

Business

Our business is based on a circular economy model, using an industrial waste called black liquor to produce adipic acid from muconic acid generated in a bioprocess with genetically modified bacteria with metabolic pathways for the generation of these compounds within bacterial micro-compartments to increase efficiency. Our market is the companies that use adipic acid as raw material, mainly the automotive and electronics industry, followed by the pharmaceutical and alimentary industries.

The way to reach our customers is mainly through a direct contact sales campaign, distributors and internet marketing on websites where chemical products are selling.

Market

Our market is the companies that use adipic acid as raw material, that market is expected to grow globally in a compound annual rate of 4.6% during the period from 2018 to 2023 and, is predicted by 2024 that the size of the global market of adipic acid reach USD 8.0 billion.

The main material produced from adipic acid is Nylon 6.6, and the main industry that uses this material is the automotive industry. Other important industries that impact the growth of the adipic acid market are the pharmaceutical and food industries in which it is used as a flavoring and gelling agent.

Finances

Adipic acid	Cost of production	Price of sell	Utility with taxes	Utility (%)
1 kg	7.98 USD	10 USD	1.242 USD	12 %

Initial inversion: 594,740 USD

Time needed to recover the investment: 9.6 months.

Breakeven point: 39,923 Kg of adipic acid, equivalent to 39,923.3 USD.

Future

THE BUSINESS

Business Structure

Company Name	EfiscienceBioproducts
ABN	Pending
Founding Date	March 2019

Company Address	Pedro de Alba, Niños Héroes, Ciudad Universitaria, San Nicolás de los Garza, N.L, Mexico
Contact Information	<ul style="list-style-type: none"> 52 1 81 1823 1769
CEO	Rodolfo García Cortés

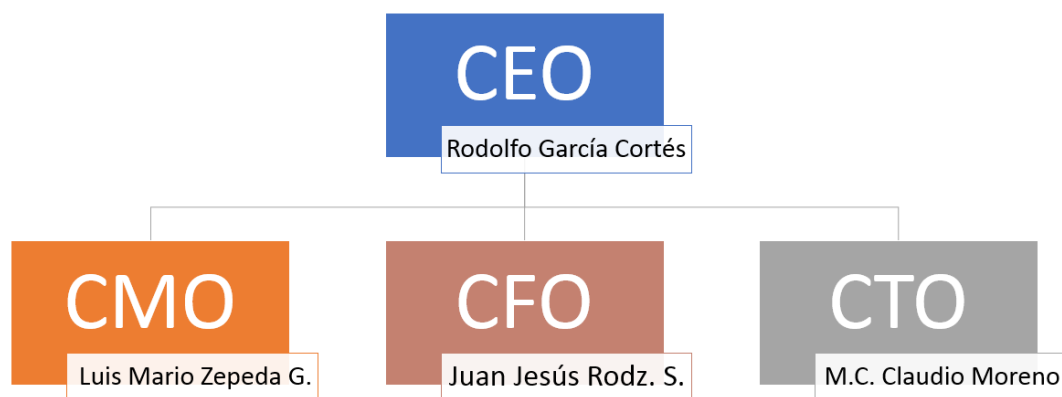
Registrations

ABN	Pending
TFN	Pending
Web license	Pending
Scientific License	Pending
Patents	Pending

Legal structure

We are in the process of forming a joint-stock company, but because the project still has areas of opportunity in the production processes, we must work them in order to comply with an ideal financial analysis. In addition, the management of intellectual property is yet to be defined, since the ideal mechanism is being defined.

Organization Structure



In Efiscience Bioproducts we make strategic decisions through a council formed by the 4 highest management positions (CEO, CMO, CFO, CTO) we seek to obtain feedback from each member of the work team to continue improving.

In Efiscience Bioproducts we believe that the most valuable thing we have is our human capital, because it is made up of true leaders and experts from each area.

Location

Currently Efiscience Bioproducts is located at the Facultad de Ciencias Biológicas in the Universidad Autónoma de Nuevo León.

Products and Services

Efiscience Bioproducts plans to sell adipic acid with a certificate that guarantees that the production is making by a biological way, and we pretend that the level of purification reaches 98% to sell the kilogram at a price of 10 USD.

Aproval Of Science

All part of the technology of Bioscience Bioproducts is Based off modelling data as well as scientific papers and bioinformatic programs, the modelling data we use to for evaluate the permeability of the membranes and the interactions between the target molecules and the microcompartments, with this tools we can predict the concentration of the molecules in different time lapses, production efficiently, toxicity, the flux of the metabolic pathway, etc. The bioinformatic programs we used to majority to a previous tests to later develop the experiments of molecular biology and we support everything with scientific articles.

Methods of action

We use the black liquor as a raw material, the aromatics compounds that it have we use them to convert them into muconic acid, which after its extraction we convert it into adipic acid.

The foundation of our efficiency in the production of this compound is due to the fact that the bacteria that we genetically modify with the synthetic cassettes, in addition to expressing the enzymes for the metabolic pathway that converts the compounds present in the black liquor to adipic acid, also express bacterial microcompartments (BMCs), this BMCs act like an assemblage with linked enzymes that isolates the target compounds and the intermediates in the pathway to reduce the interactions with t

Proof of scalability/safety

We are at a somewhat early stage to make adjustments in terms of production methods, however our bioprocess is carried out by the Escherichia coli bacteria, which has been studied for decades in industrial production systems of compounds similar to ours , so there are a lot of literature and protocols to perform a good scalability with this system.

Patents

We are in the process of publishing a patent through the international PCT treaty to obtain an advantage over competitors that want to make bio-based adipic acid with a technology of efficiency like this one, owing to the fact that other countries could copy our technology and leverage their level of industrialization to dominate the market.

A technological search was carried out in which it was found that the prototype complies with inventive activity and novelty since no documents were found that prevented the protection of our technology.

Business model

Our business is based on a circular economy model, this means that we use industrial waste to produce adipic acid in an efficient way, generating less waste and with less environmental impact. The waste we use is called black liquor, it comes from the degradation of lignocellulosic materials, mainly generated by the paper industry, our technology uses a proteinic structure called bacterial microcompartments that links the enzymes to catalyze metabolic reactions to generate muconic acid while isolates the phenolic compounds present in black liquor to make more efficiently the metabolic pathway. After the production of muconic acid in the medium, we purificate it and we make it go through a cheap process that uses reusable palladium and hydrogen gas to convert into adipic acid.

We plant to sell to the companies that use adipic acid as raw material, said market is expected to grow globally at a compound annual rate of 4.6% during the period from 2018 to 2023, and the main material produced from adipic acid is Nylon 6.6, used mostly by industry that uses such material is the automotive industry, followed by the electronics industry. In addition to the aforementioned industries, adipic acid is used in the pharmaceutical industry and also in the food industry as a flavoring and gelling agent.

The way to reach our customers is mainly through a direct contact sales campaign, distributors and internet marketing on websites selling chemical products. We plan in the future to make strategic alliances with chemical reagent suppliers, as well as paper pulp processing industries to obtain black liquor, and make alliances with laboratories that make tests for corroborating the quality of the adipic acid, to give guarantee of the quality to own customers.

Minimum Viable Product (MVP)

Our minimum viable product is a 10 L scale bioreactor where the growth of the modified bacteria is carried out with the plasmids that express the metabolic pathway and the BMCs, for the conversion of the aromatics compounds that black liquor contains into muconic acid, later we realize experimental tests to know the quantity of muconic acid and check metabolic efficiency.

SWOT analysis

Strengths	Weaknesses
Patent in process Efficient metabolic optimization Regulable promoter Circular economy process No local competition Sustainable process	Purification methods needed Quality tests required

Biobased product certification	
Opportunities	Threats
Global market Automotive market Mexican market	Reduction of the price of petroleum Well established market Public acceptance

Risk Assessment

	Risk & Likelihood (1-10)	How to avoid the risk?
External factors	5.25	
Economic factors	6	Lack of capital to optimize the process and reach an industrial scale
Political factors	7	Political administration that cuts budget for basic science, calls and incentives for entrepreneurship.
Social factors	3	Ignorance and rejection of a technology based on genetically modified bacteria
Technological factors	5	Less than expected returns in the MVP
Development of the industry	3	If the industry is not developed to accept our technology
The market & customers	5	Difficulty entering the market
Competition	6	Other bio-based and non-biobased adipic acid companies that can sell your product cheaper
Internal Factors	3.5	
Safety of workers in the industrial processes	2	Accidents that put workers' safety at risk
Production	5	Process failures that prevent obtaining adequate performance

Finances	4	Bad financial management in the company's internal processes
Organization & human resources	3	Bad human resources management as well as bad management

MARKET ANALYSIS

It is projected that by 2024 the size of the global adipic acid market will reach 8.0 billion USD.

The estimated market size for adipic acid consumed for the manufacture of nylon 66 fibers and resins was estimated at around 2,600 kilotons in 2016

Global consumption of adipic acid was estimated at 2,986.4 kilotons in 2016

Our market is companies that use adipic acid as raw material, said market is expected to grow globally at a compound annual rate of 4.6% during the period from 2018 to 2023. The main material produced from adipic acid is Nylon 6.6, and the main industry that uses such material is the automotive industry.

In addition to the automotive industry, other important industries that impact the growth of the adipic acid market are the pharmaceutical and food industries in which it is used as a flavoring and gelling agent.

Due to the traditional processes of production of adipic acid obtained from petroleum, it is that more stringent environmental regulations are expected that even hinder the growth of the market, which would be an area of opportunity for adipic acid biobased.

Stakeholder Analysis

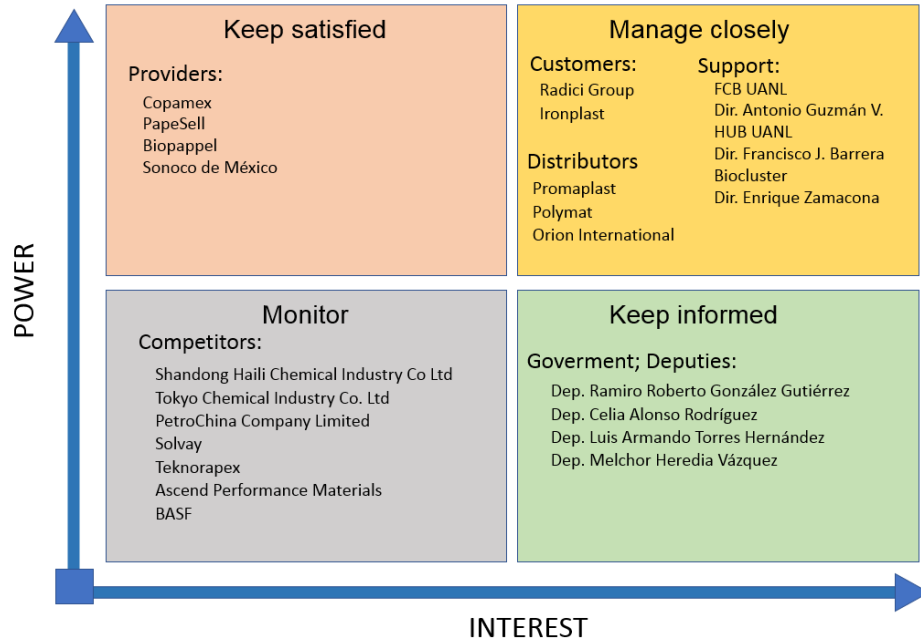
Stakeholders Engagement Assessment Matrix

Actual estate A

Desired state D

#	Stakeholders	Type	Unaware	Resistant	Neutral	Supportive	Leading
1	Radici Group	Cliente	A			D	
2	Ironplast	Cliente	A			D	
3	Copamex	Proveedor				AD	
4	PapeSell	Proveedor	A			D	
5	Biopappel	Proveedor	A			D	
6	Sonoco de México	Proveedor	A			D	
7	FCB UANL Dir. Antonio Guzmán V.	Apoyo			A	D	

89	HUB UANL guía Dir. Francisco Jesús Barrera Cortinas	Guía				AD	
10	Biocluster Dir. Enrique Zamacona	Apoyo				AD	
11	Promaplast	Distribuidor				AD	
12	Polymat	Distribuidor	A			D	
13	Orion International	Distribuidor	A			D	
14	Rodolfo García C.	CEO					AD
15	Luis Mario Zepeda	CFO					AD
16	Juan Jesús Rodríguez Saldaña	CTO					AD
17	Claudio Moreno.	Gerente					AD
18	Diputados	Gobierno			A	D	
19	Shandong Haili Chemical Industry Co Ltd	Competidor	AD				
20	Tokyo Chemical Industry Co. Ltd	Competidor	AD				
21	PetroChina Company Limited	Competidor	AD				
22	Solvay	Competidor	AD				
23	Teknorapex	Competidor	AD				
24	Ascend Performance Materials	Competidor	AD				
25	BASF	Competidor	AD				



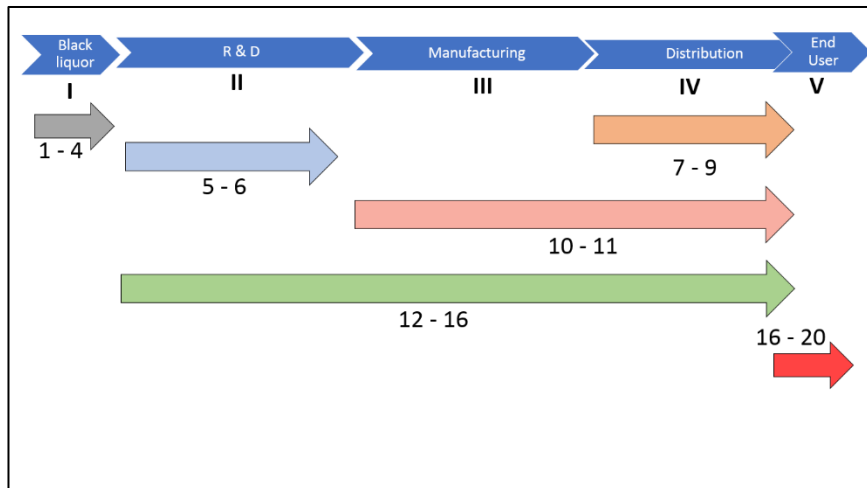
Competitors

Competitive Profile Matrix

Name	Shandong Haili Chemical Industry Co Ltd	Tokyo Chemical Industry Co. Ltd	Solvay	BASF
About	They make production and manufacture of chemicals products.	They have a big list of products (29,000) and related materials .	They sell advanced materials and specialty chemicals.	They are a German chemical company and the largest chemical producer in the world.
Founded	2003	1946	1863	1865
Strength	They have a laboral force of 3000 employes and 17 years in the market.	29,000 products, 73 years in the market and plants in North America, Europe and China.	Solvay is headquartered in Brussels with around 27,000 employees in 62 countries.	They offer Chemicals products, functional materials and agricultural products.
Weakness	They don't have a proper	To cover a lot they lacks in	They don't have a lot of bio-based materials.	They don't have bio-based adipic acid.

	distribution system.	especialitation of some products.		
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Value Chain / Supply Chain



Section	Definition
I	Companies that produce black liquor as waste.
II	Companies that do research and produce adipic acid.
III	Companies that manufacturing Nylon.
IV	Companies that distribute Nylon.
V	End users of the Nylon industry.

Sections of the chain value

Section covered	Scheme number	Name
I	1	Copamex
	2	PapeSell
	3	Biopappel
	4	Sonoco de México
II	5	Shandong Haili Chemical Industry Co Ltd

	6	Tokyo Chemical Industry Co. Ltd
IV	7	Promaplast
	8	Polymat
	9	Orion International
III-IV	10	Radici Group
	11	Ironplast
II-III-IV	12	PetroChina Company Limited
	13	Solvay
	14	Teknorapex
	15	Ascend Performance Materials
	16	BASF
V	17	Ford
	18	Nissan
	19	Toyota
	20	Seat

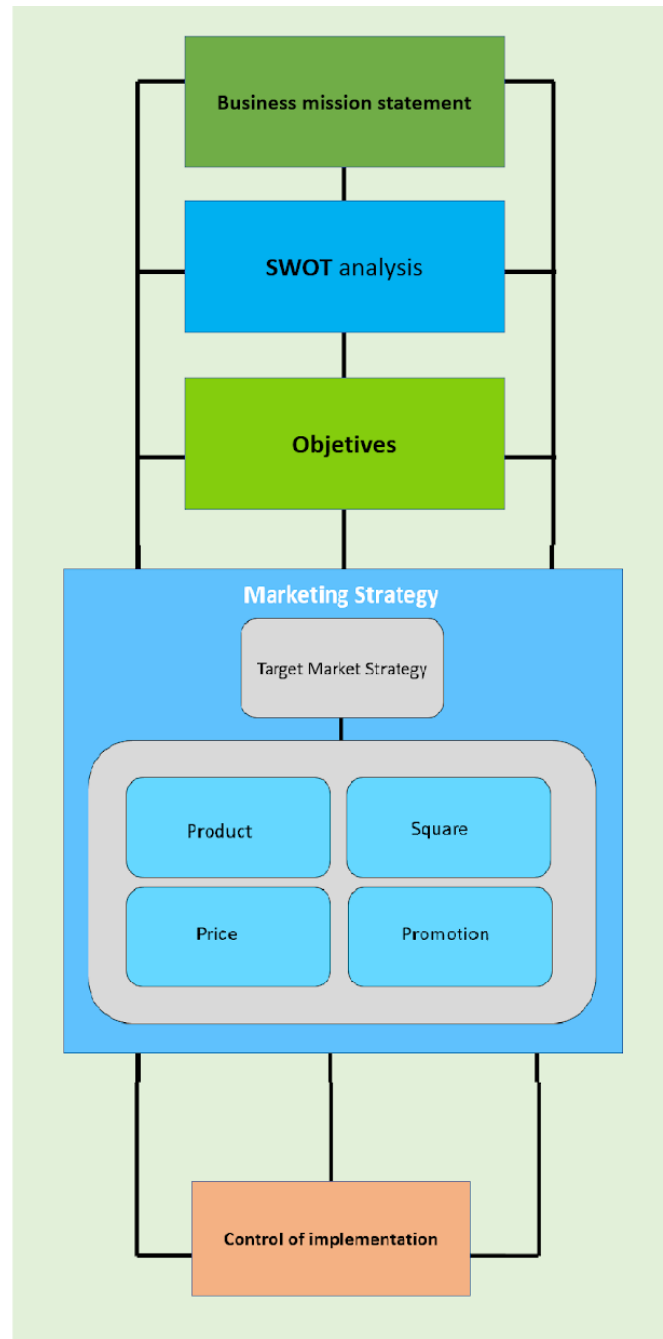
Technology Readiness Plan

Technology Readiness Level	
TRL 1	<div>Basic</div> <div>Research:</div> A search of scientific articles related to the generation of adipic acid and other

	compounds of interest that could be produced by microorganisms was carried out, the nature, generation and functioning of BMCs was searched, a search of the sequences of interest, the plasmids involved and protocols for transformation was performed.
TRL 2	<p>Applied Research:</p> <p>We conducted a national and international patent search for processes related to the production of “adipic and muconic acid”. We spoke with the technical team that developed the technology (in our case plasmids with the sequences of metabolic pathways and BMCs) to reach a licensing agreement.</p>
TRL 3	<p>Critical Function or Proof of Concept Established:</p> <p>Hemos comenzado a validar el mercado con entrevistas a personas dentro de la industria de los plásticos fabricados a partir de nuestro producto, como lo es la industria del Nylon. Los resultados de la validación indicaron interés en el mercado por la materia prima con certificación biobasada a partir de un proceso más sustentable y de cómo la industria de los plásticos comprueba la calidad de la materia prima, a través de laboratorios especializados.</p> <p>We have begun to validate the market with interviews with people within the plastics industry manufactured from our product, as is the Nylon industry. The results of the validation indicated interest in the market for the biobased certified raw material based on a more sustainable process and how the plastics industry checks the quality of the raw material, through specialized laboratories.</p>
TRL 4	<p>Lab Testing / Validation of Alpha Prototype Component / Process:</p> <p>Recently we are finishing the last tests necessary to complete our MVP, we continue with the market validation and we have established the points in which we must pay more attention to minimize the financial and technological risks, at the same time in which we seek to design adjustments in the process to make it more optimal and have higher yields.</p>

Marketing

A marketing plan will be created in which the objectives will be projected in the short, medium and long term, however in order to establish it we will need to advance in the technological maturity as described in the “Technology Management - Technology Projects -. Requirements ”; At this time, efforts are focused on completing market validation. Said marketing plan must be projected to 5 years. The marketing plan will be carried out as described by Lamb (2011), which is explained in the following scheme:



Packaging

The packaging of our product will be of the type of laminated sack, the industry is how it normally markets this type of raw material, in order to keep it intact. In the case of the food industry, the need for some special packaging will be evaluated with customers.

Distribution

The way to reach our customers is mainly through a direct contact sales campaign, through distributors, and internet marketing on websites where chemical products are selling such as Alibaba, plastico.com, quiminet, etc.

THE FINANCES

Financial Plan

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Efiscience Bioproducts - Table of Profit and Loss				
			Import in USD	Percent
Sales			\$500,000.00	100.00%
Sales discount			\$13,000.00	2.60%
Net sales			\$487,000.00	97.40%
Equipment use				
Electricity			\$790.00	0.16%
Gas			\$400.00	0.08%
Water			\$2,580.00	0.52%
Labor costs			\$10,000.00	2.00%
Raw material				
Black liquor			\$28,000.00	5.60%
Medium			\$30,000.00	6.00%
Other reactives			\$10,000.00	2.00%
Sales cost			\$700.00	0.14%
Debt			\$50,000.00	10.00%
Purification cost			\$230,000.00	46.00%
Transformation cost			\$14,000.00	2.80%
Administrative expenses			\$9,263.16	1.85%
Selling expenses			\$500.00	0.10%
Total expenditures			\$399,233.16	79.85%
Profit before taxes			\$87,766.84	17.55%
Utility Taxes			\$26,330.05	5.27%
Net income			\$61,436.79	12.29%
Table of profit and loss				

Financial Analysis

THE FUTURE

Expansion

In the next 6 years we have planned to build production plants, starting one in the state of Nuevo León or depending on the strategy taken at another point, and then continuing in the states to the south of the republic, where there have been problems related to Black liquor and it is necessary that they achieve an adequate revaluation of this waste. While we expand our production plants and internalize ourselves in the market as a producer of quality product and sustainable processes, we would seek to reinvest in the creation of Eficiencia Bioproductos as a private R&D center, where we can carry out new innovative proposals of synthetic biology. Finally, we would like our brand to be seen as one that goes beyond the socially responsible, promoting education projects for children and young people, as well as integrating an advisory service to companies promoting the circular economy.

Vision Statement

Eficiencia Bioproductos proposes to be an organization with environmental awareness that constantly demonstrates its commitment to the care of the planet through its sustainable processes and its low generation of polluting waste, in addition we will always maintain a culture of constantly seeking innovation in our products and processes, as well as maintaining good practices inside and outside the laboratory, to offer the best to our market. We also have a strong social commitment to support education, the dissemination of science and advice to companies in the field of circular economy and sustainability.

APPENDIX

Tables of data content and information collected for each interview.

1.

Interviewed (Indicate position in the company):	Director.- KARINA MILAGROS LUJANO SALINAS
Company or association (cluster, Camera, Center, etc.) and Location	Inova Plastics

Means of interview (face-to-face, telephone, etc .; Include the #):	Face to face, stand in the Poliplast expo
Date:	21/08/19
Synthesis of information obtained:	she mentions that the automotive industry prepares alloys, "they make many mixtures of plastics", which are not recyclable and therefore are not feasible to recover, said that industry does so for the durability of the materials, an interest is detected in finding other alloys with The Nylon They suggested that an investigation be carried out for the management of current alloys. The company is dedicated to the recycling of plastics, they do not buy virgin resin; says its director that "if there is demand, it is necessary to increase the production of nylon," however, says that in his company the demand for this plastic can be replaced by obtaining new alloys that meet similar characteristics to this polymer".
Conclusion	This interview is important to understand the panorama of Nylon production, it is asserted that it is necessary to increase its production to meet demand, but that there are alternatives, such as alloys. They also comment that the automotive industry requires this polymer.

2.

Interviewed (Indicate position in the company):	Ing. Rafael Blanco President
Company or association (cluster, Camera, Center, etc.) and Location	Centro Empresarial del Plástico
Means of interview (face-to-face, telephone, etc .; Include the #):	Face to face, stand in the Poliplast expo

Date:	21/08/19
Synthesis of information obtained:	The Engineer, with more than 20 years of experience in the plastics industry, comments that bioplastics are not as suitable an alternative as it seems to be for conventional plastics, as well as answering the demand question stating that “Nylon is not a Commodity polymer, it is important, it is required that its production be increased, since around 2000 tons are produced in the world ”,“ if they manage to create a process with a circular economy model it will be of great importance ”.
Conclusion	The information provided by the engineer is important, given that he is an expert in the field of production, distribution and innovation in the plastics industry and with he said, it is understood that there is important interest because the production of Nylon, polymer at that will impact our process in the production of a component of the monomer, adipic acid.

REFERENCES

Lamb, C. W., Hair, J. F., & McDaniel, C. (2011). *Essentials of marketing*. Cengage Learning.
