

CHARCOAL
How to make it by Gary Gilmore
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For thousands of years man has used charcoal for refining metals and cooking. The largest users of charcoal in Pennsylvania were the early blast furnaces that smelted pig iron from the abundant ore deposits scattered around the State. The charcoal was typically made in the forest using about twenty cords of wood for each “burn”. Men were employed year round cutting, stacking and “coaling” this resource into charcoal. Times changed, other fuels such as coal and electricity were discovered to be cheaper or better and charcoal fell out of usage.

It was Henry Ford who brought charcoal back to life as a form of fuel for barbeque grills. His sawmill in Kingsford Michigan provided wooden parts for the early Ford cars. To make use of the waste wood generated by the sawmill, a chemical plant was constructed and in operation by 1924. The chemical plant reclaimed, from every ton of scrap wood, a variety of saleable byproducts. The 610 pounds of charcoal reclaimed per ton was manufactured into briquettes and sold as Ford Charcoal. The charcoal briquettes are made from compressed charcoal dust held together with a binder of sodium nitrate, lime and clay. Mr. Ford supplied a small portable grill with some of the cars he made along with a bag of charcoal. The adventure of driving a car in to the country and having a picnic took hold and created a demand for charcoal briquettes. The charcoal grille gained popularity but the fuel has changed to natural gas or propane.

There are some folks out there that may have a desire to cook over a charcoal grille using real charcoal. There may even be some of you who want to make their own fuel for forging steel or melting metal. This article is for you.

The chemistry of making charcoal

Charcoal can be made from any thing containing carbon. The traditional material has been wood so that is what I will write about. Wood is a wonderful substance made

up of cellulose stuck together with lignin. These compounds are composed almost entirely from atoms of hydrogen, oxygen and carbon. A tree (or any green plant) takes carbon dioxide and water as the raw materials to make cellulose. These extremely stable compounds are broken down within the tree by a process called photosynthesis. New chemical bonds are made and the end result is cellulose. The tree lays down layers of this cellulose during the spring and summer of every year it is alive that causes it to increase in height and circumference.

To make charcoal, we have to remove the hydrogen and oxygen in the wood while leaving just the carbon. This is done by simply heating the wood to at least 500 degrees F. where the chemical bonds start to break apart.

What wood to use?

Charcoal is carbon, whether it is made from pine or hickory. The difference between charcoal made from these two woods is density. A bushel of hickory charcoal weighs 25 pounds while a bushel of pine charcoal weighs 13 pounds. If we take the same **WEIGHT** of charcoal made from pine and hickory, we would find they both produce the same amount of heat. Many people prefer hickory or apple wood for outdoor cooking because of the flavor it imparts to food. Charcoal made from these woods have no special flavor because the volatiles in the wood are driven off in the process of making charcoal and what remains is carbon. If you want to impart some smoke flavor to your steak, add slivers of hickory or apple wood to the hot coals while the steak is cooking.

The Process

This is a good time to state **RULE #1** of charcoal making. Do not waste your time charring unseasoned wood!!!! Wood will not char until it reaches 500 degrees F. Water

does not evaporate until it reaches 212 degrees F. If you use green wood, a lot of energy will be used

Wood moisture content %	12	15	20	40	60	80	100
Yield as a percentage	(a)100	93	76	59	44	38	35

up boiling off the water and will not be available for charcoal. This chart shows how much your charcoal yield will decrease as the moisture content of the wood increases. Make up your mind before you start, “Do you want to make charcoal or evaporate water?” Cut your wood, stack it, throw some sort of cover over it and let the summer sun season your char wood. For those of you who want a number, a moisture content of 20% or lower is good.

Here is my list of hard and fast RULES. They are a bare minimum so add more if you want, but it is your best interests to follow these basics.

Rules for making charcoal:

1. Don't waste your time using green/wet wood. This is extremely important if you want a high yield of charcoal and to stay on the good side of your neighbors. **GREEN WOOD MAKES LOTS OF SMOKE AND VERY LITTLE CHARCOAL!**
2. Don't aggravate your neighbors by smoking them out. Use the afterburner or go somewhere where no one will mind the smoke.
3. Don't use treated or painted wood for charcoal if you are going to cook with it. These nasty chemicals will remain in the charcoal and **WILL** poison you.
4. Don't put freshly made charcoal in a container that will burn or in a building that could burn. Wait at least 24 hours after removing the charcoal from the retort to make sure the fire is out.
5. Don't do this inside!!!! For Pete's sake, I shouldn't have to mention this but common sense isn't as common as it used to be. This process produces a lot of heat and carbon monoxide. You may get flame heights up to 15 feet and the retort can get red hot. **DO THIS OUTSIDE, AT LEAST 20 FEET FROM A BUILDING.** This brings me to **RULE #6:**
6. If you don't have enough common sense to be careful with fire and you want to blame me for your mistakes, **DON'T MAKE CHARCOAL.** Go play a game of golf or watch TV.

There are two methods to turn wood into charcoal known as the direct and indirect process. The **indirect** method involves baking the wood in some air tight vessel. This produces the highest yields of charcoal but requires a more elaborate set up. The **direct** method burns the wood in some container where the amount of oxygen is

controlled. This is the easiest way and one which I will share. There are many ways to make charcoal and they all work. In my research and applied techniques, this is the easiest method I've come up with for making a fair sized batch of "backyard charcoal".

The Retort

You need a container to hold the wood while it chars. You can use a one gallon pail or a 1000 gallon tank. The principles are the same, just the size differs. For my example, I'll use a 55 gallon drum. Get two of them. One will be used as the retort (bottom) and the other will act as the after burner (top). The retort needs to have a bottom and a lid. A lid is necessary to seal oxygen out of the charcoal when it is done cooking. If you cannot find a drum with a lid, cut a 20 inch diameter hole in one end of the drum. Get a piece of sheet metal 22 inches in diameter to cover this hole. You can make a good seal by sealing the gaps with dirt.

Use a cold chisel to cut 12 slots around the base of the drum. Each slot should be about two inches wide and form a flap that faces outwards. You will be regulating the rate of burning by blocking the slots with dirt. The reason for making the slots with an outward sloping flap is to keep the amount of dirt entering the retort to a minimum. That is all there is to making the retort. The following picture shows the slots in the bottom of the retort.



The After burner

Use the second barrel as the after burner. This barrel has both the top and bottom cut out. In other words, it is just a cylinder. Make the same type of slots around the perimeter in this barrel as you did in the retort. These slots will allow oxygen in to burn off the smoke.

Lets make charcoal

Fill the retort with well seasoned wood. It can be hard or soft wood. Try to make the pieces no more than three inches thick. If they are too thick, it will take too long for the heat of the fire to penetrate. They can be as long as the retort is deep, but keep them small in diameter. Try to pack the wood as tightly as possible. Shake the barrel and get as much wood in there as you can.

Retort packed full of wood and ready to light.

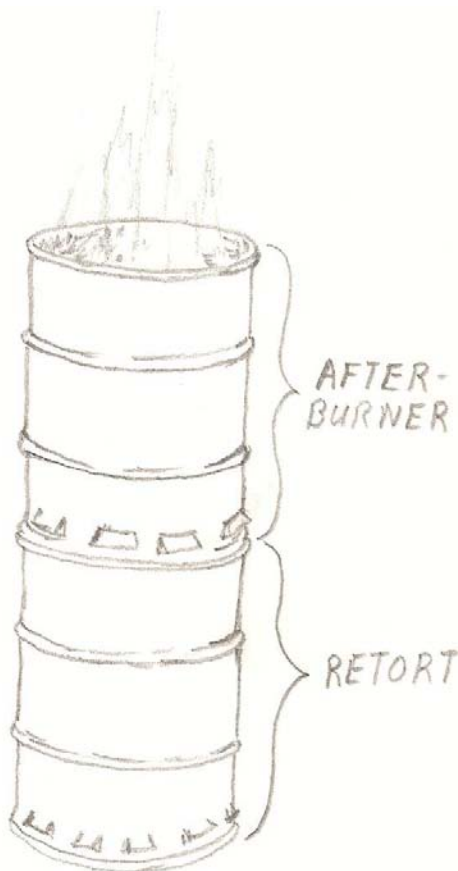


Put a small pile of kindling on top of this wood and set it on fire. After a few minutes, it will be burning well.



At this point, you should place the after burner barrel on top. Place the air inlet holes of the after burner next to the top of bottom barrel. As the smoke rises from the retort, it will pull oxygen in these slots and allow the smoke to “flare off” or burn. The amount of smoke will be small provided you are using dry wood

As the fire burns down through the wood, it will use the oxygen that comes in the barrel from the air vents at the bottom. Any charcoal located above this burning layer will not be consumed since it is bathed in vapors of carbon dioxide and steam. All of the oxygen entering the bottom of the barrel is used up in the burning zone which slowly moves downward.



It takes about **three** hours to char a barrel of wood. After about an hour, you will want to check on how it is burning. Here is where the art of charcoal making comes in. If the fire is burning too hot on one side of the retort (bottom barrel), take a shovel full of dirt and block off some of the holes. This will force the fire in the barrel to get oxygen from the other side of the retort, causing it to move that direction. After two hours, you may want to take off the after burner barrel and take a look at the charring in the retort.

WARNING: THE AFTERBURNER IS HOT AND SO ARE THE GASSES COMING FROM THE RETORT!!!! USE LEATHER GLOVES AND COVER YOUR BODY WITH FABIC MADE FROM NATURAL FIBERS.(SYNTHETIC FIBERS WILL MELT TO YOUR SKIN) THE AFTERBURNER AND THE HOT GASSES COMING FROM THE RETORT CAN CAUSE THIRD DEGREE BURNS INSTANTLY. KEEP YOUR FACE AWAY FROM THE RETORT!!!! WATCH THE

WIND DIRECTION SO THE HOT GASSES ARE NOT BLOWN INTO YOUR FACE. THE HOT GASSES CAN QUICKLY SINGE YOUR WHISKERS OR EYEBROWS.

Take a long stick and move any wood around that looks like it isn't getting charred. This should only take 30 seconds and give you a good idea how your batch is charring. Put the afterburner back on. Keep adjusting the air at the bottom of the retort (using dirt) until you think the process is done. Your objective is to cook the wood to drive out everything but the carbon and not allow the carbon to burn up. After a few attempts, you should get the hang of it. It is better to char too little than too much.

Now is time to shut the process down. Place dirt around the base of the retort to seal off all the opening. You will probably have to tamp it down somewhat so it seals off all the oxygen. Remove the afterburner barrel and don't forget the warnings. In fact, here it is again:

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Place the lid on the retort and you are done. Let the retort cool down at least overnight. If you have done a good job sealing off the openings thus preventing oxygen from entering, your charcoal should be out. Here is warning based upon experience.

Charcoal is notorious for harboring fire for days before you may notice it. That is why you never place it in a burnable container until it has set out in the open for 24 hours. Fresh charcoal actually adsorbs oxygen from the air causing an increase in heat. This can lead to spontaneous combustion.



When you unload the retort, you typically find pieces of wood that are not completely charred. These are called “brands”. Add them to the next batch you make. Making charcoal can be fun and the knowledge you gain will provide for some interesting conversation at your next social event. Why not have a cookout over your home made charcoal.