
19. Handling, Transport and Storage of Biofuels

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19.1. Introduction

The biggest challenge posed towards Argentina's exports sector consists of increasing exports not only in terms of volume and revenues, but also by selling more value-added goods. To achieve this goal, emphasis should be placed on transforming raw materials into finished products, which add more value to the original product.

In this regard, Argentina has a comparative advantage for the production of fuels from renewable sources (biofuels), because it is a world leader in the production of agricultural food and oleaginous crops, having an increased milling capacity beyond its current harvests. The country would be able to meet the energy needs of industrialized nations such as the US, where production of biofuels is encouraged but fails to supply its own demand (remember that one of the biggest B20 consumers in the US is its own Department of Defense).

Biofuels are fuels and / or fuel additives duly registered with the US Environmental Protection Agency (EPA), that meet the standards set by the American Society for Testing and Materials International (ASTM).

The following are the main features of biofuels such as biodiesel, methanol and ethanol:

- they are energy from renewable resources
- they are biodegradable, so they quickly dissipate in the event of spillage
- they reduce greenhouse gas emissions. The use of B100 may eliminate up to 90% of the toxic gases from the burning of regular diesel, which are thought to cause cancer and other diseases. In fact, the US Department of Mine Safety and Health Administration (MSHA) has approved the use of biodiesel in underground mining equipment, where workers are exposed to high levels of gases in the air as a result of combustion, thus reducing the risk of diseases
- their high flashpoint and low volatility, which prevents quick ignition as in the case of conventional diesel, considerably improving handling, transport and storage-related risks
- they are non-toxic and environmentally friendly
- in addition, biodiesel degrades four times faster than conventional diesel
- So far, based solely on confirmed projects, production in Argentina has reached around 2,300,000 tons/year of installed capacity for 2008. Since its use has not been mandated until 2010, it is clear that a considerable part of the production could be exported.

In order to reach this objective and make the most of this comparative advantage, it would be helpful to obtain tax incentives not only for production, as in the case of the Rosario-Santa Fe Pole in the Province of Santa Fe, but also for exports. By way of example, these incentives might consist of the elimination of export duties. In addition, tax-cuts would help balance the tariff and non-tariff barriers found when looking for new markets, which affect Argentine foreign trade in general.

Moreover, increased exports mean genuine tax revenues for the State, instead of recessive export duties. Additional benefits will be the creation of jobs and improvement of regional economies as a result of the opening of new production facilities.

Important differences between Argentina's position compared with that of Brazil:

In January 2005, Brazil passed law 11.097, providing for the introduction of biofuels in the country. Between 2005 and 2007, the legislation requires a mixture of 2% (B2) biodiesel in diesel, which has been possible through the permit granted by the Brazilian energy authority. Let's keep in mind that the number following letter B indicates the percentage of biodiesel in

fuel. For the 2008-2012 period, the addition of B2 will be mandatory nationwide. From 2013, the volume of addition is to be increased to 5%.

The original 840 M/liter objective estimated for meeting 2% of the total diesel demand, established by the National Program for the Production and Use of Biodiesel (Programa Nacional de Producao e Uso de Biodiesel - PNPB) has been exceeded in 2007. Biodiesel's installed production capacity at present reaches 962 M/liters. Besides this, the PNPB provides for a series of tax incentives aimed at promoting this activity.

In adopting these measures, Brazil intends to favor the less developed areas of the north and northeast of the country, while creating more employment opportunities.

Argentina, in turn, presents a more complex scenario, since the shortage of gas oil cannot be solved and the problem is far from disappearing.

Argentine Law 26.093 provides that from 2010 onwards, the addition of 5% of bioethanol in gasoline and 5% of biodiesel in gas oil will be mandatory. Even though the local Biofuel Law establishes tax incentives for this activity, the enabling regulations provide that sales of biofuels by promoted companies will be made at rates fixed by the respective authority, which clearly implies a risk of distortion.

Even though the potential markets may vary, there is no doubt that the US (due to its market size, fuel consumption levels, inability to meet its own demand, and need to break free from petroleum-producing countries), Mexico and Chile (due to their high pollution levels), and Europe (due to the deficit between supply and demand), are the natural markets for Argentine biofuels.

We have written this article with a view to analyzing the different forms of transport, handling, and storage of biofuel varieties, on the basis of the above assumptions regarding the probable destination of the larger part of our biofuel exports.

There are quite a few differences among biofuels. While B20 has practically the same features as those of conventional fuels, B100 is completely different. The former may be considered an additive which does not change the properties of the original product considerably. This is not the case of B100.

In all the cases, the tank to be used for transporting liquids must be very clean, but in the case of B100 (ASTM D6751-03) it is imperative to clean the transport or storage tank extremely well, since the product is a very good solvent and may quickly dissolve existing sediments.

On the other hand, contact with an excessive quantity of water must be avoided during transport and / or storage, since it may result in non-compliance with the specifications regarding the water content allowed. Excess water may cause corrosion and a suitable environment for the development of microorganisms.

When handling and storing B100, it must be taken into account that this product freezes at higher temperatures than most conventional diesels, and crystallizes at 1.5 to 7.5° C ("cloud point"), which may sometimes lead to the need for heated lines.

B100 should be stored at 2° C to 3° C at least, above the fuel's "cloud point", which is the temperature from which little solid crystals begin to form as the fuel cools down. A 4.5° C to 7.5° C temperature would be convenient for most B100, though some might require higher storage temperatures. Under these temperature conditions, it may also be stored in drums and / or totes (IBC).

However, since the sun's heat and light speed up unsaturation, which affects B100 stability, it is not advisable to store or transport the product in the open air in translucent or light totes during the summer.

In addition, when temperatures drop considerably, reaching the "cloud point", B100 quickly takes the form of a gel and increases viscosity. This may cause an extra burden on loading and unloading pumps.

However, when crystals begin to form, B100 may be heated to become a solution again. If this is done slowly or partially, the crystals settle in the bottom of the tank and slowly become a gel.

For this reason it is important to take precautions so that the tanks, drums or totes do not undergo temperatures lower than "cloud-point", and that the pumps and other elements used for loading and unloading are adequately protected from extreme cold temperatures by a suitable heating system.

B100 is incompatible with some hoses and gaskets. It may even soften and degrade (to the point of destruction) some kinds of rubber components used in certain hoses and gaskets (such as natural rubber, nitriles, buna-N, etc.), causing biofuel leakages and even destruction of the pump used. It is therefore imperative to ensure that all parts in contact with B100 are compatible with the product.

B100 is not compatible with certain metals and plastic components. In addition, it may form high levels of sediment when in contact with copper and copper alloys, and / or galvanized surfaces for long periods. Besides, B100 may permeate some kinds of plastics such as polyethylene and polypropylene; so these materials should not be used for storing and / or transporting B100. Instead, materials such as Teflon, Viton, fluorinated plastics and nylon are B100-compatible.

The US National Biodiesel Board recommends not storing B100 for more than six months. If so, antioxidants should be used and periodical tests performed to check acidity, sedimentation and viscosity levels and to ensure that the product still meets the ASTM D6751 standard. In general, this applies to all biofuels, though it is understood that lower blends (B2 to B20) should tolerate longer storage periods than those of B100.

Most tanks suitable for transporting and / or storing regular diesel could be used for B100 without any inconveniences. Some compatible materials are aluminum, steel, teflon and fiberglass. Materials such as copper, bronze, tin and zinc may speed up biodiesel oxidation and create insoluble sediments, gels or salts when they react in the presence of some fuel components.

As in the case of petroleum, it is important that B100 be transported without harming the environment.

The following procedures are recommended for transporting biofuels in general, and B100 in particular, either in vessels, tankers, trucks or rail:

1. Acceptable materials: aluminum, carbon steel or stainless steel
2. Inspected tanks with accompanying cleanliness certificates
 - a. In the absence of certificates, inspect previous tanks and residues
 - b. In general, only regular diesel is accepted as residue
 - c. Not accepted:
 1. Food products or vegetable oil raw materials
 2. Gasoline
 3. Lubricants
 - d. No residual water should be present
3. All parts in contact with the product must be compatible with it
4. Establish some special isolation or heating system in the event of transport, loading and unloading, at extremely cold temperatures
5. Biofuel's "cloud point", temperature, ambient temperature, kind of transport and its transit-time, are all factors to take into account when transporting biodiesel.

Based on the projected export volumes, the first option to take into account for international transport are vessels with bulk liquid tanks.

The other options, such as drums and totes, are expensive and have little capacity.

Isotanks are a possible alternative as well. However, they are not broadly available in Argentina, so they seldom meet the seasonal demand of products with such high volumes as biofuels. In addition, certain geographical locations may not be attractive for Isotank Operators, so in addition to tank rental, transport and cleaning costs, repositioning costs should be added.

Finally, flexitanks are the most suitable alternative after tankers; however, according to the information we have at present, there are no Argentine-made flexitanks approved by the National Institute of Industrial Technology (Instituto Nacional de Tecnología Industrial - INTI), so the ones to be used are those manufactured and approved abroad, at a slightly higher cost.

When it comes to opening new markets, a previous analysis of our company and product strengths and weaknesses must be conducted, and advice of experienced professionals must be sought when undertaking this kind of activity.

In order for the selected agent to be able to transport the goods, the producer and / or exporter must previously submit the MSDS (Material Safety Data Sheet) of the product in question. We are attaching a sample of this data sheet for your information.

With the above information it is possible to assess the acceptable equipment and existing availability.

We at Airsealand (www.airsealand-group.com.ar) are convinced that Argentina has a unique opportunity to profit from its enormous comparative advantages and export a product which is bound to change the rules of fossil fuel consumption. Our organisation is ready to support this change.

19.2. Glossary/definitions

additive: material added in small amounts to finished fuel products to improve certain properties or characteristics.

antioxidant: substance that inhibits reactions promoted by oxygen

biodiesel: methyl esters of fatty acids meeting the requirements of ASTM specification D6751.

biodegradable: capable of being broken down by the action of microorganisms

cloud point: the temperature at which a sample of a fuel begins to show a cloud or haze of wax (or in the case of biodiesel, methyl ester) crystals when it is cooled under standard test conditions, as defined in ASTM D2500.

19.3. Sample – Biodiesel material safety data sheet

Chemical Product

General Product Name: Biodiesel

Synonyms: Methyl Soyate, Rapeseed Methyl Ester (RME),

Methyl Tallowate

Product Description: Methyl esters from lipid sources

CAS Number: Methyl Soyate: 67784-80-9; RME: 73891-99-3;

Methyl Tallowate: 61788-71-2

Composition/Information On Ingredients

This product contains no hazardous materials.

Hazards Identification

Potential Health Effects:

INHALATION:

Negligible unless heated to produce vapors. Vapors or finely misted materials may irritate the mucous membranes and cause irritation, dizziness, and nausea. Remove to fresh air.

EYE CONTACT:

May cause irritation. Wash eye with water for at least 15 to 20 minutes. Seek medical attention if symptoms persist.

SKIN CONTACT:

Prolonged or repeated contact is not likely to cause significant skin irritation. Material is sometimes encountered at elevated temperatures. Thermal burns are possible.

INGESTION:

No hazards anticipated from ingestion incidental to industrial exposure.

First Aid Measures

EYES:

Wash eyes with a heavy stream of water for at least 15 to 20 minutes.

SKIN:

Wash exposed areas of the body with soap and water.

INHALATION:

Remove from area of exposure, seek medical attention if symptoms persist.

INGESTION:

Give one or two glasses of water to drink. If gastro-intestinal symptoms develop, consult medical personnel. (Never give anything by mouth to an unconscious person.)

Fire Fighting Measures

Flash Point (Method Used): 130.0° C min (ASTM 93)

Flammability Limits: None known

EXTINGUISHING MEDIA:

Dry chemical, foam, halon, CO₂, water spray (fog). Water stream may splash the burning liquid and spread fire.

SPECIAL FIRE FIGHTING PROCEDURES:

Use water spray to cool drums exposed to fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS:

Oil soaked rags can cause spontaneous combustion if not handled properly. Before disposal, wash rags with soap and water and dry in well ventilated area. Firefighters should use self-contained breathing apparatuses to avoid exposure to smoke and vapor.

Accidental Release Measures Spill Clean-Up Procedures

Remove sources of ignition, contain spill to smallest area possible. Stop leak if possible.

Pick up small spills with absorbent materials such as paper towels, "Oil Dry", sand or dirt.

Recover large spills for salvage or disposal. Wash hard surfaces with a safe solvent or detergent to remove any remaining oil film. A greasy surface will be slippery.

Handling And Storage

Store in closed containers between 50°F and 120°F.

Keep away from oxidizing agents, excessive heat, and ignition sources.

Store and use in well ventilated areas.

Do not store or use near heat, spark, or flame, and store out of the sun.

Do not puncture, drag, or slide the container.

The drum is not a pressure vessel; never use pressure to empty.

Exposure Control /Personal Protection

RESPIRATORY PROTECTION:

If vapors or mists are generated, wear a NIOSH approved organic vapor/mist respirator.

PROTECTIVE CLOTHING:

Safety glasses, goggles, or face shield recommended to protect eyes from mists or splashing. PVC coated gloves recommended to prevent skin contact.

OTHER PROTECTIVE MEASURES:

Employees must practice good personal hygiene, washing exposed areas of skin several times daily and laundering contaminated clothing before re-use.

Physical And Chemical Properties

Boiling Point, 760 mm Hg:>200°C Volatiles, % by Volume: <2

Specific Gravity (H₂O=1): 0.88 Solubility in H₂O, % by Volume: insoluble

Vapor Pressure, mm Hg: <2 Evaporation Rate, Butyl Acetate=1: <1

Vapor Density, Air=1:>1

Appearance and Odor: pale yellow liquid, mild odor

Stability And Reactivity

GENERAL:

This product is stable and hazardous polymerization will not occur.

INCOMPATIBLE MATERIALS AND CONDITIONS TO AVOID:

Strong oxidizing agents

HAZARDOUS DECOMPOSITION PRODUCTS:

Combustion produces carbon monoxide, carbon dioxide, and thick smoke.

Disposal Considerations

WASTE DISPOSAL:

Waste may be disposed of by a licensed waste disposal company. Contaminated absorbent material may be disposed of in an approved landfill. Follow local, state and federal disposal regulations.

Transport Information

UN HAZARD CLASS: N/A

NMFC (National Motor Freight Classification):

PROPER SHIPPING NAME: Fatty acid ester

IDENTIFICATION NUMBER: 144920

SHIPPING CLASSIFICATION: 65

Regulatory Information

OSHA STATUS:

This product is not hazardous under the criteria of the Federal OSHA Hazard Communication Standard 29 CFR 1910.1200. However, thermal processing and decomposition fumes from this product may be hazardous as noted in Sections 2 and 3.

TSCA STATUS: This product is listed on TSCA.

CERCLA (Comprehensive Response Compensation and Liability Act): NOT reportable.

SARA TITLE III (Superfund Amendments and Reauthorization Act):

Section 312 Extremely Hazardous Substances: None

Section 311/312 Hazard Categories: Non-hazardous under Section 311/312

Section 313 Toxic Chemicals: None

RCRA STATUS:

If discarded in its purchased form, this product would not be a hazardous waste either by listing or by characteristic. However, under RCRA, it is the responsibility of the product user to determine at the time of disposal, whether a material containing the product or derived from the product should be classified as a hazardous waste, (40 CFR 261.20-24)

CALIFORNIA PROPOSITION 65:

The following statement is made in order to comply with the California Safe Drinking Water and Toxic Enforcement Act of 1986. This product contains no chemicals known to the state of California to cause cancer.

Other Information

This information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any other process. Such information is to the best of the company's knowledge and believed accurate and reliable as of the date indicated. However, no representation, warranty or guarantee of any kind, express or implied, is made as to its accuracy, reliability or completeness and we assume no responsibility for any loss, damage or expense, direct or consequential, arising out of use. It is the user's responsibility to satisfy himself as to the suitability and completeness of such information for his own particular use.

NOTICE

This article was prepared with a view to analyzing the different forms of transport, handling and storage of biofuel varieties, on the basis of the assumptions regarding the probable destination of the larger part of our biofuel exports. The author does not make any warranty, express or implied, or assume any legal liability or responsibility for the accuracy, completeness, or usefulness of any information, product, or process disclosed, or represent that its use would not infringe privately owned rights. Reference herein to any specific commercial product, process, or service by trade name, trademark, manufacturer, or otherwise does not necessarily constitute or imply its recommendation.