent treated (considering the effluent contribution from batching process only)	0	KL	0	KL/tonne of finished Hessian

2	pH	6.5		NA	
3	BOD	0	Tonne	0.00000	tonne/tonne of finished Hessian
4	COD	0	Tonne	0.0000	
5	TSS	0	Tonne	0.00	tonne/tonne of finished Hessian
6	TDS	Not monitored	Tonne		
7	O&G	0	Tonne	0.00	tonne/tonne of finished Hessian
8	Cr	BDL			

Solid waste generation					
1	Total jute waste (at different % MR)generated in the whole process	23.96637946	Tonne	0.31784	tonne/tonne of finished Hessian
2	Jute waste reused in other products (at Diff. %MR); mainly non export items(Other than Geo Textiles)	20.71598528	Tonne	0.274734	tonne/tonne of finished Hessian

3	Jute caddies and dust (out of total waste) with diff. MR % used in boiler	3.250394183	Tonne	0.043106	tonne/tonne of finished Hessian
4	Coal ash	2.208535799	Tonne	0.029289	tonne/tonne of finished Hessian
Emission to Air from Stack:					
	SPM	0.769094633	Tonne	0.0102	tonne/tonne of finished Hessian
	RSPM	Not monitored	Tonne		
	Sox	0.39814654	Tonne	0.00528	tonne/tonne of finished Hessian
	Nox	0.137520232	Tonne	0.001824	tonne/tonne of finished Hessian
	VOC (FROM jbo)	Not monitored	Tonne		
	CO2 (From fossil fuel)	14.72357199	Tonne	0.195263	tonne/tonne of finished Hessian

	CO2 (From purchased electricity)	40.8931576	Tonne	0.542322	tonne/tonne of finished Hessian

Inventory for manufacturing of shopping bag

Total Hessian consumption (with 13% MR)	**2.31**	**tonne**
Total Production of Finished Shopping bags	**2.697429695**	**tonne**

INPUT

Sr. No.	Parameter	Total Quantity	Unit	Input per tonne of finished Shopping bag produced and transported	Unit
1	Water consumption	47.96	tonne	17.77931	tonne/tonne of finished Shopping bag

2	Hessian consumption (13% MCR)	2.31	tonne	0.856371	tonne/tonne of finished Shopping bag
3	Sream requirement	7.982420339	tonne	2.959269	tonne/tonne of finished Shopping bag
4	Coal consumption for steam generation	0	tonne	0	tonne/tonne of finished Shopping bag
5	Caddies consumption for steam generation	0	tonne	0	tonne/tonne of finished Shopping bag
6	FO consumption	0.9735	tonne	0.360899	tonne/tonne of finished Shopping bag
7	H2O2	0.1386	tonne	0.051382	tonne/tonne of finished Shopping bag

8	Soap	0.008197035	tonne	0.003039	tonne/tonne of finished Shopping bag
9	Sodium silicate	0.1848	tonne	0.06851	tonne/tonne of finished Shopping bag
10	Caustic Soda	0.03696	tonne	0.013702	tonne/tonne of finished Shopping bag
11	Acetic acid	0.0231	tonne	0.008564	tonne/tonne of finished Shopping bag
12	tinapol/Blueton	0.017325	tonne	0.006423	tonne/tonne of finished Shopping bag
13	DBS(labeling agent	0.00231	tonne	0.000856	tonne/tonne of finished Shopping bag

14	Dye	0.0462	tonne	0.017127	tonne/tonne of finished Shopping bag
15	Ciba Fix	0.14214442	tonne	0.052696	tonne/tonne of finished Shopping bag
16	Mineral Turpentile oil	0.165	tonne	0.061169	tonne/tonne of finished Shopping bag
17	Diamonium Phosphate	0.0044	tonne	0.001631	tonne/tonne of finished Shopping bag
18	Urea	0.0044	tonne	0.001631	tonne/tonne of finished Shopping bag
19	Fixer	0.0022	tonne	0.000816	tonne/tonne of finished Shopping bag

20	LDP Polythene granules	0.594	tonne	0.22021	tonne/tonne of finished Shopping bag
21	Energy	11671.23575	KwH	4326.799	KwH/tonne

OUTPUT

Sr. No.	Parameter	Total Quantity	Unit		
1	Finished and packed Jute product	**2.69743**	tonne		

Emission

Sr. No.	Parameter	Total Quantity	Unit	Emission per tonne of finished hessian produced and transported	Unit
Emission to water					
1	Effluent treated	47.96	KL	17.77931	KL/ tonne of finished Floor covering
	PH	6		8	

	BOD	0.0014388	Tonne	0.000533	tonne/tonne of finished Floor covering
	COD	0.016786	Tonne	0.006223	tonne/tonne of finished Floor covering
	TSS	Not monitored	Tonne	0	
	TDS	Not monitored	Tonne	0	
	O&G	0.0004796	Tonne	0.000178	tonne/tonne of finished Floor covering

Solid waste generation					
	Recycled Jute waste	1.05688	Tonne	0.39181	tonne/tonne of finished Floor covering
	Jute caddies and dust, input to boiler (including dropage)	0	Tonne	0	tonne/tonne of finished Floor covering

	Coal ash	0	Tonne	0	tonne/tonne of finished Floor covering
Emission to Air from					
	SPM	0	Tonne	0	tonne/tonne of finished Floor covering
	RSPM	0	Tonne	0	tonne/tonne of finished Floor covering
	Sox	0	Tonne	0	tonne/tonne of finished Floor covering
	NOx	0	Tonne	0	tonne/tonne of finished Floor covering
	VOC	0.01287	Tonne	0.004772	tonne/tonne of finished Floor covering

	LOSS TO AIR (75%OF Printing Paste), as solvent	0.165	Tonne	0.061338	tonne/tonne of finished Floor covering
	CO2 (From fossil fuel)	0.6345	Tonne	0.235	tonne/tonne of finished Floor covering
	CO2 (From freight)	20.58831958	Tonne	0.29008	tonne/tonne of finished Floor covering Transported
	CO2 (From purchased electricity)	48.14261794	Tonne	0.678307	tonne/tonne of finished Floor covering

PHASE III:

DISPOSAL INTO LANDFILL:

Inputs:			
	Parameter	**Unit**	**Value**
	Jute Shopping bag	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010
Output:			
Note: a: emission to air; s: emission to soil; w: emission to water			
Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a)Acetic acid	g	0.0025
	(a)Aldehyde (unspecified)	g	0.0013
	(a) Hydrocarbons	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(s) Carbon (C)	g	0.2

	(s) Nitrogen (N)	g	0.065
	(s) Oils (unspecified)	g	0.001
	(s) Phosphorus (P)	g	0.00399
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	0.0000228
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00003
	(w) Metals (unspecified)	g	0.00048
	(w) Copper (Cu+, Cu++)	g	0.00034
	(w) Chromium	g	0.00007
	(w)Zinc	g	0.00005
	(w) Iron	g	0.00126
	(w)Hydrocarbons	g	0.156
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.00437263
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163
	(w) Water: Chemically Polluted	litre	0.00002

DISPOSAL THROUGH INCINERTION METHOD:

Inputs:

	Parameter	Unit	Value
	Jute Shopping bag	tons	1.0000
	Water Used (total)	litre	0.0010
	Water: Unspecified Origin	litre	0.0010

Output:

Note: a: emission to air; s: emission to soil; w: emission to water

Outputs:	(a) Ammonia (NH3)	g	0.0191
	(a) Aromatic Hydrocarbons (unspecified)	g	0.0001
	(a) Benzene (C6H6)	g	0.0001
	(a) Carbon Dioxide (CO2, biomass)	g	0.2500
	(a) Carbon Monoxide (CO)	g	0.0826
	(a)Acetic acid	g	0.0025
	(a)Aldehyde (unspecified)	g	0.0013
	(a)Acetone	g	0.0045
	(a)Benzo(a)pyrene	g	0.0008
	(a) Hydrocarbons (except methane)	g	0.1030
	(a) Nitrogen Oxides (NOx as NO2)	g	0.0110
	(a) Nitrous Oxide (N2O)	g	0.0012
	(a) Particulates (unspecified)	g	0.0340
	(a) Sulphur Oxides (SOx as SO2)	g	0.0800
	(w) Ammonia (NH4+, NH3, as N)	g	0.0056
	(w) Aromatic Hydrocarbons (unspecified)	g	0.000225
	(w) BOD5 (Biochemical Oxygen Demand)	g	0.0000228
	(w) COD (Chemical Oxygen Demand)	g	0.000738
	(w) Copper (Cu+, Cu++)	g	0.00103
	(w) Metals (unspecified)	g	0.254
	(w) Nitrogenous Matter (unspecified, as N)	g	0.000539
	(w) Oils (unspecified)	g	0.00702
	(w) Phosphates (PO4 3-, HPO4--, H2PO4-, H3PO4, as P)	g	0.00437263
	(w) Salts (unspecified)	g	0.153
	(w) Suspended Matter (unspecified)	g	0.0163

(w) Water: Chemically Polluted	litre	0.00002
Energy	GJ	18.6