Homebrew Hydrogen Generator

Visit http://www.h2gen.info for additional information
Visit http://www.hydrogenworld.info for information on how to save 20-30% off of your energy and fuel costs 1. Requirements
2. Safety issues
3. The theory of operation
4. Making the device
5. Inplementing the device
6. Testing stages

Watch the "mad backyard scientist" videos:
video 1
Video covers basics of mixing up a batch of sodium hydroxide, water and cans total time 4:41
video 2
Watching the reaction and filling up hydrogen balloons total time 4:32
video 3
Balloon won't float, must have steam or water in it? total time 14 sec
video 4
Watching steam and H2 coming out of the hose total time 31 sec
video 5
Filling a ballooon in less than a minute total time 55 sec
video 6
Hot fingers total time 13 seconds
video 7
More fast filling balloons total time 1:41
video 8
More hot fingers trying to fill up balloons total time 28 seconds
video 9
More fast filling and hot balloons total time 2:18
video 10
Video blowing up ballooons on the kitchen stove total time 10 seconds
video 11
Video blowing up balloons on the kitchen stove total time 9 seconds

Here is a short video of the bubbler in action

Videos of hydrogen generator on car with scantool taking readings.

Video 1
Scantool reading engine sensors running on gasoline only total time 3:34
Video 2
Mixing up a batch in chamber, adding cans and getting reaction on car going total time 2:52

Video 3
Road test with hydrogen added, scantool readings live on engine total time 4:46
Video 4
After the drive, looking at pulsewidth shift on longterm adaptive memory total time 1:24

My conclusion about driving with a scantool is that it shows a lot of pulsewidth change as road conditions change
if you are going uphill of accelerating it takes more pulsewidth. At this piont I would call it inconclusive. I would also like to do an emissions test to check tailpipe emissions before and after. I've heard H2 cleans up your emissions conciderably.
This is important concidering the amount of hydrocarbons that are dumped into the air we breath on a daily basis.

Visit my offsite photo gallery
Due to an overwhelming response: Use the contact form if you want to contact me.
I also invite you to join my Hydrogen Project on my msn group, there are more pictures there.
I also invite you to my www.h2gen.info website to stay up to date on new developments and to post your comments.

1. Requirements:

Read entire article before starting anything.

Anything printed in red is indicating hazards or danger, pay special attention to this, if you are color blind, have someone who isn't read this for you and explain it to you.
BE VERY CAREFUL IF YOU ATTEMPT THIS, DANGEROUS CHEMICALS AND GASSES
***I don't recommend putting anything on your car unless you have perfected it, this process is**
purely experimental and there's a lot more work that's needs done to reach perfection.

2. Safety Issues

Sodium Hydroxide is the active chemical that works with aluminum to release hydrogen from the water,
READ ALL THE INFORMATION BELOW BEFORE PROCEEDING
Hydrogen gas will be created with this process, hydrogen gas is explosive and will burn (thats how an engine uses it)
If you plan on doing this to a vehicle, do it outside as excess hydrogen could be generated

AND COULD CREATE AN EXPLOSION HAZARD IF DONE INDOORS
Do not attempt to do this unless you understand all the risks you are taking.
I do not accept responsibilty for any loss of life, limb, injury or property because of the use of information
printed in this ebook, you are on your own as this procedure is concidered experimental. Hydrogen burns
with a colorless odorless flame, it can displace oxygen and cause suffocation.
Sodium Hydroxide (LYE) is highly corrosive and will cause chemical burns if you get it on your skin,
it can cause blindness if you get it in your eyes
READ MSDS SHEETS FOR BOTH HYDROGEN AND SODIUM HYDROXIDE

wear safty goggles to protect your eyes

3. Theory of operation

Present Invention

The present invention relates to production of hydrogen gas by reacting aluminum with water in the presence of sodium hydroxide as a catalyst. The process is carried out at room temperature and
produces lot of heat and hydrogen gas of high purity. The invention also relates to using a simple hydrogen generator which uses water and aluminum particles as fuel, and sodium hydroxide (NaOH) as a catalyst. The aluminum used in the reaction comprises aluminum foil, electrical wire, beverage cans and other similar aluminum waste.

The catalyst is mixed with tap water in a proportion of about 225 g. per liter of water. The sodium hydroxide content of the catalytic solution is preferably about 18% by weight. The catalyst is not chemically consumed in the process.

A series of experiments were carried out to measure the volume of hydrogen gas produced in the reaction at room temperature of 21 degree C and an atmospheric pressure of 758 mm Hg. It was noticed that a typical reaction with less than 5 grams of loosely crumpled aluminum foil, is complete in less than 5 minutes. The results of these experiments are shown in Table.

Exp.(#)	Al (g.)	H_2(l)	H_2(l)(STP)	H_2(l) Theo- retical	Yield (%)	Deviation (+/- %)

1	2.08	2.94	2.71	2.59	104	2.6
2	2.03	2.85	2.62	2.53	104	2.6
3	2.21	3.05	2.81	2.75	102	2.5
4	2.16	2.9	2.67	2.69	99	2.6
5	2.2	3.04	2.8	2.74	102	2.5
6	2.21	3.04	2.8	2.76	102	2.5
7	0.73	1.03	0.94	0.91	103	2.4
8	0.83	1.15	1.05	1.03	102	2.2
Ave.			102	2.47		

The reaction yields a net maximum heat production during hydrogen generation of 195.6 kCal/mole. A further 204.9 kCal/mole will be released if the hydrogen is burned with oxygen. 51% of the reaction energy is used to form hydrogen gas and 49% goes into the production of heat.

Watch video of hydrogen generation demo using lye and aluminim foil*
*requires Apple Quicktime

Mixture of water (H20) and Sodium Hydroxide are added to reaction tank then aluminum is added to start releasing hydrogen and heat. Since top of reaction tank is closed, hydrogen gas travels through outlet line into the water lock, water lock is added as a safety feature to lower the possibilty of an explosion should an engine backfire occur. It also filters the hydrogen gas to help remove sodium hydroxide vapors. Most cars and trucks have aluminum engine components and since we know it will dissolve aluminum this would not be good to get inside of engine parts. Then the hydrogen gas enters the inlet side of the airfilter housing where it will be drawn in and burned by the combustion process.

4. Making the Device

Lets go shopping, make a list of the things you will need
Tools:
1. Saw that will cut large diameter PVC pipe, for my project I used a hacksaw and rotated pipe while cutting.
2. Pocket knife to cut tubing
3. Drill and bits to drill hole/s in canister and/or air cleaner housing for gas outlets/inlets

Resource for 3/8" ID vacuum check valves US Plastics
Resource for Sodium Hydroxide through Ebay search
Another good source is your local grocery store, buy Red Devil brand Lye (has a better mix than draino)

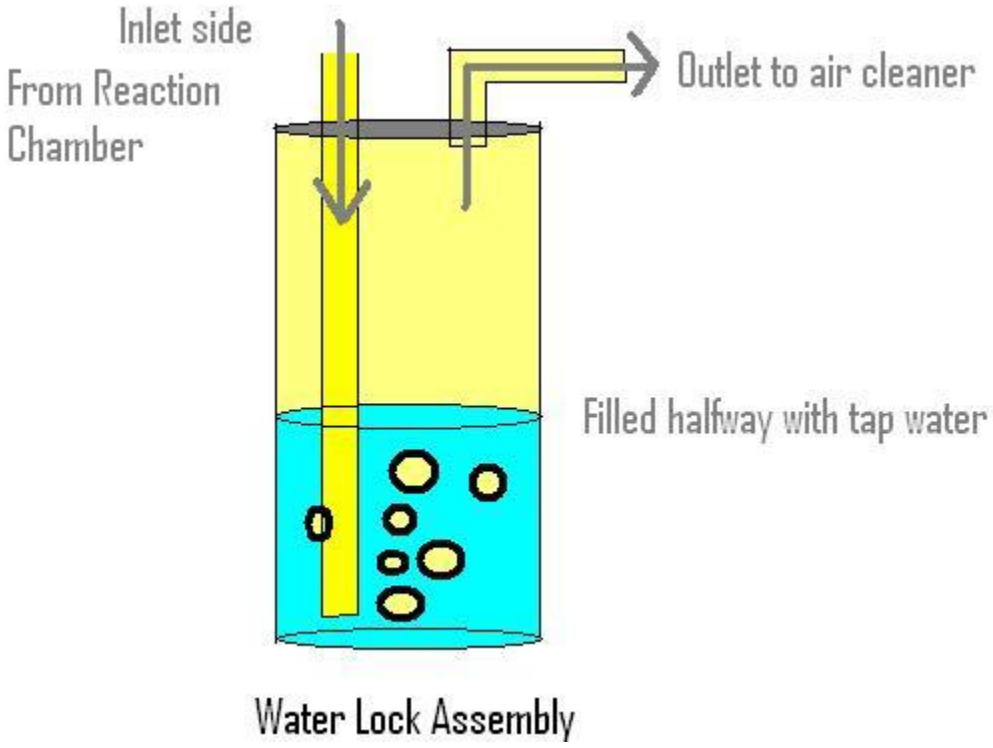
Materials (this is what I used, feel free to make improvements)
1. I word of caution, this got very hot when testing, use high temp hoses, I used 3/8" fuel line hose after my first prototype as the clear tubing melted. Make sure whatever you

choose that it is tolerant to high temperatures.
2. 18 to 24 inches of 4" diameter PVC* sewer pipe, you will cut this to length (longer is better)
*ask your plumber what pipe he recommends for high temperatures
3. 1 solid end cap to close off bottom of canister
4. 1 end cap with threaded cleanout, this is the end where you will add your reactive mixture into
5. PVC prep solvent and glue, make sure you using the proper adhesive for your PVC or you might have leaks
6. Zip ties to hold your device in place, this must be done to prevent contact with hot or moving parts.
DO NOT MOUNT REACTION CHAMBER WITHIN 12 INCHES OF EXHAUST MANIFOLD/SYSTEM, TOO MUCH HEAT!!!
Silicone RTV to seal around fiuttings (use automotive type)
Vaseline or grease to seal threads on end cap
Several miscellanious 3/8" nipple fittings (90 degree and straight)
My list of parts set me back about $30.00, your cost may be more of less depending on your location

DO NOT MOUNT REACTION CHAMBER INSIDE PASSENGER COMPARTMENT::: EXPLOSION HAZARD
Cut your PVC pipe to the maximum length that your choice in location will allow, test fitting will be neccessary during this part once the proper length is determined then you can use the PVC prep solvent and glue (follow your products directions) to attach first the bottom end cap on, then repeat for the top cap. I test assembled everything first before gluing just to make sure it would fit my location ok. Closed hood, checked all clearances, then did a final assembly. Let glue cure for amount of time on adhesive can directions. After glue is cured then drill hole in side and top of reaction canster, just below bottom of cap but make sure you leave enough space to allow retaining nut to be installed. Seal with RTV sealant between hole and fitting, install nut and tighten. This connection needs to be gas tight, after RTV sealant is cured you can use a hand type bicycle pump to add a small amount of pressure through the nipple fitting and check for leaks with soapy water. You don't want any leaks in your canister.

Next step is to build a water lock tank, you can make this out of a meduim sized bottle and will be located away from hot or moving parts.
The inlet line goes to the bottom of the water lock and the outlet goes to air filter housing

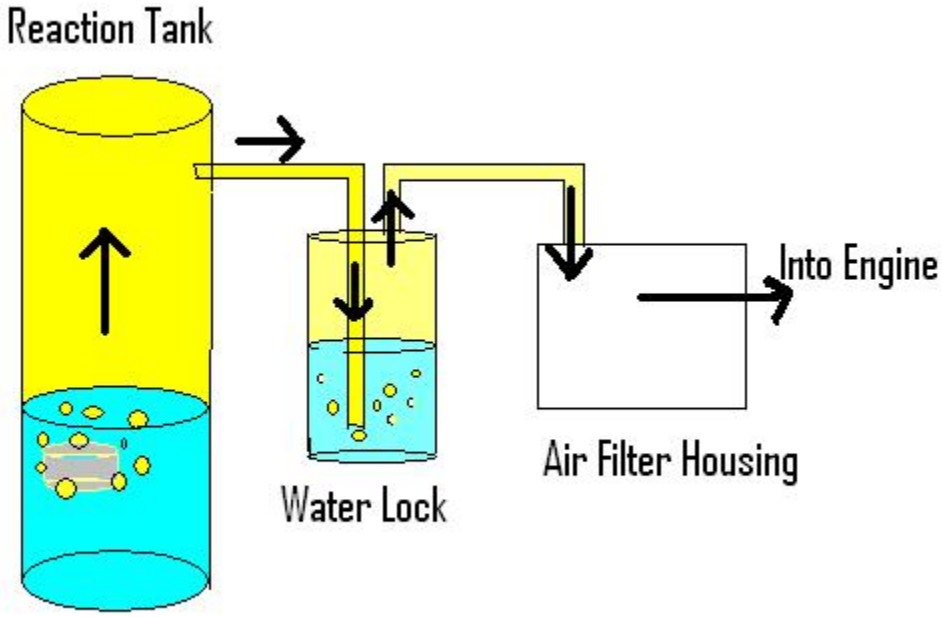
with tubing ran between them.



5. Implementing the device

Now we're excited, we got our project built and ready to make it work on our car.*
The reaction chamber is tied into a safe location, not against any moving or hot parts.
The waterlock assembly is filled halfway with water and has been checked for gas leaks with soapy water.
Tubing has been run between reation chamber to the water lock, from the water lock to the air cleaner housing.
Now it time to take your car outside if it isn't already.
Put your safety goggles and rubber gloves on at this point.
Fill the reaction chamber with 1 to 2 quarts of water (depending on how big you built it, never fill more than halfway)
For my tests I used 10 tablespoonfuls (heaping) of drano to 1 quart of water. This mixture dissolved a pop can in less
than an hour, and clean aluminum would dissolve even quicker. Most cans have paint or coatings that turn into gunk
that floats around and slows down the process. Unpainted aluminum is best.
Once I mixed the draino with the water, I let it settle down after the initial mixup, 5 to 10 minutes.
Then whatever aluminum you have can be added, be careful to not splash, I mounted my reaction chamber at a slight slant
so when adding aluminum it would just slide in and not splash.
After adding aluminum you will start to see it bubble and hiss, this is the hydrogen being

generated.
Screw the end cap into the chamber (the threads should be coated with petroleum jelly to seal)
Hydrogen should start to push out of the reaction chamber and into the water lock, from the water lock into the air cleaner.
You should be ready to go for your drive at this point.



6. Testing Stages and issues

All experiments have their growing pains and some things will work better than others.
You will find what mixtures work well, how many cans / grams of aluminum per 100 miles travel.
I noticed about a cup of water was consumed with one pop can dissolved.
You will have to add water and aluminum to continue reaction, but no additional sodium hydroxide is needed.
I havn't came up with an effective way to regulate adding water automatically, but where there's a will, there's a way.
Same thought for adding additional aluminum to continue reactive process.
Another problem is the the reactive process will continue when you turn your car off until all the aluminum or water is used up.
This is the main reason this process is done outdoors so extra hydrogen is ventilated away into atmosphere.

Visit my website for more information and tell us about your results

One of the improvements I added recently was to connect the outlet hose to the top of the reaction chamber to prevent some of the solution from exiting the reaction chamber and into the bubbler. This helped conciderably, then I connected my check valve to the lower connection on the reaction tank, it's a one way valve that only lets air in and not out. I routed the hose for the check valve to a higher location than the tank to prevent solution from running into the valve.

I have also fabricated a rope and board solution to holding the chamber in place while I drive down the road, This makes it easy to remove the chamber and swings out of the way when you don't need it. I had a problem with the chamber wanting to fall out the bottom of the engine compartment, it wouldn't be good if you ran over it on the highway. (or someone else did)

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Photos - Click on Image for full size picture


This is where I started from, figuring out a location of where to put my reaction chamber.


This has plenty of room here between the radiator and the engine.


This is a test fit in the engine compartment


Measuring where to cut for best fit and room for the hood to close


Cutting the pipe for my project


This is an installed test fit, again checking for hood clearance


Another view of the location I have chose for my reaction chamber.


This is the unit assembled on the floor


This is the unit on it's side looking into the end of it


Another side view of reaction chamber, this picture is a little clearer than the last


Me and my goggles, protect your eyes as this is a harsh chemical that would be very bad to get in your eyes

I would recommend safety goggles/and or a face sheild to prevent eye damage

This is a bucket I did my preliminary experiments with

I did my first experiments with Draino, switched to Red Devil brand lye, less stink.

This is a tablespoonful of Draino, I used 10 per qt. of water in my experiments.

This is the Draino mixed with water, it was bubbling a little at this point, Draino is mixed with little fragments of aluminum and Red Devil Lye is not.

This is shortly after I had added a can to the solution, wanted to see what would happen.

Can started to give off gasses and started bubbling pretty fast

I started the clock to see how long this takes

You can visably see the vapors/gasses rising from the can at this point

You can still see a lot of vapors and gasses rising off of can

Fifteeen minutes later

This is at about 30 munites, reaction is slowing down

This is 55 minutes later and reaction has pretty much used up the aluminum

This is all that is left after an hour and if I jad left it in there, it too would eventually be dissolved

This is what is left of a quart of water, it was about 1 cup less than when I started

This is the aluminum oxide remaining in the bottom of the bucket, this is the oxygen from the water bound to the aluminum

This my engine compartment with a fully assembled and working prototype

This is an 8oz bar of aluminum, this is about 6 inches tall x 1 1/2 inches wide x 1/2 inch thick

Another view of an 8oz bar of aluminum

This is how I supported my reaction chamber, it is suspended from a rope tied around it and through a board laid from the engine to the radiator.