Paper packaging manufacture by using sunflower seed shells in enhancing sustainable future

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Abstract:

The use of modern technology has made sustainable packaging constitutes a relatively new addition to the environmental considerations of packaging. The environmental impact of paper as one of the packaging materials and the resulting consumption of paper led to a reconsideration of its manufacturing and uses.

The much criticism at packaging materials is due to their negative impact on the environment. Paper waste is one of the most prominent global environmental issues, where these recently discussed issues such as air and water pollution, greenhouse gas emissions, fuel consumption, climate change, and waste accumulation to take action in this regard.

Sustainability has become an environmental requirement in paper industry. Where sustainable packaging is no longer focused on recycling, but also on the environmental goal, which requires more study of materials and processing.

In paper packaging industry, environmental innovation is an important way to achieve and advance industrial transformation, by improving methods, products and processing, consuming less resources, and reducing the release of harmful substances in order to protect the environment and obtain sustainability.

This paper research looks for reducing the usage of resources in the manufacture of packaging paper to solve the environmental problem facing workers in this field. Therefore, the aim of this study was to use sunflower shells to produce paper suitable for product packaging.

For applying this, we replaced one of the ingredients for making paper with sunflower seeds shells. Several attempts have been made to adjust the appropriate proportions for a specific type of paper suitable for the application of product packaging process.

The two researchers reached good results that led to reduce the components of the raw materials consumed and replacing them with recycling sunflower shells to achieve a positive contribution to environmental sustainability.

Keywords:

Paper environmental sustainability, Sunflower seed shells, Technical scheme of packaging system.

الملخص :

إن استخدام التكنولوجيا الحديثة جعل التغليف المستدام يشكل إضافة جديدة نسبيًا إلى الإعتبارات البيئية للتغليف. حيث أدى الأثر البيئي للورق كأحد خامات التغليف وما ينتج عن استهلاكه إلى إعادة النظر في طرق وتصنيعه و استخداماته.

إن الكثير من الإنتقادات الموجهة لمواد التغليف المستخدمة يرجع إلى تأثيرها السلبى على البيئة. ويعتبر إهدار الورق من بين أبرز القضايا البيئية العالمية، حيث أدت هذه القضايا التي يتم تداولها مؤخّرًا مثل تلوث الهواء والمياه، وانبعاثات الغازات والإحتباس الحراري، واستهلاك الوقود، وتغير المناخ، وتكدس النفايات إلى إتخاذ إجراءات بهذا الشأن.
وأصبحت الإستدامة متطلب بيئي في صناعة الورق. حيث لم يعد التغليف المستدام يركز على إعادة التدوير، ولكن أيضا على الهدف البيئي الذى يتطلب المزيد من الدراسة لإختيار الخامات والمعالجة.
يشمل التصنيع الأبعاد الرئيسية الثلاثة للاستدامة (الأبعاد الاقتصادية والبيئية والاجتماعية). لذلك من الضروري أن يشمل تقييم الاستدامة للقطاع الصناعي جميع هذه المعايير الثلاثة.
وفي صناعة التغليف، يعد الإبتكار البيئي وسيلة مهمة لتحقيق التحول الصناعي ودفعه، من خلال تحسين الأساليب والمنتجات والمعالجة واستهلاك موارد أقل وتقليل إطلاق المواد الضارة من أجل حماية البيئة والحصول على الإستدامة.
وهذه الورقة تبحث في تقليل استخدام الموارد فى تصنيع ورق التغليف لحل المشكلة البيئية التى تواجه العاملين فى هذا المجال. ولذا كان الهدف من الدراسة هو استخدام قشور بذور عباد الشمس فى إنتاج ورق يصلح فى تغليف المنتجات.
ولإجراء ذلك إستبدلنا أحد مكونات تصنيع الورق بقشورعباد الشمس، وتم إجراء العديد من المحاولات لضبط النسب الملاءمة لنوعية معينة من الورق تصلح فى تطبيق مراحل تغليف المنتج.
وقد توصل الباحثان إلى نتائج جيدة أدت إلى تقليل مكونات الخامات المستهلكة وإستبدالها بإعادة تدوير قشورعباد الشمس لتحقيق مساهمة إيجابية فى الإستدامة البيئية.

1 Introduction:

Industry is one of the most important sectors of the global economy according to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC's). By dividing the global type of packaging materials (Figure1), paper and board production (Figure2), the current market size for packaging materials (cardboard, plastic, metal, glass and other types of raw materials) and their growth rates (Figure3), it was found that paper packaging materials have reached 41% of global packaging production, while plastics has reached to 37% in the same period. [5, 8]

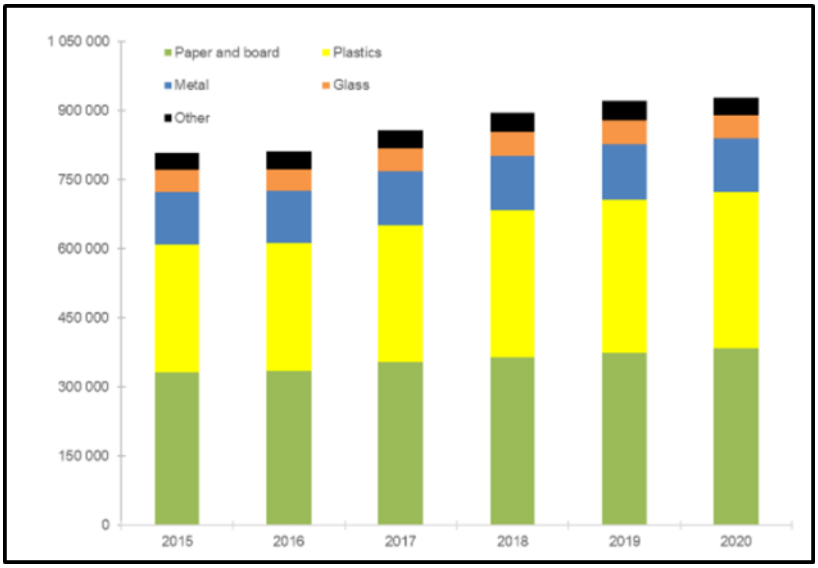

Figure 1: Global packaging consumption, by type of material

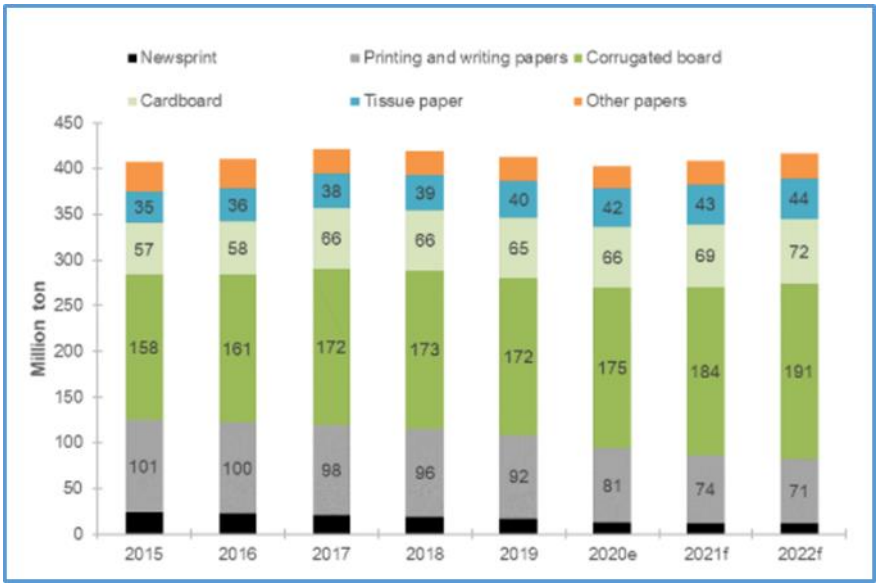

Figure 2: Global paper and board production by type

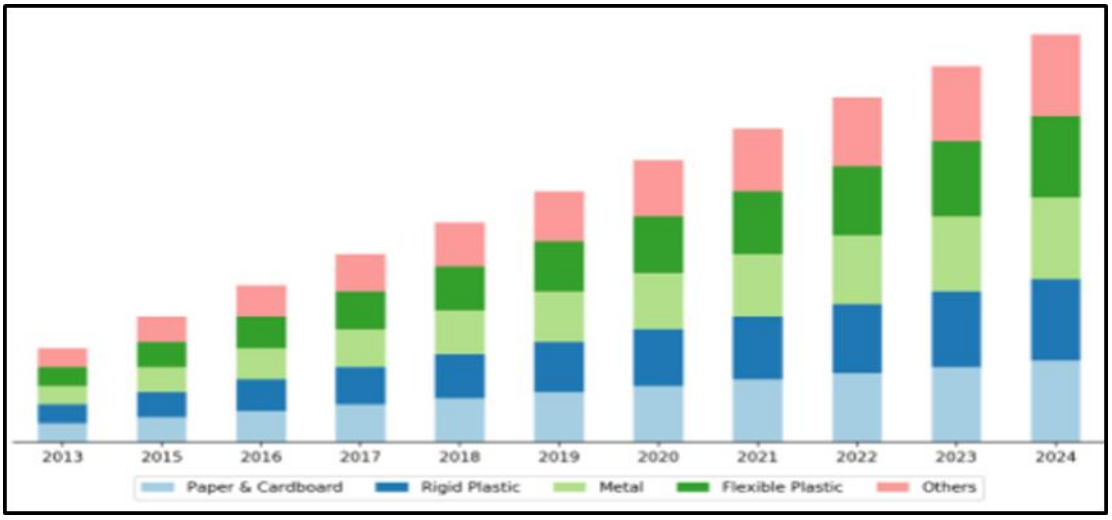

Figure 3: **Global packaging materials market size, by product, 2013-2024** [13]

The industry contributed approximately 21% (CO2) of total emissions energy consumption. Although industry is often considered as a source of environmental degradation and resource depletion, it is a vital part of development and the identification and implementation of more sustainable options. [9]

Paper manufacturing process is one of the sources of ecological problems. Paper industry is one of the five (i.e. steel, cement, ammonia, aluminum, and paper) most energy intensive industries in the world. Papermaking accounts for over 12 % of manufacturing energy use, pulp and paper industry accounted for approximately 5% of total industrial final energy consumption (Energy estimates that it takes 17 watts of energy to produce one piece of paper).

In addition, produces 9% of the greenhouse gases, 2% of direct carbon dioxide emissions from the industrial sector globally. Pulp and paper manufacturing produce the third largest industrial emissions of Toxics Release Inventory (TRI) into the air.

Industrial performance indicators used to estimate sustainability, such as energy consumption (with carbon emissions) and environmental efficiency, faced encounter difficulties in assessment such as allocating energy use in the case of multiple products and energy consumption changing with the type and volume of production. [5]

Manufacturing includes the three main dimensions of sustainability (economic, environmental and social dimensions). Therefore it is necessary that the sustainability assessment of the industrial sector includes all three of these criteria.

In paper packaging industry, environmental innovation is an important way to achieve and advance industrial transformation, by improving methods, products and processing, consuming less resources, and reducing the release of harmful substances in order to protect the environment and obtain sustainability. [1, 2]

Research Purpose

This research aims to:

- Emphasizing the effectiveness and integrating between (economical and environmental aspects) to meet current needs of sustainability.
- Identify and enhance of using sunflower shells seeds to produce paper packaging that can significantly reduce the impact on environment and achieving benefits for the paper companies.

Research Problem

In this study, the effects of pulp and paper industry are a high energy-consuming, and it also generates tremendous pollution to the environment. For this purpose, the main problem of the study stated that there is no integration and interaction between the usage of resources in the manufacture of paper packaging and environmental problem, meaning that it does not consider the value of resource inputs and the ratio of paper packaging manufacturing value to the environmental impact and sustainability.

2 Methodology and case study

2.1 Analysis of the Current Pulp and Paper Industry in Egypt: [10]

The Egyptian Paper Packaging Market is Segmented by Product Type (Corrugated and Solid Fiber Boxes, Folding Cartons and other Product Types), and End-User Industry (Food, Beverage, Healthcare and Pharmaceutical, Household and Personal Care, and other End-user Industries). [1]

Packages paper are primarily made up of wood pulp and plant fiber, and thereby, considered as a renewable resource with the difference being use cases and paper thickness. The market study covers the emerging trends in the Egyptian paper packaging market, and it is segmented by product type and end-user industry in the country’s scope, also export-import of carton board products (Table 1). [10]

The Egyptian paper packaging market is expected to register a CAGR (Compound Annual Growth Rate) of about 4.1% during the forecast period (2021-2026). The factors which are majorly leading the growth of paper packaging market are increasing demand for paper-based packaging in the food industry in Egypt coupled with a significant upsurge in the e-commerce segment. Furthermore, the rising awareness of the usage of sustainable packaging is also leading to growth of the market (Figure 4, 5).

Table 1: The Egyptian Paper packaging Market is segmented by Product Type

Grade	Carton board	Solid bleached sulphate (SBS)
		Solid unbleached sulphate (SUS)
		Folding boxboard (FBB)
		Coated Recycled Board (CRB)
		Uncoated recycled board (URB)
	Containerboard	White-top Kraftliner
		Other Kraftliners
		White top Testliner
		Other Testliners
		Semi Chemical Fluting
		Recycled Fluting
	Other Grades	
Product	Folding Cartons	
	Corrugated Boxes	
	Other Types	
End User Industry	Food	
	Beverage	
	Healthcare	
	Personal Care	
	Household Care	
	Electrical Products	
	Other End User Industries	

Study Period:	2018 - 2026
Base Year:	2021
CAGR:	4.1 %

Figure 4: Egyptian market summary (CAGR)

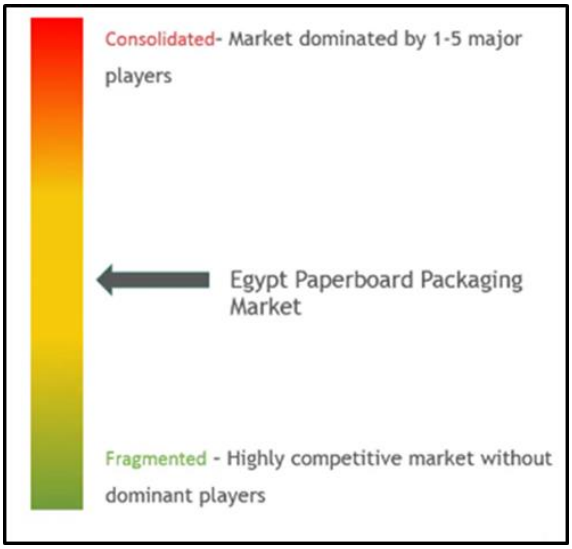

Figure 5: Egyptian paperboard packaging market concentration

Through the control requirements of Egyptian pollution control requirements, it was found that the total production of paper and paper products is about 500,000 tons. Most of the paper and paperboard production is based mainly on secondary fibers, as well as imported fibers and papermaking materials sources (Figure 6). Local pulp production includes 150,000 tons utilizing sugar cane waste (bagasse) and 35,000 tons from rice straw (Table 2). The environmental impact due to bagasse pulp production is more controlled compared to rice straw pulping, due to the different chemical properties of the effluents. However, consideration is being given to improve the economic and environmental impacts of the industry. [5]

Table 2: Types of Non-Wood Fibbers

Group	Plant species used
Straws and esparto	Wheat, rye, rice, esparto
Canes and reeds	Sugar-cane, bagasse, cornstalk, reeds
Woody stalks	Kenaf, flax, hemp, cotton, soy-bean

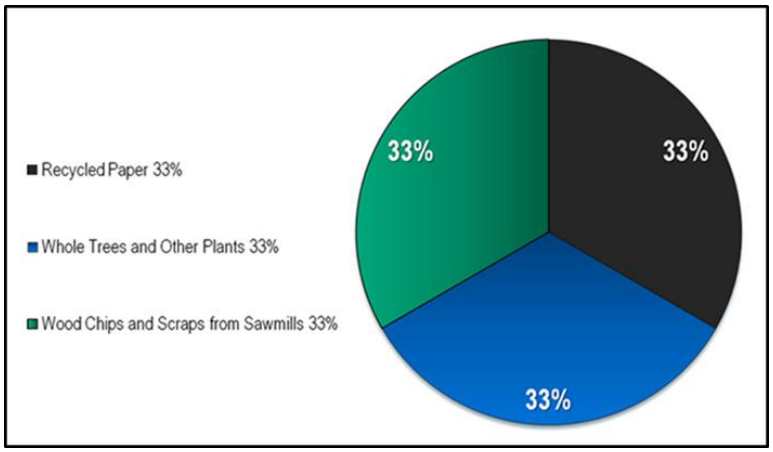

Figure 6: Source of papermaking materials [6]

2.2 Inputs to paper packaging Industry in Egypt

Pulp and paper industry is one of the growing industries all over the world, including Egypt. The production of paper and paper products in Egypt is about 436 thousand tons annually (the average annual production of writing and printing paper is about 171.632 thousand tons annually, while the volume of kraft paper production ranges from 210 thousand tons to 425 thousand tons, and the volume of fluting paper production is about 215,000 tons).[1, 2]

Paper is manufactured by preparing cellulose fibers in pulping process and a number of additives to obtain the quality of the paper and its suitability for final use, as shown in the following stage:

2.2.1 Pulping Processes

Pulping processes in the pulp and paper industry include chemical and mechanical, pulping. Additionally, recovered paper is used to produce secondary pulp. Chemical pulping includes sulphite (kraft) and sulphate pulping processes. Sulphate (Kraft) pulping is widely used in wood and non-wood fiber materials (bagasse and rice straw) which are being used in in Egypt.

2.2.2 Chemicals

Chemicals are mainly used in the pulping processes (Figure 7)**,** as well as other complementary processes e.g. bleaching and coating. The commonly used chemicals and the consumption rates for the main puling processes are based on the European data. Chemicals are mainly used in pulping processes and other complementary processes such as bleaching, coating and wastewater treatment. The chemicals commonly used and consumption rates for the main pulping processes explain as follows:

Kraft Pulping: Chemicals and consumption (kg/t) for unbleached kraft pulp is in the range of NaOH (10-20) and CaO (5-10). The consumption of the main chemicals used in bleached pulp production is NaOH (25-50), O2 (5-25), NaClO3 (20-50), H2O2 (2-30), MgSO4 (0-3) and SO2 (2-10), CaO (5-10).

Recovered Paper Recycling: Depending on the specific process, the chemicals may include: H2O2, NaOH, and Na2SiO3. The consumption of chemicals in a typical mill including de-inking process (kg/t) is Sodium hydroxide (10–20), Sodium silicate (20 –30), Soap (5–8), Talc (10 – 15), Hydrogen peroxide (5–25), Chelating agent (2 – 3), Sodium dithionite (6 –10) and Sulphuric acid (8 –10).

Paper and Board Production: Chemical additives and auxiliaries are usually applied in paper and board production processes. Chemical additives are used to give paper various characteristics while chemical auxiliaries are used to increase efficiency and reduce disruption of the production process.

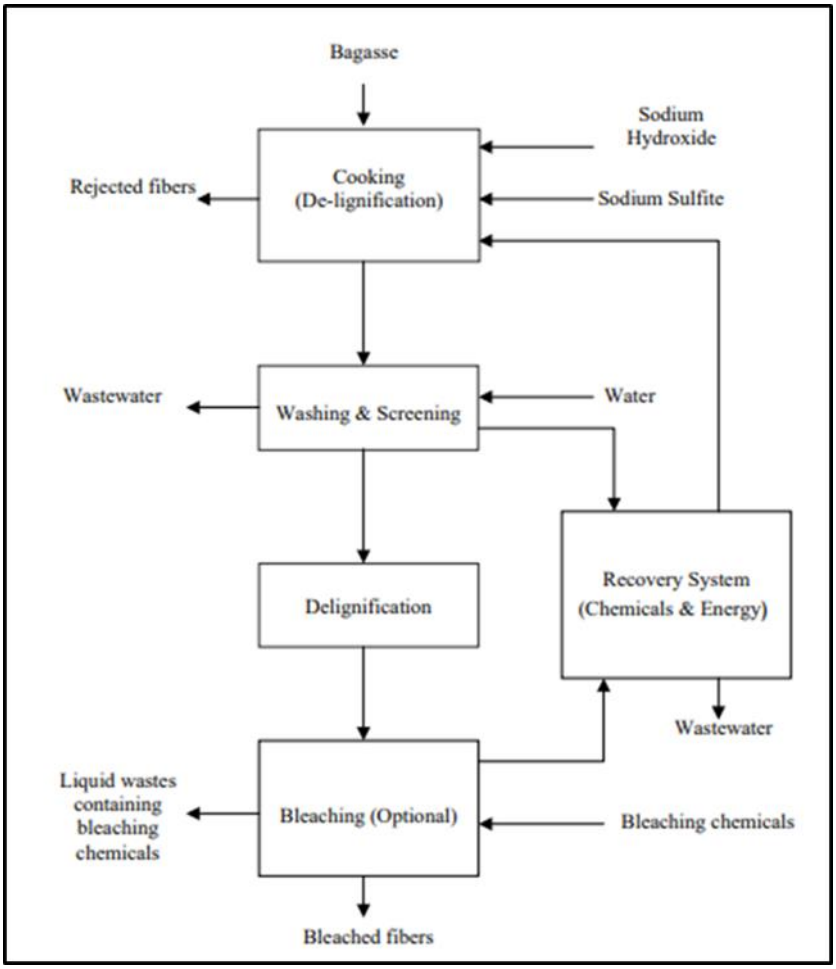

Figure 7: Main Process in Chemical Pulping (Craft and Sulfite Pulping) [1]

Recycled paper line for paper packaging (RCF) [3]

The recycled paper processing (Figure 8) system varies according to the paper grade to be produced (e.g. paper packaging, newsprint, tissue paper and paperboard production) (Figure 9, 10, 11).

All process systems are aiming to defibration, deflaking and remove the impurities. The typical stages of recycled fiber processing include re-pulping, mechanical removal of impurities, de-inking (optional), bleaching (optional) and cleaning and de-watering.

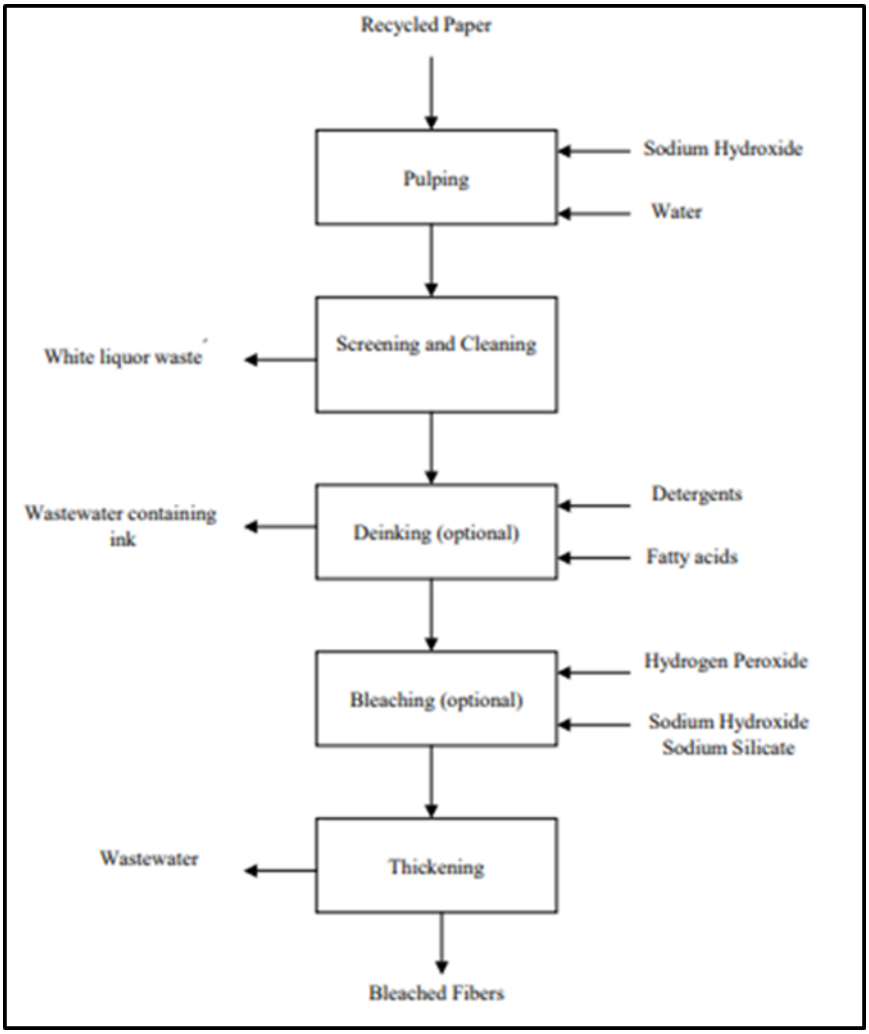

Figure 8: Main Process in Recycling Paper Pulping [1]

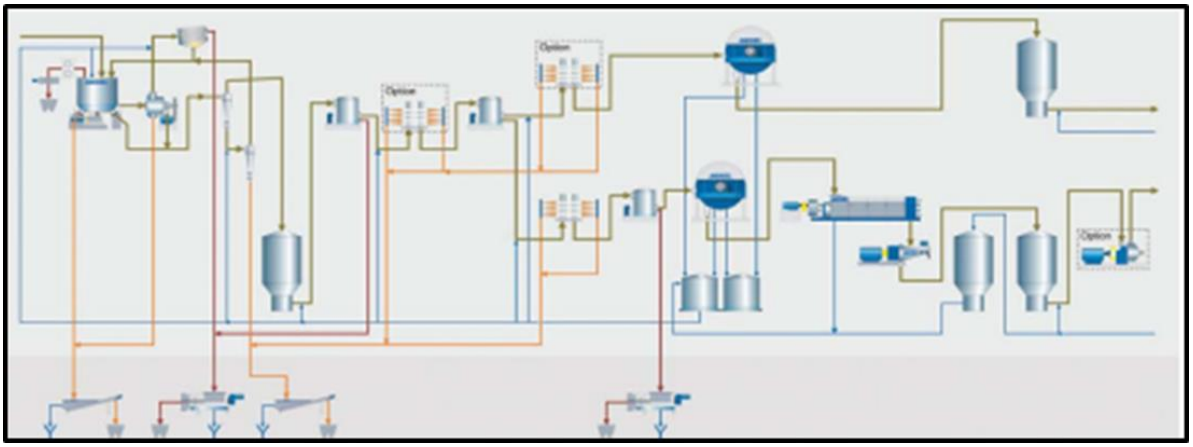

Figure 9: The scheme of RCF packaging system for test liner [3]

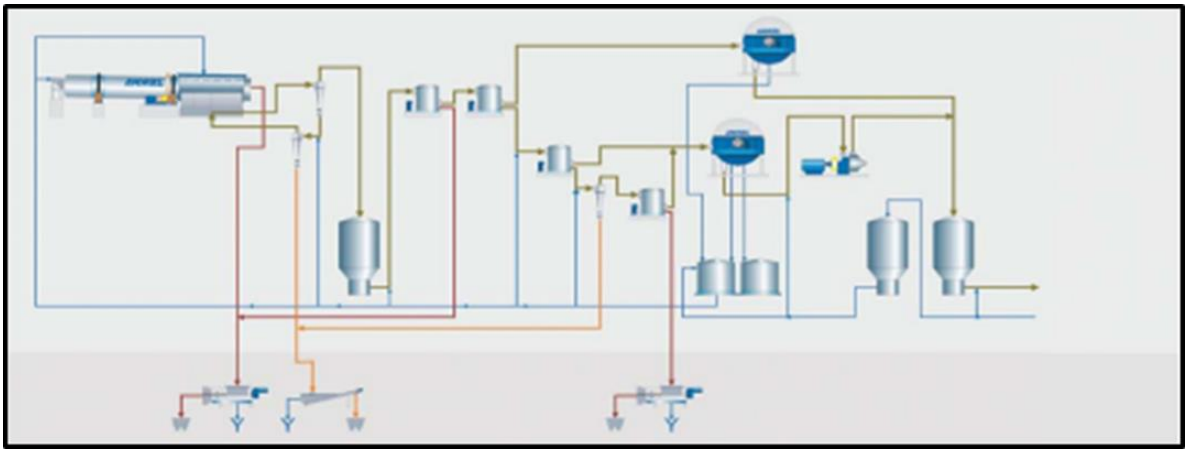

Figure 10: The scheme of RCF packaging system for corrugated medium

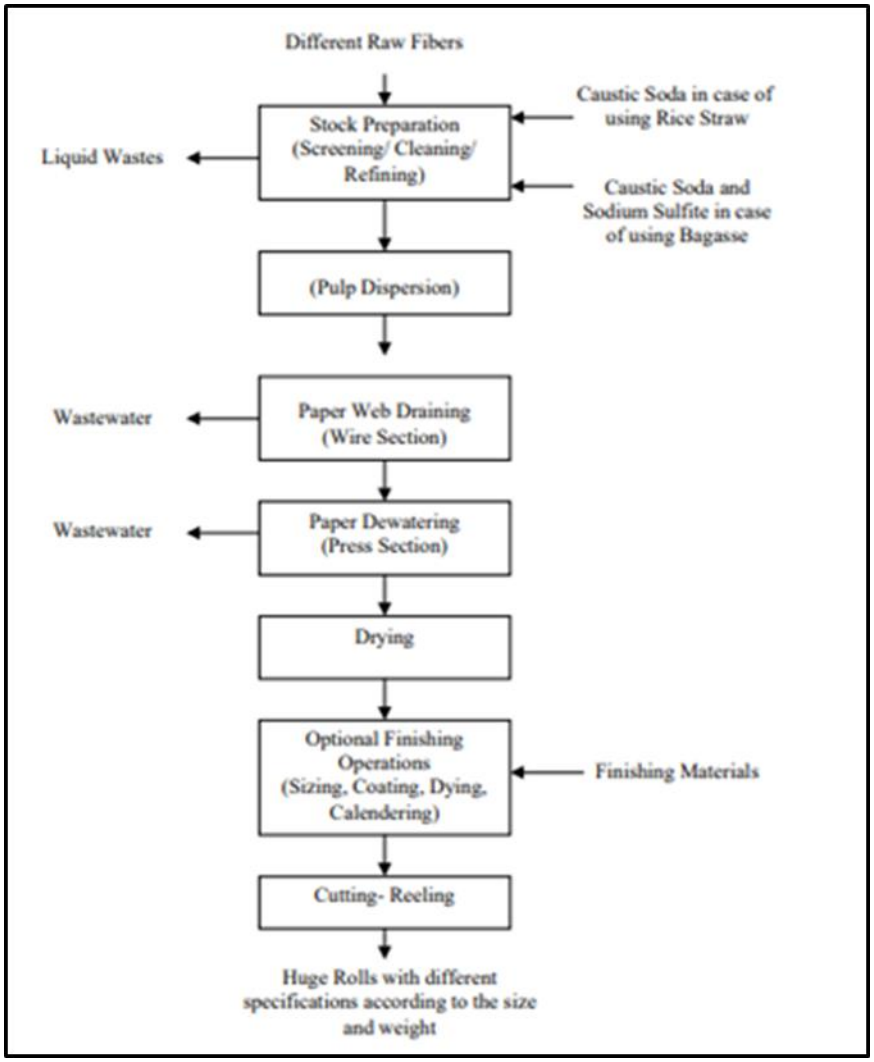

Figure 11: Main Processes in Paper & Paperboard Production [(1)]

2.3 Pollution sources from the pulp and paper industry

The production of chemical pulp is the major source of environmental impacts in the pulp and paper industry, subsequently raw materials preparation has been increased as source of environmental impacts. [(1, 2, 15)]

2.3.1 Air Emissions: Air emissions from the pulp and paper industry originate from the combustion of fuels. Auxiliary and recovery boilers related to chemical pulping processes all emit sulfur and nitrogen oxides gases which acidify the atmosphere and in turn contribute to environmental impacts. Particulates as well as odorous compounds are pollutants which have an environmental impact in the vicinity of pulp mills(Table 4,5,6,7,8,9,10,11).

Table 4: Gaseous Emissions from the Kraft Pulping Process [(1)]

Emission parameter	Value range (kg/t pulp)
Reduced sulphur compounds	0,005-10
Sulfure dioxide	0,01-10
Nitrogen oxides	0,02-5
particulates	0,02-12

Table 5: Gaseous Emissions of Different Types of RCF Paper Residues

Parameter	Unit	Average values Rejects from a RCF Packaging mill (Without de-inking)	Average values Rejects from a RCF newsprint mill (with de-inking)
Dust	mg/Nm^3	3.2	6.6
SO_2	mg/Nm^3	26.0	1.2
NO_x	mg/Nm^3	195	"95:271;"96:227;
CO	mg/Nm^3	14.1	"97:176
HCI	mg/Nm^3	1.7	14
HF	mg/Nm^3	0.06	2.6
Total-C	mg/Nm^3	1.4	no data (n.d.)
Cd, TI	$\mu g/Nm^3$	< 17.0	1.1
Hg	$\mu g/Nm^3$	5	(n.d.)
Sb, As, Cr, Co,	$\mu g/Nm^3$	71.0	(n.d.)
Cu, Mn, Ni, V,			(n.d.)
SN	$ngI\text{-}TE/Nm^3$	0.097	(n.d.)
Dioxins/Furans			

Table 6: Air Emissions and Noise Measurements in Pulp Production

Process	Dust mg/m3	Chlorine ppm	Noise decibels
Straw cutting	1.27 – 4.83	-	81.7
Pulp washing	0.92	-	85.2
Pulp bleaching	0.98 – 1.06	0.02 – 0.09	71.1
Straw storage	2.80	-	71.0
Max. allowable	10	1	90

Table 7: Air Emissions and Noise Measurement in Papermaking

Process	Sulphuric acid vapour mg/m^3	Temperature °C	Noise, decibels
Stock preparation	0.54	-	85.7
PM dryers0.14	0.14	25.8	83.1
Rewinder & Cutter	-		87.2
Max. allowable	1	29.5	90

Table 8: Air Emissions in Bleaching Chemical Production

Chlorine production	Cl ppm	Dust mg/m^3
Cells	0.33	-
Outside control rooms	0.014	-
Inside control rooms	0.011	
Hypo production		
Pumping section	0.01 – 0.29	0.25 – 0.89
Lime store	-	1.16
Max. allowable	1	2

Table 9: Dust Ambient Air Measurement outside the Mill

Locations	Dust µg/m^3
Location 1	136.2
Location 2	88.3
Location 3	104.9
Location 4	83.3
Max. allowable	230

Table 10: Emissions from Boiler Chimneys for Mill

Boiler	CO mg/m^3	SO mg/m^3	Nitrogen dioxide mg/m^3	Dust, mg/m^3
No 2	415.8	189.8	Not detectable	16.9
No 3	473.2	382.2	-	22.6
No 4	392.4	223.6	-	12.8
No 5	389.8	509.6	-	33
Max. allowable	5000	4000	3000	200

Table 11: Emissions from Boiler Chimneys for Mil

Parameter	Boiler 1	Boiler 2
Combustion efficiency/%	87.8	82.0
Carbon monoxide/ppm	81	82
Carbon dioxide/%	11.4	2.8
Oxides of Nitrogen/ppm	120	21
Sulfur dioxide/ppm	206	60

2.3.2 Effluents: Effluents in wastewater depend on production processes and operational standards. Pulp and paper processes discharge organic matter and nutrients originating from raw materials and also from chemicals used in different stages. **(14, 15)**

The highest load of organic matter comes from the residual cooking liquor produced in chemical sulfate pulping. This is usually regenerated for re-use and for use as fuel.

The recovery of spent pulping liquors in mills using non-wood raw materials is less common due to the lack of feasible recovery systems and silica removal technology. This spent liquor is therefore often discharged without treatment leading to a very significant environmental impact.

Treated spent liquor from the digester contains the largest amounts of dissolved organic material of all process liquors. The detailed composition and the environmental impact of the liquor depend on the fiber raw material, the pulping yield and the process conditions.

Part of the dissolved material is volatile, it will be released from the liquor and appear as condensates when lowering the digester pressure. The lignin and its degradation products not only impart color and odor to waste water but also increase its BOD and COD values. BOD (Biochemical Oxygen Demand) and COD (Chemical Oxygen Demand) values for the spent from kraft pulping are given in (Table 12, 13, 14, 15). [1, 11] (BOD) caused due to suspended low molecular weight solids)

Table 12: BOD and COD Values for the Spent Liquor [1]

Process	Fibre raw material	Pulp yield %	BOD7 Kg/t	COD Kg/t
Soda	Straw	50	250	930
Soda	Cotton	55	340	970
Soda	Bagasse	80	256	750
Sulphate	Bagasse	48	350	1340

Table 13: Effluent Characteristics from Fibers Bleaching Process

Pulping process	Fibre raw material	BOD (kg/t)	COD (kg/t)
Soda	Straw	16	60
Sulphate	Bamboo	17	90
Sulphate	Eucalyptus	14	60
Sulphate	Pine	15	80
Sulphite (paper)	Softwood	15	60
Sulphite (viscose)	Softwood	30-40	-

Table 14: Polluting Materials Generated during RCF Pulping (kg/t) of pulp

Type of waste paper	BOD kg/t	COD kg/t	Comment
Mixed waste paper	5-15	10-40	Depends on contaminants
Commercial waste paper	5-10	10-30	Little contamination, depends on starch content
Old newspapers	20-40	40-90	De-inking increases loads
Old corrugated containers	5-15	10-40	Depends on starch and glue
Selected wood free waste papers	5-50	10-100	Wide range depends on starch

Table 15: Overall Wastewater Pollution Sources for Pulp and Paper Industry

Process	Wastewater Pollution Sources
1. Raw materials preparation	Removal of fibers by the wet process and straw washing
2. Pulping	Condensate of acids, black liquor, cooling water, pulp washing water, rejected fibers and filtration liquors from pulp thickening process.
3. Bleaching	Pulp washing liquors after bleaching
4. Paper making	Chemicals and additives, liquors containing cellulose fibers and the white liquor from paper making machine.
5. Utilities	Boilers condensates liquors and water treatment chemicals.
6. Chemicals recycling	Steam condensate, dry solutions from residues washing operations, cooling liquids and scales constituents condensate.

2.3.3 Solid Wastes: Waste is formed at all stages in the pulp and paper life cycle. Solid wastes generated from a waste paper pulping operation which varies considerably depending upon the degree of cleaning set up within the process. The yield of the pulp is inversely proportional to the amount of material removed. Sludge constituents from waste paper pulping vary with the type of waste paper used. They most often include clay and other fine inorganic fillers, fine plastic debris and organic materials from inks. [15]

Also fiber from the paper is always present. After drying, these materials landfill quite satisfactorily. Waste paper sludge is often difficult to de-water. A significant amount of water is sufficient to accommodate bacteria, which rapidly produce hydrogen sulphide and other noxious or dangerous gases. Landfilling of wet sludge can produce considerable odor problems.

2.3.4 Essential dimensions to measure sustainable development in paper packaging industry (Figure 12, 13, 14)

- Ensure dimensions of sustainable development.
- Solving the paper pollution problem.
- Preserve clean production processes.

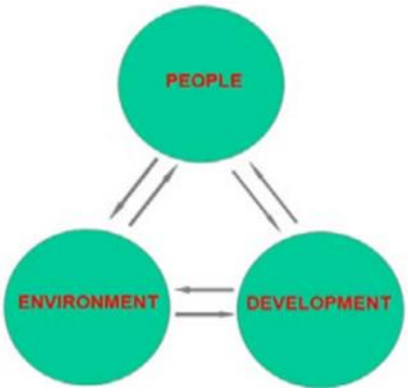

Figure 12: Relation between people, environment [12]

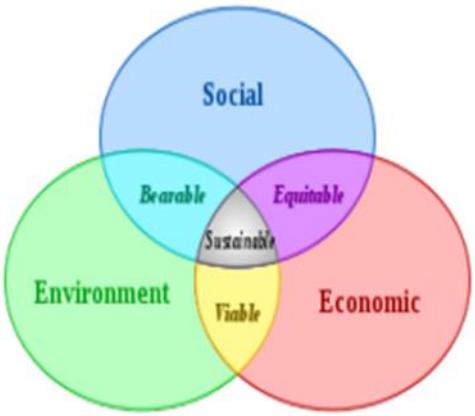

Figure 13: Dimensions of sustainable development

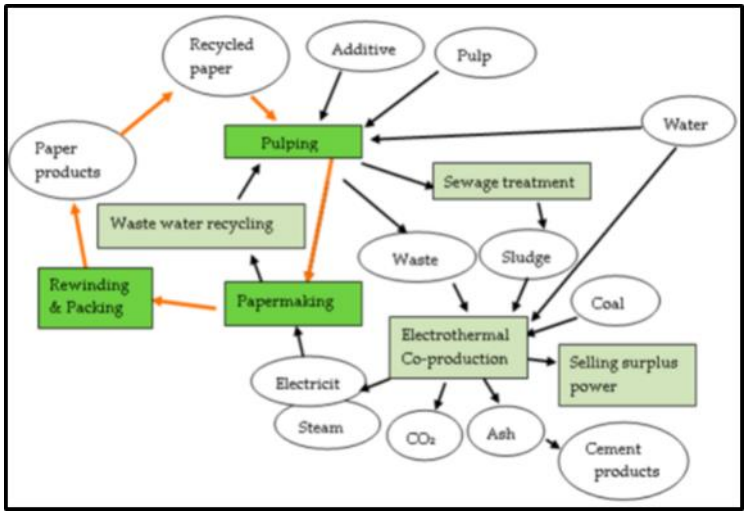

Figure 14: Schematic diagram of interaction circular economy in paper packaging industry [13]

3 Sunflower seed shell and Technological challenges [7, 15]

Main change factors of pulp and paper industry (PPI) (Figure16) is one of the environmentally sensitive sectors. The renewable material and the environmental benefits are the global trends with the pulp and paper potential.

The requirements of the final product depend on the quality of the recovered paper, a considerable influence on the configuration of the RCF (recycled fiber). For cheaper raw material mixes, there are also technical and process solutions available without any effect on the final paper quality.

Sunflower seed shell (P3S) is used for chromogenic acid extracting, natural pigment, production of fiber board, particleboard, being used in paper packaging production field. Using a natural, renewable resource such as sunflower seed shells has a lower impact on the environment than depleting slow-forming resources like trees to serve the same purpose.

Current challenges in pulp and paper industry include attaining quality pulp while preserving the environment by reducing the energy, water and chemical requirements during the pulping process. Sunflower seed shell have emanated as one of the viable agricultural plant for pulp production due to substantial cellulose content.

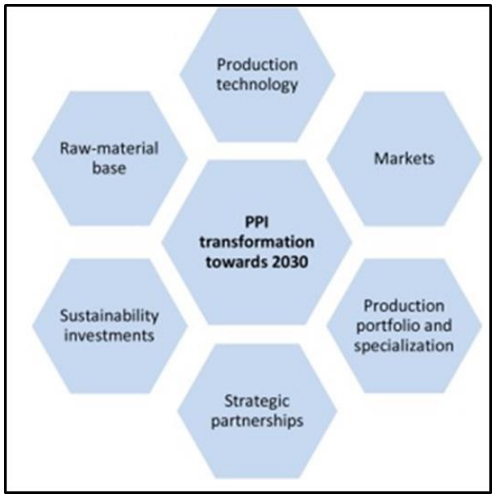

Figure 15: Main change factors in pulp and paper industry (PPI)

4 Applications for Paper Packaging Manufacturing

Application method related technologies developed mainly include the technical scheme as follows:

4.1 Sunflower seed shell (P3S) fiber morphology and content

The method is analyzed firstly of, physical dimension and the chemical composition. Sunflower seed shell fiber is fusiform, and fiber surface is more, stiff, inner wall edge in irregular, fiber is shorter, average length only 0.60 mm, but cell wall is relatively thin, and the distribution frequency of length, width is more uniform. Hetero protein content 10.20%, miscellaneous carefully compared with other grass raw materials. (P3S) showed a mean surface area of 1.30 cm^2 and a mean pore area of 244.80 m^2.

Sunflower seed shell content of cellulose 31.9% - pentose 27.2 %, lignin 29.2%, ash 1.51%, cold water extract 1.33%, and hot water extract 6.42%. ((Figure16)

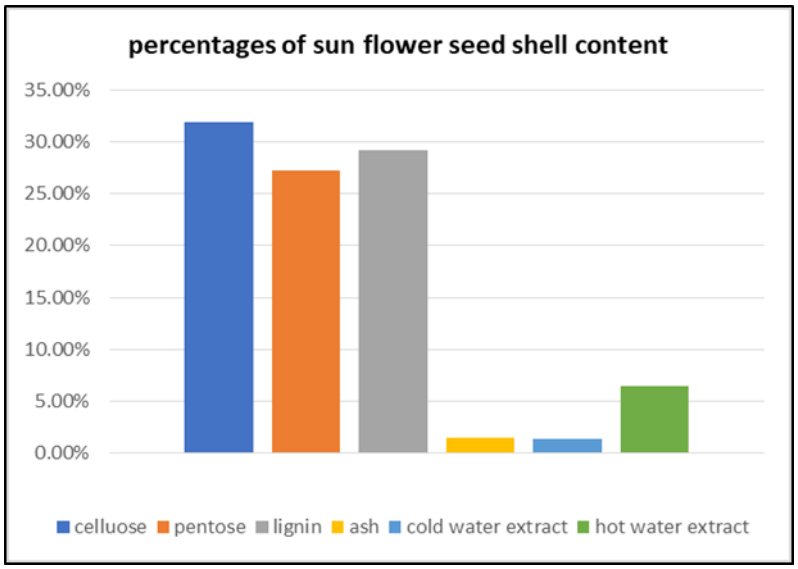

Figure16: Sunflower seed shell content

Sunflower seed shell has the lignin content less than most papermaking plant materials, with tradition grass raw material such as wheat-straw. The content of cellulose is suitable, hemi-cellulose content of appropriateness relatively low ash and extraction.

4.2 Materials and method

The method of pulp paper-making with sunflower seed shell (P3S) is described as follows:

Water: Sunflower seed is peeled off, washed to remove any adhering dirt, soaked for 5-6 hr. with the clear water of 40-50 C, rubs, and then remove sunflower seed shell surface black material and internal layer membrane and removes part aqueous material simultaneously, Extruding excessive moisture, dry in room temperature for 36 hr. with filter screen, control moisture at 8%-15%.

Chemicals: Treated liquor is Na OH and Na2. The aqueous solution of (P3S), wherein, Na OH is Na of sunflower seed shell is 2S (with Na2O). The 18%-24% (based on dry mass) of seed shell, the volume ratio of liquid is 1:3.5.described absolute dry mass is refer to that biodiversity content is 0%.

Pressure: sunflower seed shell being separated by hydraulic press, operation pressure is 3-5 MP, and slurry is put into filter screen, Clear water washing, is constantly rubbed in washing process and disperses fiber.

4.3 Data Analyses

Average performance rates: screened yield (40 %), degree of polymerization (1400), whiteness (22% -30%), beating degree (11-14° SR), residual alkali (2.2 -10 g/L), average fiber length (0.700 mm), average fiber width (18.36 mm), average clear appearance (0.20 mg/m).

Reduction rates in pulp polluting factors using sunflower seed shell: (Figure17)

- Energy consumption 10%.
- Gas emissions 1.5%.
- Wastewater 1%.
- Solid waste 3%.

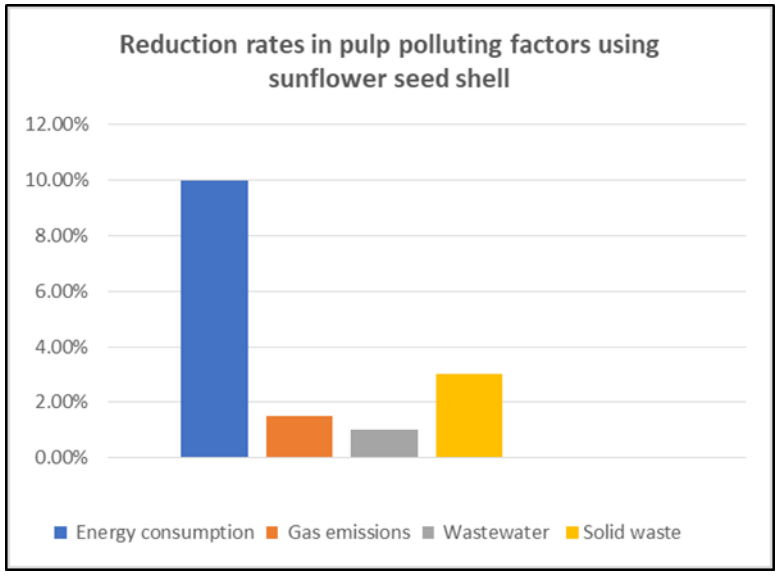

Figure17: Reduction rates in pulp polluting factors using sunflower seed shell:

Positive effect of sunflower seed shell:

1) The unbleached chemical pulp method has high screened pulp yield, small in chemical residues, high in polymerization and good in strength and intensity.
2) It can be made into unbleached paper or/and blended with other fibers to produce paper with whiteness requirement.
3) Solve the environmental problem as solid waste.
4) Improve pulp quality and reduce paper defects.
5) Reduce pulp washing water consumption.
6) Achieved paper pulp evenness good, time is saving and energy saving.

5 Results and dissection

1- Sunflower seed shell can be used in the manufacture of paper cartons.
2- It was found that the processing method takes a short time.
3- It was found that the loss of fiber decreases with the usage of sun seeds, which leads to an increase in the durability of the paper.
4- The method of preparing paper pulp using sunflower seeds contributes in solving environmental problems.

6 Conclusion

Sunflower seeds were used in the manufacture of paper cartons due to its high percentage of cellulose. The recycling of sunflower seeds shell and its processing method takes short time, low chemical consumption, high paper pulp production and higher degree of polymerization.
The bleached sunflower seed pulp can be obtained individually or can be mixed with other fibers.
The abundance of sunflower seed shells, and the high degree of mechanization of the shells processing helped in solving environmental problems, in addition, the chemical composition, fiber property and separation method of the sunflower seed shells pulp is different from the traditional herbal raw materials.

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