

This is a guide to help those starting out or wondering about using Veg oil as fuel in diesel engines.

I have been running veg in vehicles and stationary/ industrial motors for over 15 years now. Much of what I say here will disagree with mainstream / internet thinking. This is because rather than just copy what others have done and preached, I have tested everything I have put into practice.

My first diesel vehicle was an old Mercedes I didn't want to buy and in fact walked away from but got Nagg....encouraged, by my wife to go back and buy. It broke down less than 10 KM from where I bought it and so my love affair with my German mistress " Helga " began. That is a story in itself and one documented on a forum at the time but the learning curve with this vehicle was steep and through.

Rather than be scared about blowing the thing up, Having no faith at all it would last the few remaining months of registration, I set about seeing what would cause it to fail. That reverse aspect taught me so much especially how many complete and utter Myths there are out there about using Veg oil.

My account here is based on real hands on experience, testing and arseing about. It taught me that there is much paranoia about using veg oil as fuel and most of what is written is plain wrong. In it's heyday there was an industry based around veg fuel and like everything else in the motor industry, many accessories and products were dreamed up which were far more effective in taking money out of peoples pockets than making engines run better. I'll touch on that later.

Most people are expecting the worst the first time they run veg and are then very disappointed. They are waiting for the point for something to change to signify the thing is now running on veg instead of diesel and nothing at all happens. The thing sound no different, goes no different or shows any sign there is a different fuel. The only effect is you may suddenly get hungry from the warm Donut / fish and chips smell.

The big event a lot of people have built up in their minds becomes a Complete anti climax and other than the smell of the exhaust if you can catch a wiff, you couldn't tell it was running on anything other than normal Diesel.

There is one important thing to always bear in mind when running mechanically injected diesel engines....Unless something goes bang, the problem is fuel related.

Keeping that in mind will make any problems you do have much easier to Diagnose because you only have to look at one system instead of Multiple.

First things first.....

In a nut shell, pretty much any Diesel engine with a mechanical Injector Pump in REASONABLE condition will happily run on veg oil. Many people have tried to run clapped out engines on it and then professed it didn't work well or the engine shortly died when it would have on diesel anyway.

Industrial/ small engines that tend to have Plunger type Fuel pumps will also run fine on veg oil provided

they are also in good condition and not worn to the point they would be troublesome on diesel Fuel anyway. On vehicles, the inline and rotary type pumps are best. Those by Lucas and others and electronic common rail fuel systems are more problematic and some should be totally avoided as they are relatively weak and marginal on diesel as well.

Electronically controlled Mechanical pumps are fine but need more care, Modern electronic common rail pumps CAN work but are a risk. Some are completely unsuitable and the more late model the engine, the less likely it is to tolerate anything other than diesel. Vehicles Fitted with particulate filters are NOT suitable for veg at all.

It's not possible for me to know every pump out there so one needs to do their own homework with what they have. You are not the first to do this and research will yield info that tells you the suitability of what you have. Generally, the older the vehicle the better.

The Mechanical, simple pumps on Lister, China clones, others such as Ruggeri, Kubota, Hatz, Lombardini and other small engines all work perfectly well on veg oil with NO modification.

The KEY factor to running veg oil is NOT having the oil hot as is often made out but rather having CLEAN, DRY oil. This is over looked but is critical. You CANNOT just put the oil through a cleaning cloth and into your fuel tank as I have seen shown on TV, The oil needs to be properly cleaned and dried.

With that done, the rest is pretty easy.

Starting out.

Before you get too excited about using veg oil in your vehicle or for running a generator or other equipment, the first thing to do is secure a Supply of veg oil. No use setting up for it and then finding you can't get any. The smartest thing you can do once you decide to go down the oily road of veg is start stocking up on Veg BEFORE you do anything else. Make sure you can get oil before anything else and when you find you can, start stocking up before you get a vehicle if that's your aim. By getting the oil first you build a reserve which will make things very much easier later down the track.

Finding and sourcing oil is a thing a lot of people have trouble with. Some places you can get it easily and others have contractor cowboys whom the world over seem to be bastards that stand over their suppliers and other people alike.

Often you will go into a place, ask for the oil, get a funny look and a stammering excuse that amounts to no. I never bothered asking for the majority of the oil I collected. If there was an accessible drum, I took it. While this upsets the moral high ground whingers looking for something to complain about and elevate their apparent morality on forums etc, one has to understand the flip side.

Waste oil is not only garbage to restraunteurs, it's a Liability. There are all sorts of fines if the stuff gets spilled by hoodlums or foraging animals (often the same thing) so they just want it disposed of responsibly and quickly. It's a big problem if they have an over flowing rum as their space for rubbish is often restricted and policed by council inspectors etc.

You are Doing them a favour by taking it and I have never had a problem when someone walks out and

sees me pumping out their drum. I have had on more occasions than I can count had people from other places come up and ask me to take their waste oil as well. The collectors can be unreliable as well as belligerent. In some few places the collectors will pay the restaurant for their oil (and a lot promise but don't pay) so check out the situation before you help yourself. I know no one paid for oil anywhere I collected it so therefore it was rubbish, not an asset.

When I did ask for oil, I expected to get the knockback so was not put off and had counter measures up my sleeve. If you merely ask if you can have some oil and they say no and that's the end of it, you won't get far. Don't be easily put off.

I would check out a place and if I wanted their oil I'd go in a couple of times and buy food trying to have a chat to build rapport with whoever was there. A good thing was to take my young kids with me and get them to order and pay and do other " Cute" things especially if the place has a female working there. I'd tell them I was into alternative fuels and saving the planet type thing and tell them my car ran on used veg oil. I'd ask if I could take some of their oil to put in it.

Often I'd be told they had someone collecting it and I'd clarify this was a commercial collector. When it was, I'd look a bit frown and say something to the effect the Big guys got it all and left nothing for anyone else. Brief pause and then ask if they would mind if I just picked up a bit here and there to keep me going. This had a virtual 100% agreement rate and then I was set.

I never clarified how much was "a bit" so took all I wanted. Pump off the good stuff at the top, leave the settled crap at the bottom for the collector (who's collection time I quickly worked out so I knew when to come) and never had any difficulties from the shop owner, they just want it gone and out their way.

It's good to collect at Night or early morning when the premises is not open. There will be no cars in the way between you and the oil drum and with more places having outdoor dining at the rear, the last thing they want is people coming around collecting the rubbish during service.

I remember asking at a local club after seeing a pile of drums out the back. They were a bit disbelieving at first but really happy for someone to take the stuff. When I pulled round the back in my vegmobile and they could smell it was running on veg, they were amazed. They went through a LOT of oil that was always top quality so was a good score. Where you can, sell the story of what you are doing. Most people have heard of it although never known anyone to do it and are fascinated. It can also lead to further supplies as people in the hospitality game tend to associate with others in the industry and talk. If you need more oil than a single supplier can provide which is a good thing to have multiple anyway, ask the ones you do have if they know anyone else you could get oil from.

Always make sure you come at a convenient time, leave no trace you have been there and don't disturb any neighbor's etc when you are there or come and go. Where you can, check out the oil before you ask for it. Some places use it till it looks like sump oil which is not what you want. The clearer and more golden the better but don't be put off if it's a bit creamy. It can be like that from the foods cooked in it and the temp of the year.

When My kids were young and we went for a drive somewhere, usually to a beach, before we would get food at a place they would often want to go around the back and check out the oil. They knew Clean oil was good food and crappy sump looking oil was best avoided. We were often able to Pick up a bunch of tins as well and took home more oil than we used on the days outing several times over.

Oil can be collected in Drums or Cubies as they are called in some places but in my area, most places put the oil into open lidded 200L drums or tanks provided by commercial collectors. I found getting oil in Tins was a pain in the backside to transport, store and dispose of them. Pumping the oil is a much better process particularly if you need oil in quantity. There are many pumps available on the net but most are overly expensive and of very questionable quality and certainly longevity when pumping oil. Most are designed for things like kero or diesel and those that are oil rated are more for pumping oil from your sump 5l at a time not 200L+ in one go.

I built my own pump many years ago and have yet to find something better despite looking constantly.

This is a vid of what I built and how I built it. <https://www.youtube.com/watch?v=fkBIYcT6j8U&t=508s>

This is the oil collection tank I use and setup:

<https://www.youtube.com/watch?v=A73BOwoGPW4&t=485s>

Running oil.

There are 3 ways to use veg oil.

1. Straight oil. Just like the name says. Usually done with a “conversion” that heats the oil to thin it which is often not needed and a waste of time and money.
2. Blending. Mixing veg oil with Diesel/ petrol/ kerosene/ jet fuel/ turps or any other non aromatic fuel/ solvent. This IMHO is far and away the best application of veg but also the least used.
3. BioDiesel. This is oil converted through a chemical process and is straight substitute for Diesel. It's not oil as such but another fuel so I won't cover it here although I have made 10's of thousands of liters of the stuff over the years with a friend.

Straight oil and blending can overlap but normally are seen as different. The done practice with straight oil is to fit heat exchangers to the engine to get the fuel up to ideally 80oC to thin it so it goes through the pump and Injectors supposedly to prevent failure. Most times it is done with a 2 tank system so the engine is started and switched off on Diesel. This is done by a 6 port “Pollack “ valve usually and requires a 2nd fuel tank and fuel lines to the engine. Most people use a Flat Plate heat exchanger to run water from the heater circuit of the engine which is direct from the head and the hottest water into the HE and the oil goes through the other side. Many people go to total overkill using 2 HE's of 30 Plate size.

This results in a mess of heater hoses, fuel lines and filters that make for a lot of failure points. A lot of people used to get other people to do their conversions which was a dangerous thing. Alternative fuel

systems are not something the average mechanic has ever seen let alone understands so If you can't fix something yourself when it goes wrong, you are going to be paying a lot for someone else to learn how it all works and figure out the problem is a loose hose clamp that is leaking air into the fuel system.

IMHO, most conversions are unesacary and always completely over done by people who don't really understand what they are doing, why they are doing it, the principals involved or are taking their situation into account. Most people copy chapter and verse what they read the last guy on the internet did who copied the guy before him. If he lived in some place where it snowed 6 Months of the year and you live where snow has never been seen and your winter clothing is a light sweat shirt, obviously you don't need to go to the same trouble as the guy who lives where things are frozen.

It' is clear to me in many different fields and interests, some people just won't accept that something can be easy, cheap, straight forward and still work perfectly. These people have a mental proclivity that unless something costs a lot, is complicated and has a lot of built in failure points it can't work.
Poppycock!

My own Nissan patrol has no more conversion than a Different cheaper and easier to get fuel filter. Not because of the fact I run straight oil in it even in winter with no problem but because it's cheaper and easier to get than the OEM filter. My 405 Peugeot was the same. Only difference was a cheap inline fuel filter to replace the expensive and hard to get here OEM filter. With my first Veg car, a w123 Merc, I started with blending, did a conversion with my own HE, and discovered I didn't need a lot of the complication so went back to blending and running straight oil with no conversion. That engine was hard to start at the best of times so Putting methanol down the intake was just what I did as a matter of habit. Once started in the morning it would start on its own the rest of the day.

Every thing you do that takes the vehicle away from stock makes it less reliable. Adding in heat exchangers and extra fuel lines and tanks just complicated things and gives the vehicle more failure points from leaks and blown hoses, bad clamps etc than the benefits they provide. If you have an inline or a rotary pump and can find the actual spec sheets of the things, you will see they are capable and rated to pump thicker fluid than veg up until the point it's frozen. Heating the oil to thin it for the sake of the IP and getting a good spray pattern into the engine is pointless and needless. Sure, many people will tell you otherwise. Firstly, they have never got their hands dirty actually trying or testing running straight unheated oil and secondly, the people selling heat exchangers and kit brainwashed people into thinking they had to heat the oil or their engines pumps would expire immediately.
It's crap!

Some might think they live in a cold area so need to heat the oil. If it's that cold the oil will be too thick/frozen to pump from the tank so you should be running a blend or waiting for the weather to warm up. Some engines will not start on straight veg in cooler weather due to lower compression, worn injectors or pump or low compression. For these engines a 2-tank system will be beneficial and the Heat exchanger can merely be rubber hose wrapped around the top radiator hose and insulated.

In cold climates putting SOME heat in the fuel before the filter to melt any fats that may condense can

be wise. This can be simply without replumbing and filling the engine bay with miles of hose. You only need to get the oil/ filter to about 30oC to melt out the fats. Anything else is useless overkill and I' challenge anyone to prove me wrong on that within the parameters of an inline or rotary pump on an engine in good condition.

Maybe the reason I say "Don't mess with things" where others will disagree is because I'm not trying to sell anyone Kits or components. :0)

In many cases just getting new injectors and having the pump timed and advanced 5o to suit the veg will make a hell of a difference to the way an engine starts and runs.

If you are using a stationary engine, heating the fuel is more than useless. The single plunger type pumps especially are so rugged and have virtually limitless ability to handle thick fuel, all you need to do is make sure the fuel can run down the lines from the tank, through the filter and into the IP and it's all good. No other modifications are needed. Adding a drip or pumped Water injection system to keep the engine clean is a good addition to any engine running veg or Diesel and I will go into that later. Prep your fuel as explained for a vehicle to ensure it is clean and dry.

Blending.

Mixing Veg with diesel is popular and OK although not the best method IMHO.

The mindset is to thin the fuel but what you really want, against the parroted mantra of veg thinking, is to make it light off easier. In any case, mixing a fluid that you want to thin with something that is where you want to end up is nonsensical. You end up with thick diesel not thin oil. Logically you want to start with something thinner than where you want to end up so you can get to the target point.

Can't do that with diesel BUT, it will make the veg more easy to ignite but you have to use a fair amount of it. As most people buy their blending agent, the more you use, the less your savings will be. If you can halve your fuel cost, that's still a great thing for most people though.

I have used Jet fuel, Turpentine, kerosene and Naptha as blending agents as well. Jet fuel and kerosene are the very best things to use as they are thin and non aromatic like petrol however where I am, are expensive and not easily available. If you live near an airport and can buy Turbine fuel (NOT Avgas Which is high octane petrol) that may be cheaper than petrol in some places as there will be no road tax. Don't tell them you want to put it in a vehicle however as they may not sell it to you for tax/ liability reasons. Tell them you want it for your parts washer or as cleaning solvent. If there is a maintence place there, go offer them a slab of beer for the stuff they pump out the aircraft before they work on them. They have to drain the tanks and are not permitted anywhere I know of to put it back in so it has to be disposed of. This stuff can be blended in high ratios with veg and will make your vehicle go like never before. As it also has additives to keep it from gelling to -40oC, you can run it all year round and still have summer like diesel in the tank that will never freeze up..... Unless you live in some snowbound wasteland hell that is!

My preferred easily available blending agent is Petrol. It is thinner than diesel so can reduce the viscosity of veg effectively although there is a very definite limit to what you can run. More importantly, petrol is far more easily ignited than diesel. I can hear the screams of protest over that statement so I will elaborate.

Petrol is formulated to be hard to ignite so higher compression ratios can be achieved without knocking (pre ignition) and the engine is more efficient/ powerful. The scale is octane and is resistance to compression ignition.

Diesel is the opposite and its scale of measurement is Cetane which is how easy a fuel lights under compression which is what you want in an engine with no spark plug.

The misnomer in veg circles is that adding petrol makes the oil harder to light because of its inherent formulation against this. WRONG!

A high performance, computer controlled, spark ignition engine will run 12:1 Compression. Maybe 13:1 but that's on the ragged edge and the computer is probably pulling back a mile of timing, injecting a rich mixture and other things to stop the thing pinging its head off... literally. Most every day, nonperformance cars engines on unleaded are running 8-9:1 compression. Only the high performers and exotics are at the 12-13 mark.

OTOH, a LOW ish compression diesel will be running 16:1 Compression, many around 20, some of the high performers up to 28:1.

If it takes a big dollar engine and management to tolerate 13:1 Compression without the fuel lighting off on its own, there is no way in hell it's going to resist 16:1 compression or anything near it in an engine DESIGNED to light the fuel off by compression and timed to inject the fuel at near max compression and heat in the cylinder. That's a key point to remember, The fuel in a diesel is sprayed into the cylinder at High compression and heat within the cylinder so it lights in a jet of flame unlike a petrol engine where the fuel is admitted and THEN compressed. Petrol is going to light off under these conditions way faster than any oil (which is what diesel is) and in doing so, when mixed with veg oil it will start the other harder to burn fuel (veg oil) combusting a lot sooner in the compression cycle which is what you want.

Putting petrol in the veg oil (which lights off SLOWER than diesel) means the petrol component will light off sooner and bring the overall timing of the veg burn to something much closer to that of regular diesel. As adjusting the ignition/ fuel pump timing on most engines is a specialist process and one few people do, bringing the volatility of the Veg back closer to diesel is an ideal and worthwhile endeavor. As such, whenever I want max performance from my engines, I run 5% ULP no matter what the ambient temp.

Running ULP is best done to suit the ambient temp. 5% in summer is good for performance and clean combustion as I just explained. In cooler weather, 10 and 15% blends are good. I don't recommend 20% unless there is snow and at that stage you will want real good oil to not solidify anyway.

Some engines, particularly the small industrial/ stationary types are not particularly sensitive to using straight oil or temperature. Perhaps if you are trying to start one in freezing condition it will be different but I would not use Veg oil in those conditions to start with unless the engine (and fuel tank) was in a warm, heated garage to start with and therefore NOT subject to freezing conditions.

My stationary engines and my current Nissan Diesel will start with no problem on straight Veg oil down to freezing point. Yes, takes the vehicle a few more turns to light but on an engine that cold, I'm happy to give it a chance to get the thick sump oil flowing before the engine lights so I'm not running it dry for too long.

NEVER use alcohol/ ethanol fuels where possible.

Alcohol boils at 70°C. A temp easily reached in fuel systems and under bonnet temps. Straight petrol boils at 90°C so although can easily be reached as well in warmer conditions especially, does give a worthwhile buffer. If a liquid boils in a fuel line, it expands 1000X. That 1ML of Alcohol which is insignificant as a liquid suddenly becomes 1 LITRE of gas in your fuel system and that will be a BIG problem!

The main time you will have difficulties is if you are driving in warmer weather, stop at the convenience store to grab some milk, come back and try to restart the car 5-10 min later when it's heat soaked.

Ethanol is also problematic in Stationary engines. It will pull moisture out the air and it can settle in the bottom of your tank. The other thing is it can attack seals and gaskets in older fuel systems that were never designed to have alcohol running through them and are susceptible to its effects. It's a good starting fluid to get an engine going by putting it down the intake but just as water is good in the intake, you don't want it going through the fuel system.

A big problem with Veg and particularly Biodiesel is that it is hard on soft (rubber) fuel lines. Bio tends to make them soft and sweat, Oil tends to make them hard and crack. There are a number of painfully priced fuel lines out there supposedly resistant to biofuels. This is something I have not tested but everything I have read says that rather than being a replace and forget deal as people thought, they merely last a bit longer than the normal and much cheaper fuel line before they deteriorate the same way.

Being a tightwad, I use cheap braided Vinyl hose for fuel line. It lasts more than a year so I change it every year when I do my annual maintenance. Being cheap it costs me just a few dollars to replace the small amount I have in my vehicle and on my stationary engines. I use the aircraft maintenance principle of replace something well before it fails rather than wait till something is about to or has failed. By regularly changing the line which takes minutes, I never have to worry about it failing because I know it's going to be in good condition and I have checked everything else like the hard lines for running and cracking, loose mounts etc. Some of this Bio fuel resistant line is \$40 meter. Stuff I use with 100% success is \$12 for 5M as I buy it. It is the common clear Vinyl with the criss cross thread running through it generally used for water and food grade applications.

The main thing with blending is to allow easy starting. The colder the weather, the more help the oil/ engine needs. The Mercedes W123 owner's manual on page 133 specified Petrol/ DIESEL blending ratios of up to 30% at temps of -30°C but also warned of power loss at that ratio which would be significant.

I wouldn't recommend over 20% at any temp myself.

The thing with blending is to test YOUR oil with YOUR vehicle in YOUR conditions.

If you can't start the vehicle, a bit of Methanol/ methylated spirits or even a small capful of petrol down the intake will spark it to life. Blending is not as much about running as starting.

On that note, do not try to get or worry about if your engine does not start first compression cycle.

Letting a cold engine turn a bit so there is oil to bearings, cams etc is a very good thing. As long as the engine starts reliably, does not matter if it takes 5 sec of cranking every time, that's a good thing but again, the general consensus on the net is a vehicle should fire into life every time the key gets within an inch of the ignition barrel let alone wait till the key is actually turned. A bit of cranking so the oil is in the bearings or very close to it when the engine does light is a good thing and far from a detriment of taking a few sec to fire up.

Vehicle/ Engine.

If you are looking for a vehicle, you are going to be looking at something getting on in years now.... Or a tractor.

The engine is pretty much irrelevant, Indirect injection is better but direct (No glow plug) can work fine too. The injector pump is the important thing.

The best IP is the INLINE type such as Bosch pumps fitted to W123/ W124 Mercs and older and other vehicles and engines. All the injector lines are in a row usually at the top of the pump. These are tough as nails and you WON'T break them. Ever.

Second best is the rotary type such as used by a myriad of manufacturers like Nissan, Peugeot, and many others. Not quite as tough as the inlines but you will have to put significant effort or stupidity into breaking one. Electronic pumps need care, Common rail types are best avoided but can work but need a lot of babying. Some will fail easily on Diesel fuel and are prone to trouble so do your homework with these.

Small engines tend to have plunger type pumps which are very simple and rugged in design. As long as the Pump, injector and engine are not overly worn, you can put Veg into these with no problem at all.

Fuel Preparation.

The BIGGEST and most important factor to successfully running an engine on veg is CLEAN, DRY fuel. Yes I have repeated myself and I will again so the point is not missed.

Many people filter their oil, often to excess and think it's good. It's not.

Veg oil unlike mineral oil is hygroscopic and WILL absorb water. It is held in suspension and can be from having water added to the oil dry it will absorb moisture out of the air from the humidity. For this reason and finished Dried oil needs to be in an airtight sealed container.

Veg oil is the perfect lazy man's sport. The less you do with it the less you need to. My preferred method of oil preparation is settling. Ideally the oil should be settled through one summer when it is thin and the particulates and free water have the least resistance to fall to the bottom. 6 Months say from Spring to the end of Autumn in most places should be OK as well.

If your oil is heavily contaminated, pre-filtering through some material like felt, an old bedsheet or even a reusable shopping bag made of woven nylon/ plastic is ideal.

This is a vid on how I prefilter when I need to. https://www.youtube.com/watch?v=OAm-kGk_udQ&t=168s

As these are cheap to buy usually, they can be used and thrown away when blocked to eliminate mess. Pre-filtering in winter can be particularly useful in winter. The fats will collect in the fabric and then form a layer. It may take days for the oil to filter through but as it is filtering through a fat layer, the oil going through is VERY clean straight off. This will prolong the life of your final filtering medium.

The settled oil is pumped from the top till all the clear, thin and clean oil on the top is removed and the fat Gunk layer is hit. If this is only say 20% of the vessel volume, the tank can simply be refilled and resettled. When the rubbish layer becomes significant, it can be pumped out and processed separately. Any oil can be cleaned up, just depends on the useable oil amount you can extract and the time and energy required to get it.

Once the clean upper oil is withdrawn from the settling tank it can be finished or polished. I recommend a 5 or 1 UM (micron) 10" household water filter although Filter bags which are UM rated can also be used. They tend to be more exy and hard to get than the household water filters which are available the world over in hardware stores.

Drying the oil to remove any dissolved moisture is important but something few people do, I suspect out of complacency and laziness. It is far more important than the weight it is given in veg circles. If you tip dirty, as collected oil in your tank, the filter will block, the engine will stop and will need the filter to be replaced till all the rubbish in the oil is removed. No damage will occur to the engine and the fix is simple and cheap.

If you have water in your fuel, the engine will run at usually an acceptable performance (although below what it is capable of) and continue to do so until something significant occurs. This may be blocked fuel lines due to algal growth which is common, blocked onboard filters from that or erosion and damage to critical parts in the injection pump or injectors. When this happens it's a Major expense for a Pump and injector rebuild. You can't tell it's happening but it's a guaranteed certainty over time. Along the way you may get poor performance, certainly harder starting and less than optimal combustion creating other potential problems such as coking of the ring lands which once started, quickly escalates.

I would rather pour dirty Dry oil in my tank than clean wet oil long term.

To clean and dry my fuel, I use a processor made from a 200L drum to process my oil.

I have a video here <https://www.youtube.com/watch?v=PQL5ff9ICUs> on the process and setup I use.

The drum has holes about 8" cut at 2 opposing sides. There is a pump on the bottom of the drum which is turned upside down and the bung hole is tapped and goes to an electric Pump. The pump has a T'd outlet. One goes to the filter housing and then returns to the top of the drum and the other merely squirts the oil at pressure through a ¼" nozzle back into the oil pool. This creates a bubbling action which injects air into the oil and takes away the moisture. There is a fan located in one of the holes cut into the bottom of the drum which is not the top with the drum being inverted and the fan SUCKS the air out carrying the moisture away with it.

I tried blowing the air into the drum and onto the oil and it did not work well at all. It was the same as having no fan at all in the oil did not get much drier after many hours where as with sucking the air out the oil can be dry in anything from 3min to 2.5 Hours depending on ambient temps and humidity. I have no explanation for this other than there is some scientific/ physics principal at play I am ignorant to. All I know is the fan has to be sucking the air out of the drum and the space above the oil rather than blowing into it.

If you are drying in a shed, ensure it has a positive airflow. The water from the oil will go into the air and once the atmosphere reaches saturation point for humidity, no more drying of the oil will occur. Make sure at least 2 openings are available so air can go in and out or have something like a roller door open. I recommend making the air positive displacement by the use of a fan blowing into or out of the space.

As the oil is circulating and drying, I also open the valve on the filter branch to circulate the oil through there to clean it. This way the oil gets multiple passes through the filter and ends up very clean. Where I can I like to use 1Um filters but that is overkill. Diesel is filtered to 10 Um which is what most onboard filters are rated at. Usually 5Um filters are available which are more than amply sufficient.

When the oil is dry as verified by a hot pan test, the circulation outlet from the pump is closed and the filter pipe is removed from the push on fitting on the return to the tank and used to fill the tanks I am storing the now clean and dry oil in. It gets one last pass through the filter so I know it is 100% filtered. With pre filtering or settling of my oil, I get about 2000-2500L through one 10Water filter which cost me about \$6 at the hardware store. In summer the oil can be processed in as little as 30 Min but I generally let it run longer for peace of mind. It may be dry but not properly filtered on a short run or vice versa. I can let the thing run overnight as well, it does not have to be attended as it's just pumping oil in circles.

To speed up oil drying in winter or humid conditions you can heat it.

This speeds the process of evaporation and having the oil warmer than the surrounding air works well to drive out the moisture. I used a veg fueled oil burner for this and took the oil up to a max of 80oC. Any temp up to 100 is ok but be aware as I was of the temp handling of your pump and the effect heat will have on things like plastic fitting and hose. You don't want something blowing off at even 50oC which can cause burns and a terrible mess.

Drying by boiling is a very POOR method. It takes forever, is energy intensive and potentially dangerous.

A slug of water sitting on the bottom of a column of oil in a drum can super heat and then turn to steam expanding hundreds of times in a millisecond causing a veritable oil eruption. As the oil will be over 100 oc, the results can be catastrophic. I have had this happen to me once and although I escaped any injury, it's something I will not forget. If you HAVE to dry by heating, make sure there is no free water in the oil to start with and keep stirring the oil regularly to allow any water to boil off.

Never have the oil so hot it is smoking as that is around 200o c and on the verge of self-ignition.

Having the oil that hot also "damages" it and tends to cook it making it black, thick and often smelly.

It can also create carbon particles which are fine enough to block filters quickly.

Boiling oil dry may seem easy and simple particularly if you have a wood supply for a fire but it is painfully slow and inefficient with too many real dangers built in to be worth the significant risk.

Some people filter through Filter bags and then dry by running a fish pump and air stone in the drum. In my experience, this can take days to dry the oil as the air rate is so much slower than the jet aeration method. I got this idea from watching my kids squirt the hose in the swimming pool to make a "spa" effect. Another way of drying is to spray or create a fan of oil so it is exposed to the air and the water can evaporate that way.

Another way to process oil is with a centrifuge. To me this is a classic overkill with too much expense, complication and only half does the job. A fuge will not dry the oil no matter what type or what people say. A fuge gives you much cleaner than needed and far less dry than is critical. To dry the oil, you either have to pump a lot of energy into it to heat it or perform a separate drying operation.

Having oil that is filtered to a fraction of a micron is useless. Anything smaller than 5um is going to pass through the pump and injector without problem so a fuge is really like filling a bucket from a water tanker and thinking you got more water in the bucket because of how much the bucket over flowed.

The jet nozzle type Fuges are also troublesome with dirty oil and require it to be well pre filtered. Any particle that blocks the fine jets will mean the thing ceases to function properly and has to be stopped, disassembled and cleaned then put back together and the cleaning re started.

The amount of debris they can hold is also limited.

Bowl type centrifuges are by far the better option but also far more expensive to set up and have issues to be aware of on their own.

Pre settling and filtering gives a result that is perfectly acceptable, the cheapest to do and the least resource intensive of all.

For the price of a fuge setup you could buy 1000 onboard fuel filters so one would be better to just change them regularly (6 months for my car and they aren't blocked but I do it preventively) than the cost, time and energy investment in a fuge.

In stationary and not often used engines, I recommend only filling the tank with the amount of fuel you need for the running you intend to do. Veg oil will pull water out the air and become wet again as well as also developing Varnish like substances and "Poly" which is where it turns plastic through exposure

to air and water. This stuff is hard to shift and best avoided.

If you can fill your tank and you know it's clean, seal it with some plastic wrap under or over the lid if it's vented to prevent oxygen and humidity ingress. This will keep the oil in good condition for years if completely sealed. If you can't do that, add diesel or kero to the tank.

If it's not going to be used for a long time, Drain the tank, put in diesel and run the engine till all the oil is through the lines and in the pump. Diesel is more stable in long term storage than Veg and will not gum up in the same way.

Testing for Dryness.

The most common and easy way to test your oil is dry is the "Hot pan test". This is literally a pan placed on a heat source with a drop of oil to indicate it is Hot but the oil smoking which will happen at around 200oc, far above the water boiling point.

A small amount of oil is poured into the pan and observed. If the oil boils and bubbles like lemonade can be seen, it's still wet. If only a few, very few bubbles are seen it's OK and if it spits, it's soaking wet and should never go near your fuel tank or engine!

DRY oil will sit in the hot pan and do nothing. You may see one bubble but that's about it. It should sit there then smoke too as it heats up. The oil amount is not critical but a teaspoon full would be heaps. Just look for the bubbles and if there are a couple to none, you have dry enough oil for an engine. Some people use expensive testing procedures fit for chemistry and scientific purposes but we are making engine fuel here, not a cure for cancer.

If one wants to see how dry their oil really is using the hot pan test, get a cup of your finished oil, add a drop of water, mix and test. Really dry oil will be able to get 2-4 drops of water mixed in before it shows on the test. If you can do that you know your oil is way drier than it needs to be and will give the best starting and performance in your engine.

An obvious word of warning.... If you have gone the nonsensical way of mixing Petrol or something else in with your oil to settle it faster (and waste your money) DO not try to do a HPT. The petrol or whatever will bubble rendering the test useless. You also can't dry oil with anything added because you will drive off the petrol as a light aromatic well before the water. Not a bright idea to fill and enclosed space like a shed with flammable gasses either.

Potential Problems.

If you use properly prepared oil, problems will be minimal.

One that can and does frequently occur is black gunk blocking your fuel filter. Most people blame the veg but it is really the years of diesel Crap being cleaned out of the tank and lines by the veg.

I have had cars that had loads of this stuff coming out and blocked the onboard fuel filter in just a couple of hours running. I have had vehicles just as old where I saw nothing to minimal rubbish coming through.

If you get this problem and can't figure why the clean oil has so much crap, it's not the oil, it's the residue from the Diesel being liberated.

The shortcut to get rid of this is pull the tank and clean it. You can have this commercially done at radiator places whom will blast it with steam and solvents or you can DIY it.

The way I do it is to remove the tank and put it handfuls of sand, small pebbles and gravel along with some caustic (Lye/ drain cleaner) with about 5-10L of water. I then seal the tank and shake the hell out of it rotating it around so the diesel residue is abraded away. If you have had Oil in there before it will come out easy, if not it will take a little more effort. Letting the tank soak initially and using boiling water will also help. Once the tank is clean you can wash it out and dry it by rinsing with some clean dry veg oil which you then reprocess and don't have to waste.

Tanks on Stationary engines are particularly prone to being dirty from settle dust and rubbish from refueling carelessly as much as anything. It's a real good Idea to clean these before you start using veg as they are probably over due for a clean out anyway.

It' is also a good Idea to do the fuel lines on a vehicle which can also house a surprising amount of crap. Biodiesel is an excellent solvent for this but if you can't get that, Naptha is also great as is a caustic mix. Pump it through the lines and let it sit. Putting some clear hose on the end and elevating it to keep the solvent in there works well. From there I get compressed air and blow the hell out of the lines. Do the fed AND return line. I have blown the remenants into a coke bottle and what comes out is amazing. I repeat the process till I get no more crap then rinse, reinstall the fuel tank, ne soft lines and I'm ready to go.

Another thing that can lead to problems with veg is a weak battery .

If the engine is not spinning fast enough, it won't start very well. You need the engine to be spinning at the best revs to make plenty of heat in the cylinders for good starting. If the battery has a eak cell the engine can spin slower which makes starting hard or it won't start at all. I have seen this problem numerous times.

It also seems possible to " Flood" a diesel buy long time cranking without starting. Also come across this with people trying to start vehicles with low batteries. Putting in a good batter does not start the engine either but you may see some smoke out the exhaust. Removing a glow plug or injector and cranking will send a stream of fuel out the hole which will eventually clear to the smaller amount the injector is firing in each stroke. Once the plug or injectors are re installed, the engine will start OK but may be a lttle ragged at first. Some methanol or other starting aid will be helpful and a new battery can be fitted.

Accessories and Myths.

There are many products and procedures parroted in the veg world which go to the complication, expense and failure points I touched on earlier.

Heating Oil that will flow into an IP through a filter on it's own without heating is one such futility that is

widely championed on the net but largely a false anxiety.

Another pet favorite/ hate of mine is injector line heaters. These are supposed to keep the oil hot in the injector lines between the IP and the injectors to make for better running. The stupidity and illogic thought behind this to me is incredible.

An injector is imbedded in the cylinder head. Usually a great chunk of cast iron weighing at least 25+ Kg. The injector is screwed tightly in and has significant surface and thermal contact with the head. To think that a Pulse of oil less than 1ML at a time at a rate of around 1L an hour per line is going to stay hotter than the injector it is traveling through the small passages in the injector which give a lot of surface area if said injector is cold (or hot) is ridiculous. It's like dropping some oil into the hot pan and expecting that oil to stay at the temp it hit the pan at.

If the Engine/ head/ injector is cold, the oil will be cold when fired into the engine. No ifs or buts no matter how hot it was to start with. Conversely if the engine is up to temp, the oil will be fired in at the same temp.... Or higher due to the pressure it is fired in at.

The other glaring stupidity of these line heaters is their rating. They are generally under 50W total. Call it 12 w per line they are attached to. Figure out the temp rise through the many calculators on the net of 12W on a litre of oil per hour and you see the temp rise would be lucky to be 1 oC.

In other words even if the injector did not determine the temp of the oil, these heaters are too incredibly underpowered to do squat. And to make them even more ineffective, they are exposed to the moving air currents under the bonnet meaning they have to give up at least 50% of thier output to the back side which is not insulated. I have been lambasted by people selling and making these things many times but none would take me up on my challenge to set up a demonstration showing the start and end temp of the oil flowing through the line at even half a litre an hour. They won't do it because they know it will show a 2oC temp rise if that and prove the things are a complete and utter crock.

Do not waste your money on these insults to a persons intelligence.

Keeping your engine free from the Dreaded Coking and buildup.

The first and most important thing to prevent clagging of your engine using veg is to make sure it's operating correctly in the first place. Injectors are a maintence item with any Diesel engine and are neglected more times than not. If the injectors are streaming rather than Spraying as they should, your engine is on a path to the graveyard no matter what you are running in it. Just your injectors tested or better still just put a reco set in if you do not know how many miles they have done. Have the pump pressures tested and make sure each line is within tolerance of the others. Have the timing checked and advancing it 5o will make for optimal timing for veg oil use.

Veg oil does tax the tolerances of an engine somewhat so you need to keep the thing as on spec as you can. Many people run veg in old clapped out engines and then think the oil was the problem when they died. Did they really thing the engine was going to get better and less worn with MORE use and neglect??

I wouldn't run ANY diesel engine on any fuel, particularly an alternative one without running water

injection. Yes, many ignorant people claim they wouldn't put water in their motor but are oblivious to the fact thousands of aircraft in WWII as well as airliners ran it, it's still used in Shops, trains and a couple of years back, BMW had it standard and integrated into one of their performance vehicles.

The reason to run Water injection in a veg fueled engine is to keep it clean and free of buildup. It basically steam cleans the engine particularly in the ring lands and valve area where even diesel makes deposits over time. There are also benefits in combustion and performance from cooler air intake temps. WI is as a maligned and misinformed topic as veg fuel.

You do NOT need a steam like fine spray for keeping an engine clean as the manufacturers of high priced kits would have you believe. It can be a very simple, cheap, and basic setup which is probably why some people don't believe it works. It's not complicated or expensive enough.

All you need to do to keep the engine clean is get a controlled amount of water in the ending. It can be dripped and squirted in, You do not need 500 PSI pumps and vapor producing nozzles. A windscreen washer pump squirting water into the manifold through a large gauge blunt syringe needle or a bit of bashed down copper pipe will work perfectly. For cleaning, having droplets of water in the cylinder is a GOOD thing. The action of the liquid phase changing instantly from a liquid to a gas called Cavitation works effectively to erode the carbon deposits without touching the much harder metals in the engine components.

You can also spray water on the air cleaner element but I prefer more droplets going into the engine than vapor alone.

For engines of 3L capacity, I recommend a starting point of 300ml Minute. Most engines will take a LOT more but you don't need it. Just enough to remove any buildup and keep the engine clean and free of carbon buildup. The WI does not need to be running all the time when the engine is, I have mine set to come on with full throttle on Non turbo engines and at about 4 Lb boost on turbos. It's not critical, you just don't want to have to fill your water tank every 100km. that said, On a fast country run on the highway with a good amount of hills, I can pump 25L of water through my 4.2 litre engine in 200 Km and the thing loves it especially when I put in 50% Methanol which gives the thing a significant power boost and also seems to aid in cleaning the engine as well.

Again, all you have to do is get the water in there at a controlled rate. An engine may take months to come clean depending on it's condition and the delivery rate. Some clean up in hours and you can feel the little improvements till they level out. For engines not previously watered, you can up the injection rate to speed the process and then back it down again when it only has to do a work in progress rather than dealing with and clearing a backlog of buildup.

On stationary engines, just a drip into the intake will work well. I prefer to pump for accuracy of dosage but again, a constant/ regular application will do the job you want and prevent the dreaded and feared coking and buildup.

Fuel Filters.

A popular but questionable choice for Filters is the CAV/ Ryco type of filter with the glass bowl and filter that sandwiches between that and the top housing. These are used in many industrial applications but due to the fact of being made by a number of manufacturers now, quality and fit which creates air leaks is questionable. The filters themselves do not hold a lot of material for their size and as most people tend to set them up in a draw rather than push through arrangement, they can be prone to airleaks. Many people like them for veg because of the water settling feature but that is useless on Veg applications anyway as unlike diesel, Veg will absorb a lot of water.

These filters are also very messy and fiddly to disassemble to change and the numerous gaskets they have are fiddly to position correctly. They are not a filter you want to change by the side of the road at night.

I find a MUCH better filter is the sealed Canister type. They are used on Subaru Vehicles from about 97 to 10 amongst others. They are relatively inexpensive, made from metal so won't break and can be placed near hot engine components like exhaust to give some heating to melt out any built up fats and cannot leak anywhere other than the fuel connections which is the same for any filter.

Another good idea is to use the disposable inline filters. They can be put before the main filter to preserve the life of the more expensive filters.

Lack of power and fast fading performance.

As I said at the start, on a mechanically injected diesel, unless something goes bang, it's a fuel issue... or more precisely, LACK of fuel.

Fuel starvation problems that come on fairly quickly are generally and commonly associated with blocked fuel filters. This can be due to improper fuel preparation, residue from tanks and lines coming loose and even mistakenly putting a drum of unprocessed fuel in the tank which was still very dirty. Yes, I have done that myself and shamefully over the years, more than once. Make sure you keep the clean and dirty fuel well identified if not separate.

Other starvation problems can be due to collapsing filter elements and collapsing fuel hose cutting off flow.

Another one that has caught many people out is a blocked screen in the injector pump. A lot of pumps used to have a very fine mesh screen under the banjo bolt where the fuel entered. Over the years this screen can block from all sorts of things and cut off fuel supply. Many people don't even know they are there so can determine there is fuel being pushed to the pump but the engine runs like a dog.

Dodgy Diesel mechanics will say the pump is stuffed and needs a \$1000+++ rebuild when all it needs is the screen removed and thrown to hell. I have personally seen too many people with this problem and they are stumped because it's not something you can see. Not all pumps have these screens and to get to them you have to take off the fuel inlet fitting and then poke around carefully with a fine hook or pick

to get the screen out.

Once removed and fuel can flow again the engine runs perfect.

If you put in a new filter and the engine runs OK then quickly falls off again, change the filter again. If you have recently put on a new filter and can't find any problem, Change the filter. I have been caught several times with this looking for bigger problems only to find the filter was at fault. As a mechanic mate says every day, " Just because it's new does not mean it's good!"

Safety.

My pet hate.

Veg is harmless and cannot hurt you or your dog that will be happy to lick up any spills you make. If they eat too much they will throw up. Other than that, regular limited amounts will give them the shiniest soft coat you ever saw. Bit of oil is something I add to my dogs dinner about once a week as a way of keeping her looking good.

There is one real safety issue to be aware of with Veg though.

Spontaneous Combustion.

No matter how clean you think you will be with it, there will always be spills and oil to clean up. When you do be VERY careful with those old rags. I'm ashamed to say I have had 3 near misses with them now where they have caught alight by themselves. Lucky they went no further or I smelled the smoldering rag before any incidents occurred.

People have heard of this but until you experience it, it seems impossible to believe. Believe it.

All the problems I have had with this have been in summer when the rag is fairly oily but not saturated and dropped in a heap. If it's in the sun, it's a matter of when not if.

Keep oily rags in the shade, preferably opened out like washing or as the usual industrial advice, Put them in a metal tin with a lid where if they do smolder in the drum, they can't ignite anything else . Other good ideas are to throw them in a container of soapy water. I have never had a rag light off in winter but have no reservations it could happen in the right circumstances.

It's a real hard thing to remember because it's hard to see the danger and harder to remember the problem bit it is something to try ones best to remember and avoid.

You don't need to be a safety zealot, just opening the rag out over a mower handle bar will eliminate about 99.9% chance of it happening because the rag needs to generate heat like a compost pile. It can't do that in one or 2 layers. The hard part is to remember not to just leave the rags in a pile and walk away.

If you do remember to be conscious of them then you will automatically do something to prevent the problem from there. Here is a vid I did with one of my experiences of this.

<https://www.youtube.com/watch?v=S9MROuPyOH8>

