Make Your Own Biodiesel Processor

by **drinkmorecoffee** on April 21, 2008

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My name is Nathan!
Feel free to ask me any questions you may have about my instructables, or anything related to coffee, BioDiesel, or cooking.

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http://twitter.com/Nateinboone

Ask about skype!

-DMC

Intro: Make Your Own Biodiesel Processor

In a world where environmental awareness is becoming increasingly important for individuals, businesses, and mankind as a whole, it's always important to be looking for ways to re-use waste and cut carbon emissions. Biodiesel is a great way to do this. You're reusing waste oil and reducing your impact on the environment.

This Instructable will take you step-by-step through the process of making a BioDiesel processor. This type of Processor is called an appleseed processor. It uses an old (or new if you feel like dropping the money) water heater. The amount of fuel you can make will depend on the size tank you use. My first prototype uses a 10 gallon tank. Not too efficient if you plan on making large quantities, but great for figuring things out.

Before you do this project you should research the process and dangers involved in producing biodiesel at home.

Before you run out and buy $100+ worth of plumbing materials, I should say this: As biodiesel becomes more and more popular the resources available become more and more scarce, and people are starting to charge for things that used to be free, specifically Waste Vegetable Oil (WVO). I would suggest securing a source for WVO before you embark on this project.

There are many unspoken rules about gathering WVO from businesses, and I can talk about those in another instructable. For now just know that you CANNOT just take oil, for this you can get arrested and tried. You also need to be consistent (If you say you'll be there every Tuesday to pick up someone's oil and you show up on Wednesday half the time people will often give your oil to other people).

My instructable on how to use this processor can be found here.

Image Notes
1. 5 gallon Carboy
2. intake valve
3. Glycerin Drain

Image Notes
1. These don't run Diesel... Sad, sad, sad. Trying to convince my parents to upgrade to diesel vehicles, maybe someday....

4. Pressure vent- Very Important
5. 10 Gallon water heater
6. Outlet valve

Image Notes
1. Intake valve
2. outlet valve
3. Mess
4. drain

Step 1: Do some research

Do some research. You can't read too much about biodiesel. I spent about a year researching before I built this and started making fuel.
A book that is a must read is Biodiesel Basics and Beyond: A Comprehensive Guide to Production and Use for the Home and Farm Much of the information you find on the internet (including this instructable, no doubt) is incomplete information. This book will give you the ins and outs of every step you need to take.

Be familiar with how the process works before you build a processor. If you understand how it's supposed to operate when it's finished, you will make fewer mistakes when you're building it.

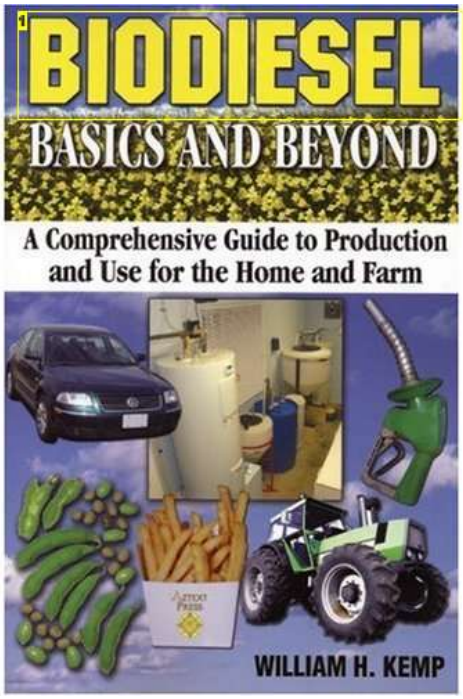

Image Notes
1. BIODIESEL

Step 2: Plan

Plan, plan, and plan some more. You can't get too detailed in your planning. Map out every part you'll need, list the functions of every part, and estimate costs. Nothing would suck more than getting half way through and realizing you're out of money and you've just blown $130 on half a processor. We made the trip to Lowes about 9 times before we had everything we needed.

Here's some pictures of our planning process, but only a fraction of it; we probably drew this diagram in a dozen ways a dozen times.
Tip: Black boards and white boards come in handy, like mine, when you;re trying to get a feel for what you need. Things erase easily and you get a larger diagram to concentrate on.

I will include some more detailed diagrams of what we did here soon.

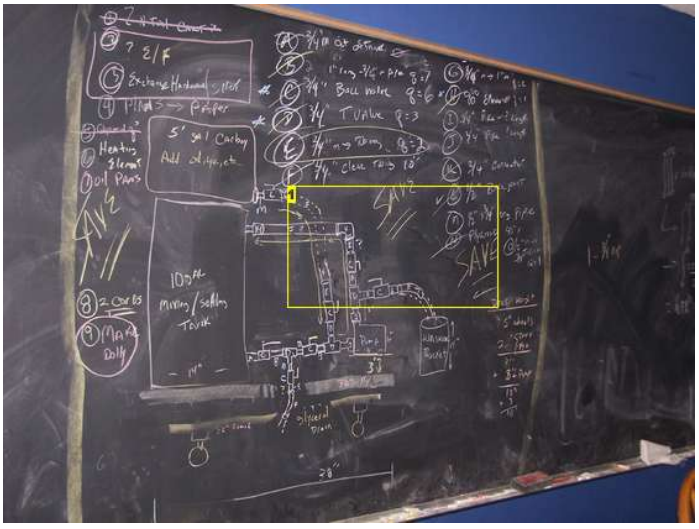

Image Notes
1. The coolest chalkboard-- 4x14 feet!

Step 3: Aquire the necessary parts

You will need a water heater, a pump, and all the plumbing in between. I used a 10 gallon water heater and a 1" water pump from Northern Tool.
Be sure that the water heater does not leak and has a working heat element. The element is very very important since you will be heating the oil up prior to making the fuel. You will also want to keep it warm when it settles, in addition to when you remove the glycerin.

You will need about ten feet of 3/4" clear PVC flexible hose. (+hose clamps)
The plumbing materials I used were:

-3 tee Joints 3/4" x 3/4" x 3/4"
-2 3/4" Unions (these are so you can disconnect your pump without disassembling the whole thing.)
-2 1"-3/4" reducer couplings
-1 3/4" 90 degree elbow
-7 3/4" Ball valves
-11 3/4" x 1.5" male connectors
-1 3/4" x 2" male connector
-2 1" x 1.5" male connector
-4 3/4" to 3/4" Male adapters (Barb to MPT)
-2 to 3 lengths of 3/4" pipe (this depends on the size of tank you're using. Lows, the one by me anyways, will cut and thread piping for free. Measure twice, so you only have to pay once.)
-You will also need tape to seal each fitting.

You're going to need some way to secure your processor. We used some adjustable straps and some connectors. Certainly you can secure it however you like, but this best suited us since we plan on replacing the tank very shortly.

One other thing you'll need to get acquainted with are carboys. You can some good ones here. You need one with a cap that has a 3/4" female threaded port. This will make your methoxide mixing tank, so you will want it to be air tight.

Lastly, you will need 2 power cords. Or just one if your water heater is already wired.

Step 4: Start Assembling

Start putting it together. No doubt you will have leaks the first time you run water through this, so don't tighten things so tight you won't be able to get them apart again.

Start with the bottom of the processor. First attach a ball valve and work your way to where you'll put the pump.

TAPE EVERY CONNECTION

The three places you use the Tee joints are essentially identical, so I recommend assembling these before you put them on the rest of what you have. From the tee-connector-> Ball valve->Barbed adapter

Then it goes--Ball valve-> Connector-> Tee joint (assembled)-> connector-> Ball valve-> Connector-> Tee joint (assembled)-> Connector-> Union-> Connector-> Reducer coupling-> 1" Connector-> Pump-> (now heading up)-> 1" Connector-> Reducer coupling-> Connector-> Union-> connector-> Tee Joint (assembled)-> Connector-> Ball Valve-> Pipe (length depends on how tall the processor is)-> 90 degree elbow-> Pipe back to processor (again, the length depends on how far it is to the processor)-> Malleable coupling-> and you're back!

Be sure to have the unions disconnected when you assemble the upper part, then connect them again to put the pump back on.

This is a good point to start thinking of what to mount it on, and where. Keep in mind you need a place to drain glycerin below the processor, so you'll need it raised some.

The last piece to assemble is the carboy lid. Drill a hole where you're supposed to and screw in the connector. Onto this, add a ball valve and the fourth hose adapter.

Be sure that your carboy has a vent behind the handle, and be sure this vent is drilled out.


HOT
COLD


COLD

Image Notes
1. Ventilation. VERY important.

Step 5: Wire it all

Go ahead and wire your pump. A wiring diagram should be included.

Wire the Water heater, the next step is testing the element.

Step 6: Pressure and leak test.

Now that you've got it assembled you need to do a pressure test. You can use an air compressor or you can run water through it, which is what we did.

Reasons for pressure testing:
-test for leaks
-gives you an idea of how to use the valves to get liquids where you want them
-to test the heating element
-to be sure everything is facing the right direction (the first time we hooked it all up the pump was facing the wrong way... oops)

Fill a carboy with water and connect a section of hose from the carboy to the intake valve. Use hose clamps to secure the hose. *Be sure to have primed the pump.* Now open the valve on the carboy and the intake valve. Turn on the pump and make sure the glycerin drain and out-take valve are both closed, so water doesn't come shooting out. Also be sure that all the valves in the circuit are opened so you don't have any pressure building up. **At this point it is very important to have the pressure vent on the tank open.**

Mark where you see any leaks with a sharpie.

Go ahead and turn on the heating element, it may take a while to heat up. Mine didn't, 7 gallons of water takes just a few minutes to get hot. You can open the out-take valve whenever you like to get a sample of the water. Be careful, though, we're talking hot water here. You can test it with a quick-read thermometer.

When you're finished, close the valve nearest the tank and let the pump run a few more minutes before you turn it off. There's still some water behind the pump, so open the glycerin drain to drain off the cup or two of water left.

Close the next valve over from the drain and open the first valve. *Have something to catch the water as it comes out.*
It's probably still hot, so be careful depending on how hot you got the water.

One more thing. After testing all this be sure to open up every connection and let it dry. You don't want a drop of water in there when you make your fuel.

Image Notes
1. Intake valve
2. outlet valve
3. Mess
4. drain

Step 7: Mount it

Now it's time to mount it. You may find it useful to disconnect the pump at the unions when you're moving it around. You can mount it however you want, and it doesn't have to be able to move, but you do want it raised some so you can drain stuff.

We mounted ours on an existing wooden box, just because we had it. We just took some plywood, screwed some 2x4's onto that, and attached some wheels to the 2x4's. Two of the wheels are locking,so it won't roll down my driveway, slide around, or generally escape us.

We screwed the pump into a board on top of the box and used adjustable straps to secure the tank.

In my next Instructable I will explain how to use this processor. In the mean time, build one!

Related Instructables

Make Biodiesel! by drinkmorecoffee

Mer-Chevy Project: Engine Pull Day (video) by bennelson

Easy BEGINNERS guide to making a "BIODIESEL" powered car by deth2all

Cheapest and best biodiesel (video) by mieszalniapasz

Mer-Chevy Project: Tranny & Flywheel removal (video) by bennelson

Waste Vegetable Oil Conversion for Diesel Bus by TimAnderson

Comments

50 comments **Add Comment** **view all 94 comments**

Matt D655 says: Jul 17, 2008. 8:09 AM **REPLY**
would biodiesel work in a gas engine by chance?

PhantomOfHeat says: Mar 15, 2011. 7:09 AM **REPLY**
It is possible but you should never try it. The only way it will work is if the car is to full temp and diesel is added it the tank but when it cools there is no chance of starting it till the tank and fuel lines have been drained and the fuel injectors are cleaned. (That all refers to dino-D but should be about the same.)

Do not try running any Diesel on a gas engine.

owenaero says: Sep 18, 2010. 5:48 AM **REPLY**
NO

MT-LB says: Jan 24, 2010. 8:29 AM **REPLY**
Before you try this, read about how diesel and gas engines work first. If you do want alternative fuel for your engine, try alcohol fuel or natural gas.

drinkmorecoffee says: Jul 17, 2008. 12:34 PM **REPLY**
No.

nolanpoe says: Jul 16, 2009. 2:28 PM **REPLY**
where do i get a water heater. is it assumed that i have an old one lying around. thanks, nolan

PhantomOfHeat says: Mar 15, 2011. 7:00 AM **REPLY**

As a reminder if using an old water heater I recomend filling and flushing the tanp several times to make sure that nothing that settled in the tank (hard water).

crashtestmonkey says: Mar 10, 2011. 9:25 AM **REPLY**

You can use an old immersion heater or hack one out of an old kettle.

BUT they are way too hot for this application it will boil and brun the oil. You will need to step down the voltage to reduce the output. A 2KW kettle element @220V can be stepped down with a 110V transformer to 1KW.

Bytesmiths says: Mar 10, 2011. 10:26 AM **REPLY**

BE CAREFUL about heating the oil! You need to keep the temperature below the boiling point of methanol (about 62C) or you will release a toxic cloud of methanol fumes!

crashtestmonkey says: Mar 10, 2011. 11:46 AM **REPLY**

Oops! Forgot that slightly important bit of information!

I used a submersible thermostat on mine set to 60C about 2/3 of the way up the tank and a good flow around the element from the pump to prevent any overheating.

And of course, a very well ventilated area to work in.

PhantomOfHeat says: Mar 15, 2011. 6:45 AM **REPLY**

A tip if using a white board is to use wet-erase markers and not dry-erase markers. The reason is you will not rub the marker off and when you do clear it with a damp cloth it does not leave a residue that cant be removed (try removing dry-erase markers after it has been on it for a few days.)

Laisseraller says: Mar 11, 2011. 6:05 PM **REPLY**

Great Article! I like the stop and think first approach, I have purchased the Old School Black Boards from closing schools I can cut them into any size needed and put wood frames or metal frames I even have some felt errasors.
www.johnsartsandcrafts.com visit or send for more info.

oilitright says: Mar 11, 2011. 1:38 PM **REPLY**

I hope anyone who considers either biodiesel or SVO does some serious investigation into the availability of feed stock. The days of readily procurable waste oil from restaurants and other sources has for the most part disappeared. When biodiesel and WVO was pretty much unknown to the general public there was a lot more waste oil to be found for free. Now days there are so many companies paying for waste oil it is hard to come by. Unless you have a known secured source think very hard before proceeding.

As far as the WVO vs biodiesel argument goes, this too needs a thorough examination and understanding of the factors involved. Most importantly what kind of vehicle are you going to use it in as fuel. Where you live in relationship to weather and temperature is a factor. If you have a relatively new diesel vehicle you can pretty much forget about WVO unless you exert great effort in making sure you are doing it correctly, new diesel fuel systems are not at all tolerant and are hugely expensive to repair. But if you have an older diesel you are in a much better position to try WVO.

Biodiesel will be ok in newer vehicles again the fuel systems are expensive and can be cranky so unless you are confident your biodiesel meets fuel standards you risk disaster.

I have 20+ years experience with alternative fuels, live totally off the grid, run vehicles on both biodiesel and WVO, heat my shop and make hot water with waste motor oil and heat my house with wood and also use PV and solar for heating.

hyoung says: Mar 10, 2011. 4:13 PM **REPLY**

love this post. this is what instructables is all about. makes me wish i had all my cars converted to such fuel. We know there are soo many places that waste their oil. it would be such a lucrative self employment indeed.
kudos to the posting.

marcintosh says: Mar 10, 2011. 2:29 PM **REPLY**

This is spot on thanks. I however have decided not to go this route. I'm headed to SVO land. In this place I'm not concerned about glycerine disposal, methanol and it's attendant issues (use storage recovery aquisition etc). I'm not concerned with burning anything down or blowing it up. My concerns are with filtration and moving it to and fro and storage.
Do not let me rain on your parade though. I'm certain that at one point or another I will become brave enough to move from SVO to BioD.
Thanks again

Bytesmiths says: Mar 10, 2011. 10:49 AM **REPLY**

I've had very bad luck using the Harbor Freight "clear water pump" pictured here. I went through two of them before switching.

Problem is it is only rated for room temperature fluids.

I prefer a Taco or Grundfuss pump that is designed for hydronic heating systems. They cost about twice as much (~$80 vs ~$40), but they are designed for circulating hot liquids.

An added advantage is that these pumps are "flange mount," which means it is very simple to change them out -- although they don't ever need it! In contrast, the "theaded in" Harbor Freight pump causes you to disassemble almost everything to swap it out -- which was twice, in my case.

Esmagamus says: Jul 24, 2008. 4:56 PM **REPLY**

I suggest you put a low-pressure methanol recovery system there. I wouldn't want any unreacted methanol filling my garage or diesel tank with fumes. I can get you a schematic of a processor with methanol recovery, if you want to. Keep it green, keep it safe.

Bytesmiths says: Mar 10, 2011. 10:37 AM **REPLY**

Since it is the biggest cost component of biodiesel, methanol recovery can be useful, but also consider that it makes your biodiesel "better" than commercial biodiesel.

In the winter, I purposely leave the methanol in the biodiesel and don't wash it. This allows me to run B100 down to about -7C, whereas commercial biodiesel is a solid brick at that temperature. You generally cannot use commercial biodiesel below about 3-5 degrees C, but just a bit of residual methanol lowers the cloud point significantly.

That said, in the summer, I do recover methanol. The beauty of an Appleseed design is that it can be pressurized with a vacuum pump. I then use an aluminum radiator with a fan for a heat exchanger to distill the methanol out.

But consider also the energy cost and time of doing this. I recover about 2 litres of methanol from a 120 litre batch. So that's a savings of $8 or so for hours of extra work.

drinkmorecoffee says: Jul 24, 2008. 5:15 PM **REPLY**

Yep, methanol recovery is next on the list. Thanks for the input! -DMC

StevenArroyo says: Jul 24, 2008. 6:29 PM **REPLY**

yo man whats up!!! i like how you made your bio-diesel processor here is a picture of my processor i make with my dad. i can make 20 gallons at a time!!!! i also have alot of good web-site's to help you with any problems you have i'll give you a web-site biodieselpictures.com they have alot of cool pic's all about bio-diesel

Bytesmiths says: Mar 10, 2011. 10:30 AM **REPLY**

Be very careful with a poly processor. I have a friend in Molalla, Oregon, who burnt down his barn (and $20,000 worth of solar panels) when the processor heater melted the poly tank, which then ran out, causing the heating element to explode and ignite the biodiesel, which then ignited the methanol stored on site.

Thinks can get out of hand VERY QUICKLY! I strongly suggest avoiding the combination of plastic tanks and electric heating elements. You can use a poly tank processor ONLY if you use hydronic heating that well NEVER get hot enough to melt the tank!

sarahfish says: Sep 10, 2009. 12:09 PM **REPLY**

Do you have a parts list for this?

jpaulstra says: Aug 31, 2009. 10:31 AM **REPLY**

Steven, I like your system. Is it possible to obtain a step by step schematic of your entire processor? Thanks, Jim jpaulstra@hotmail.com

dutchypoodle says: Sep 5, 2008. 8:26 PM **REPLY**

I had an inkling that might be a problem. Think you could share the love my way, Esmagamus?

danfolkes says: Mar 10, 2011. 9:52 AM **REPLY**

I had a REALLY good idea! :-D

tysherman says: Sep 21, 2010. 1:27 PM **REPLY**

I love the set-up, it looks somewhat mobile, which is what I'm trying to go for. The only question I have so far is, do you wash your biodiesel after it is finished in this particular processor? If so, may I ask what technique you've found is best for this task? Thanks!

Biodiesel says: Jun 6, 2008. 7:23 PM **REPLY**

Two other often-cited sources to stay away from are Josh Tickell's From The Fryer To The Fuel Tank (even worse than Kemp) and Journeytoforever.org

JeremyA says: Jan 16, 2010. 12:36 PM **REPLY**

What is wrong with journeytoforever? I have been using thier methods for years without any problems?

proetus says: Feb 17, 2009. 3:20 AM **REPLY**

hey dmc lemme be frank im bit new to this field of biodiesel...but read thro ur instructable ....wus actually curious 2 know in what way does this your bdp top the previously made ones.

CAMACHO815 says: Jan 22, 2009. 8:23 PM **REPLY**

NICE SETUP. CAN YOU ALSO WASH AND DRY IN THAT PROCESSOR?

drinkmorecoffee says: Jan 23, 2009. 6:17 AM **REPLY**

I suppose you could, if you were careful. I don't, however.

Derin says: Aug 17, 2008. 2:14 PM **REPLY**

mazot var m? ki biomazot yap?can?

Metalron says: Jul 25, 2008. 5:47 AM **REPLY**

men!what is the procedure in make the biodiesel you got there?

drinkmorecoffee says: Jul 25, 2008. 6:40 AM **REPLY**

http://www.instructables.com/id/Make-Biodiesel/

kelleyboys4 says: Jun 19, 2008. 1:53 PM **REPLY**

Congratulations and way to go DMC!!!!

Biodiesel says: Jun 6, 2008. 7:21 PM **REPLY**

For the love of God, do not buy Kemp's book, it's an overpriced underedited rant full of misinformation. Just as one example, his 'proper disposal' method is to pour glycerine on the roads- which most jurisdictions won't allow anyway, and he bases his chemistry recommendations on one set of lab tests done one time, which turned out a protocol that doesn't work most of the time to produce quality conversion fuel. His science is wrong in a lot of ways, he's just ripping off other people's work, he shows no evidence of having any real experience in making biodiesel, and he spends most of his time bashing the homebrew biodiesel community and setting up 'straw men' arguments for bad things he claims everyone else does. Here's the agreed-on-by-the-homebrewers set of good resources: www.biodieselcommunity.org (peer-reviewed site!) www.b100supply.com (has an excellent book on the subject and an even better 'library' of free information) www.biodiesel.infopop.cc (best forum on the subject, most info there is really good) www.graham-laming.com www.localb100.com/book.html

drinkmorecoffee says: Jun 7, 2008. 3:43 AM **REPLY**

Wow, I was not aware of the misinformation in Kemp's' book. All I've heard up to this point have been positive things about it. I'll keep this in mind. I have used some of those resources, most of them actually, very handy stuff. And I've also heard mixed things about Journeytoforever. Care to explain why to steer clear?

forgesmith says: Jun 7, 2008. 8:57 PM **REPLY**

Umm, dude, "Biodiesel" just signed up, the bio lists gender as robot, and the three comments here are all that they've made period. I've just done a lot of reading about Kemp and the book, seems he's irritated a lot of homebrewers, especially by criticizing about safety and waste disposal, with special mention to glycerine disposal which, curious enough, "Biodiesel" goes right to in the second sentence.

I think someone found this on a search and joined up only to bash Kemp, maybe one of the scores of disgruntled homebrewers offended from being told they are unsafe, wrong, and just not doing it as it should be. Well that and to mention resources recommended by "Real Homebrewers." You may be waiting a while for that reply.

Hey, I've been searching and everything I've found so far says the book is technically great and very informative, excellent reviews. You know you like it and it's worked for you. So...

Oh, hey, found this YouTube link in the search, Bill Kemp himself and the book, 1 min 23 sec. I'm on dial-up and that's like a half-hour of download time, so let me know if it's any good, alright?

drinkmorecoffee says: Jun 8, 2008. 3:17 AM **REPLY**

Well, actually, I think he came in on the link I posted on the biodieselcommunity forums. The timing was within a few hours. Anyways, I see what you're saying. I'm definitely not throwing out all the helpful info I've got from the book, I'm just planning on keeping my eyes open. (Like I said in my reply to him, everything else I've heard has been positive.) And yes, I do realize Kemp made a lot of people mad. On another note, thanks for watching my back, so to speak. -DMC The video, btw, is of Kemp talking about the importance of washing fuel. He had some handy jars of biodiesel from different stages in the washing process.

forgesmith says: Jun 8, 2008. 8:56 PM **REPLY**

Ah, so now you have some video to link to for your third part, excellent!

drinkmorecoffee says: Jun 9, 2008. 4:11 AM **REPLY**

Eh? No. It doesn't show HOW to wash the fuel...

forgesmith says: Jun 9, 2008. 10:17 PM **REPLY**

Well, didn't think it would being that short, but it does show what it'll look like at different stages. You'd have to whip up a slideshow to get the equivalent.

drinkmorecoffee says: Jun 12, 2008. 2:58 PM **REPLY**

I use a different wash method, actually. I have pictures of most of the steps, too.

Biodiesel says: Jun 6, 2008. 7:27 PM **REPLY**

One more good source:
State of Pennsylvania biodiesel production best practices manual (currently being revised):
http://www.wilson.edu/wilson/asp/content.asp?id=2735

ygree001 says: Jun 6, 2008. 8:24 AM **REPLY**

Thanks. I had been looking for a plan with a little more detail than the "appleseed" plans on biodieselcommunity. The one thing I can't figure out is what is the outlet valve for. Can't you just drain the biodiesel out of the glycerin drain?

drinkmorecoffee says: Jun 6, 2008. 10:00 AM **REPLY**

You can if you like. It's probably easier that way. The outlet valve is just useful, but not completely necessary. I use it to get quick samples to see how hot the oil is and things like that. Glad this i'Ble helped! -DMC

ygree001 says: Jun 6, 2008. 10:29 AM **REPLY**

Thanks for the clarification. I'm planning on starting pretty soon.

forgesmith says: May 31, 2008. 9:45 AM **REPLY**

You know, one would probably be better off using BD to heat your home. Generally home oil furnaces use #2 heating oil, which is basically diesel. It tends to "gel" when very cold, thus if you have an outside oil tank and low outside temps you'll probably use #1, aka kerosene, or "half-and-half" mix. Oil burners don't care which it is. Kerosene also is a solvent, and the burner can handle it. But for a vehicle, well, diesel (presumably) has additives for better burning and to keep it from gelling. To use BD in a vehicle you may need to upgrade hoses and rubbery components like O-rings as BD will deteriorate all but certain materials like Vitron for example due to BD acting somewhat as a solvent. Plus there might also be ignition timing adjustments (if possible) needed for peak running. Your oil furnace is much less fussy, and will tolerate fuel that 's not quite "refined" enough for a vehicle engine. So if you have an oil furnace you could feed it less-than-perfect BD, feed your vehicle quality diesel, and be saving time, money, and effort over doing otherwise.

MasterOfNone says: May 29, 2008. 5:27 PM **REPLY**

I am preparing to make a research/pilot scale reactor system for biodiesel at a local university. i am a Ph.D. chemist. I have read Kemp's book (cited in step 1) and agree with the recommendation. The book is pretty carefully written in lay terms. Kemp emphasizes the importance of "doing it right." There is no environmental benefit if you dispose of your hazardous materials improperly. Also, you need to take care to make good quality product, or you run the risk of damaging your vehicle's engine, negating any cost savings from "brewing your own." So, learn your stuff and do it right.

userhck says: May 17, 2008. 12:59 PM **REPLY**

Just purchased a '82 mercedes today to do this project. I can't wait to get started!

view all 94 comments