

## **Bio-Diesel Fuels**

### **“Their Potential in Prairie Agriculture”**

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#### **Summary:**

As we examine the opportunities Bio-Diesel (methyl esters) have for the Prairies and Canada, one has to first understand the development in other countries and learn from them. Europe has produced Bio-Diesel commercially since 1988, but there the focus was on sustainable agriculture and saving the environment along with taxation concessions. The U.S.A. on the other hand has huge surplus of soybean oil and has developed a Bio-Diesel industry, based on large Plants with large volumes and low cost feed stocks. The implementation of a B20 blend (20L Bio-Diesel and 80L Diesel Fuel) for emission control has been the main focus. Europe and the U.S.A. both have a large population and with that, a taxation base to subsidize the agriculture and Bio-fuels industries.

For us here in Canada we have hurdles to overcome, but we also have a unique opportunity for a Bio-Diesel based industry. That is because of the lower lubricity petroleum based diesel fuel, and sulfur removal mandated by our Governments. Throughout this session we will look at how BIG or small the opportunities are. As well as the economies of scale of the production facilities and the high value end uses. Keeping in mind the need for creating real value to the Producers who grow the crop, as well as adding value to Bio-Diesel. As we examine these principles we also must keep in mind Kyoto, Green and Common Cents ~\$. So is BIG or small the best for our new found industry?? I will examine with you the options, but ultimately it is your choice.

**1) History:** Bio-diesel has had a long history of development from the time of Rudolff Diesel using peanut oil in the 1800's. The Europeans with high fuel prices have been very active in this research since the mid-1980s and now there is a fairly significant production developed. The driving force in Europe has been high fuel prices, clean air and water and support for farmers. Because the Europeans were promoting a B-100, the quality issue quickly became a huge priority and as a result the development of Din 51606 std.. The North American development in the early 1990's has been slow, but the U.S. has spent a huge amount of dollars in demonstration projects to convince major transit authority's and other end-users the value of bio-diesel. This approach was not scientific base and at the end of the day could only be used as testimonial evidence. The other driver from the U.S. was that the soybean growers who were the major funders, to develop another market for their oil byproduct and promote the use of a B20 blend. There is also a huge lobbying effort to buy the growers to government in U.S. of a subsidy to bio- diesel producers to use the soybean oil and as a result this feedstock oil is at near zero cost to the bio-diesel plant.

Whereas in Canada our dependence on world oil reserves is minimal and generally our fuel here in Canada is substantially less costly than in Europe, the bio-diesel industry would have a difficult time marketing a product that cost two half times that of regular diesel. Our company Milligan Bio-Tech Inc. (MBTI), Agriculture and Agri-food Canada (AAFC), University of Sask.

(UofS), Saskatchewan Canola Development Commission (SCDC) through many years of research, found that fuel lubricity component of the Diesel of today was weak and that a bio-diesel based conditioner using Canola gave the greatest positive effect, with the lowest inclusion rate. We believe that the sulfur in the fuel as it is being removed has a negative effect on the lubricity on the fuel. The regulations that were put in place in 1990 have required fuel company's to reduce the sulfur content from 3000 PPM to 500 PPM, this fuel is commonly known as low sulfur diesel. The new regulations for 2006/2007 require that this sulfur be further reduced to no more than 15 ppm. The fuel companies are struggling with new additives and as we show them what are renewable, environmentally friendly, and agricultural based, additives can do, they are still very apprehensive to use it because it is not of a petroleum origin.

Throughout the 7 years of researching this product in many real world tests, ( using real drivers and real road conditions) that included many thousands of kilometers . This work was conducted by Agriculture Canada and University of Saskatchewan, along with cooperation from various funding organizations. This testing in the early stages had good scientific background , was on light duty engines. The data generated using the Bio-Diesel was all very positive and allowed us to initiate the Saskatoon Bio Bus project, to use heavy-duty engine testing. All of the preliminary results are positive nature and the city is extremely interested in moving to the next step.

We have also had many operators of heavy duty trucks do their own testing of our Conditioner and with the computer systems in these trucks it didn't take them long to see the value of using our Bio based additives. The range of fuel economy increase varied from 3 percent to 18 percent.

**2) Product Feed stocks:** there are a number of feedstocks that can be used for bio-diesel production, any vegetable oil or animal fat product is a potential input feedstock. From the testing that we have done over the last seven years in his been proven that every feedstock has unique properties and as a result of this, some feedstocks may need to be blended with other feedstocks to produce an effective quality product. Canola oil / Rapeseed oil have been used for bio-diesel production in Europe for many years. The testing done at Agriculture Canada labs has also confirmed that Canola / Rapeseed oil are very efficient and effective feedstocks. One of the more significant parameters for quality is oxidative stability and because of the fatty acid profile of Canola oil , it is able to deliver this quality. The other is cold flow or cloud point that determines the flow ability of a product, Canola oil also delivers on this item. A typical cloud point number for Canola bio-diesel is approximately -15 Celsius, whereas some of the other feedstocks like soybean is approximately - 7 Celsius, and animal fat approximately + 15 Celsius. This gives you an idea of the wide range of cold flow numbers from feedstocks. There is also the energy value is of the various feedstocks as well and the quality output.

The other property is the ability for the feedstock to deliver the lubricity component and from all the testing it appears that Canola is the highest of those tested. Because of this it requires lower volume of product to be used to be effective. The other component that is as important, is the production technology that we've developed with AAFC, to ensure that the Bio-Diesel produced is high quality product all the time. We've also found that even different Canola varieties have an impact on the effectiveness of the lubricity.

The feedstock costs is definitely the highest single costs of the production, approximately 75 percent of the end unit cost. In the U.S. soybean oil is the main feedstock and because it is a byproduct in the soybean industry the price is lower but also because of their federal government subsidy program the bio-diesel producers can get their oil at zero cost other than freight. In Canada, Canola oil is a high-end oil and demands a premium, but it also has superior quality in our products.

**3) Processing Technology:** Esterfication, this process is said to be simple and can be obtained on most Internet sites, but the difficulty lies in being able to produce a high quality every time and all the time. The chemical process is to remove the glycerin, (sugars) in a efficient manner to obtain the highest quality possible at the end of the process without excessive loss of the reagents. I use the analogy of making a cake, the recipe used can be the same for everyone. The outcome from several different people would be drastically different depending on ones past experience and practice.

COD / Biodiesel, that our product uses is in the unique properties of both products and further refines them to be marketed under our label. The bio diesel offers superior cleaning and cetane enhancement properties, whereas they COD offers superior lubricity. We also have been able to select specific varieties that also help us to deliver the high-end product .The downside to the Bio-diesel is that the energy value is significantly lower than fossil diesel fuel, that is why engine manufactures are reluctant to have higher inclusion levels. The COD if used at higher levels will do harm to the engine. So the balance is crucial for the positive outcome.

In reality our experience over last many years of research has paid dividends .We have been able to learn from the experience through the research that was conducted with Agriculture Canada and our private teamwork throughout the piloting phases.

**4) Standards:** there are standards that are being developed in North America for quality assurance, but the European standards are the most vigorous .In the world today the new European standard DIN 14214 which replaces DIN 51606 is of the highest quality. In the U.S. today the standard is ASTM 6751, but the European standard, which is higher is the quality of our product.

Milligan Biotech has been using the services of Alberta research Council to perform quality analysis work and as shown in the results, our product exceeds the new European standard. One of the main reasons for ensuring high quality is the end-users. They are our customers, whether that is Engine manufactures or the Injection Pump Suppliers. We have to be sure that they are comfortable with the product quality (referring to a statement from the injection pump manufactures association), that states no greater inclusion than B2 that meets EN14214 is acceptable. Even if the engine manufactures are not comfortable with the B20 they refer to only a B5, it is the lowest common denominator that determines the levels acceptable. One of the concerns the engine manufactures have is as you increase the level of inclusion, the lower energy content, so ultimately lower engine performance. Where as on the other hand the injection pump manufacturers are concerned about quality because glycerin (sugar) levels if they are too high

will gum up the injection nozzles and create hot points, which in time cause premature failure. Our Milligan product has documentation to show that we meet the EN14214 std.. We have also had supplied product to some independent companies in U.S. who in turn have ordered our product for some other clients in South Africa and Australia. The Australian comment on a product they received was comparing it to a "fine" Bordeaux Wine, which we're very proud of.

**4) Co-Product Development:** Our Company (MBTI), is continuing its research into new products as a result of the background knowledge gained in the Bio-Diesel work. We have found many new and exciting ways to add value now to the Bio-Diesel, the first of which was a Camp fuel Starter, but found that the market was small and slow. The other more exciting product is the Penetrating / Lubricating oil, which we introduced in 2004, and has been gaining ground, because of its superior effectiveness and low application rates.

There are many other unique products in the Industrial market place that this environmentally, consumer cost effectiveness product BIO-DIESEL can be used in the value added process.

Ultimately this is where the producer will extract the highest value for the crops we grow. But to effectively achieve this, there needs to be more vertically integrated production to end user systems in place to benefit from these value added opportunities, which real means that in order for the grower to gain from the value added portion they must lay dollars on the line, (some of which has high risk) in the early stages of development. But there is also truth in the saying "that there is value in numbers". So ultimately it is up to you, are you comfortable in trying to compete with large, and I mean really large Farms in South America ( 2-3 Million acre) sizes on a purely commodity basis or do you want to extract premiums in the Value Added Process . The question is yours and only yours to answer, but remember " THE POTENTIAL IS HUGE" either way, the difference is, are you going to be on the receiving side of the benefits.