

# Charcoal Making at Home

**Robert Lea**

Copyright Valentine Chemical, Fayetteville, Arkansas, Reprinted by permission of the author

---

## FOREWORD

Many people who have read my instructions for making drawing charcoal have contacted me seeking information about how they can make larger quantities of charcoal for various purposes. Since my experience with making charcoal has been limited to making small sticks for drawing, I have not been able to answer their questions. In 1982, Robert Lea published an instructional pamphlet which seemed to cover many points of interest. In answer to my request, he has generously given permission for this online republication of his creative property. Mr. Lea retains all rights of copyright. Questions about the process or permission to reprint his article should be directed to Mr. Lea, whose address appears at the bottom.

Evan Lindquist  
July 10, 2000

---

## Charcoal Making at Home

### PREFACE

Dear Reader:

Curiosity led us to make charcoal; satisfaction with the results caused this booklet.

My family and I are cook-out enthusiasts and use several pounds a week, Winter and Summer.

One day at the store, our usual brand of charcoal was not available so we had to settle for an alternate brand. It turned out to be "natural" charcoal and was not formed into briquettes. It started easy, burned well and made our hamburgers taste just a little better. That made me curious: If someone else could make charcoal, why couldn't I? My wife got just as curious and our search began.

There was very little information available at either the Public library or the local University library. It turned out that there are several charcoal plants in our area here in N.W. Arkansas and nearby Missouri. We did some traveling to visit some of these plants ranging from one-man operations to huge industrial

complexes. The smallest operation had a minimum kiln capacity of 15 tons per week. In scaling down the size to a back yard operation, we ran into some engineering problems. When these were overcome we had a very simple, economical and efficient kiln.

We hope you enjoy using your kiln as much as we enjoy ours.

Thank You and Have Fun.

---

## **Charcoal Making at Home**

The production of charcoal has in every country of the world been among the first industries. Our pioneers processed charcoal for winter fuel in very crude, sod covered piles. It was a preferred fuel because ventilation was poor in most settler's homes and it smoked less than wood. It is doubtful they were aware of the dangers of the fumes in wood smoke or even the chemicals in the smoke. They were aware though, that it was difficult and painful to try to breathe the smoke. So charcoal, smoking less than wood, became a popular fuel.

This popularity has grown, for various reasons, while our population and the demand increasingly exceeds the supply. The demand for charcoal is not just for recreational uses but it is a vital part of several industries. Rarely now is charcoal made for the chemicals in the wood as it once was but is used extensively as a fuel for smelters, industrial forges and furnaces. It is regaining popularity too as a fuel where coal is used as our supply of coal is being used up. Besides being prepared for the increasing shortage and expense of charcoal, there is another feature: It can be made from scrap wood that might otherwise be discarded as waste.

Any kind of wood can be used to make charcoal. However, if softwood is used, it will make soft charcoal and therefore burn quicker. Most charcoal is made from the hardwoods common to most areas: ash, hickory, oak, and hard maple. The main thing to watch is to not mix a load with soft and hard woods. If you stop your burn when the soft woods are charcoal, the hardwoods won't be ready, and if you continue the burn for the hardwoods, the soft wood will burn clear to ashes.

Your wood can be located at a variety of sources, even if you don't happen to be in a timber area; lumber yards, cabinet shops, flooring companies, tree trimmers, building contractors, furniture factories, etc. A few phone calls will usually locate all you can use for for hauling it off.

### **CONSTRUCT THE CHARCOAL KILN**

Charcoal making in your back yard can be accomplished with little cost or effort. Most of your effort will be used in making your kiln and that will take only a couple of hours with common tools and using commonly available materials. Your cost will be in acquiring those few materials that you don't already have in your garage.

#### **TOOL LIST**

1. Electric drill
2. Saber saw
3. 17 tooth per inch metal cutting blade

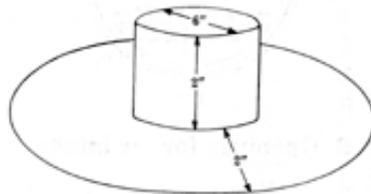
4. 1/4" drill bit
5. 1/8" drill bit
6. Circle scribe or compass
7. Starting punch
8. Screwdriver
9. 1/4" open end wrench

#### MATERIAL LIST

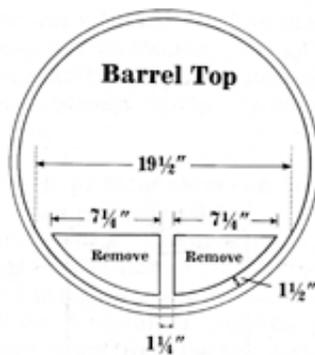
1. Metal 55 gallon barrel with removable top held on with a lock ring
2. 90-degree elbow of common 6 inch stove pipe
3. Two lengths of common 6 inch stove pipe
4. One stove pipe damper
5. Six inch collar with flange
6. Eight 1/4" X 1/2" common bolts with nuts
7. Six 1/8" X 1/4" metal screws

The barrel will, of course, be the main body of your kiln. It must have a removable top for loading and unloading. The rim and lid should have only minor dents, for it must make a good fit.

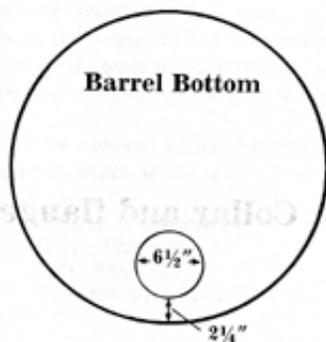
The collar and flange can be made at your local sheet metal shop at a very nominal cost. (See sketch "A") It is made from fourteen gauge sheet metal and it is intended that the stove pipe fits inside the collar. The rest of the materials are available at your local hardware store.



Let's get right to the making of your kiln: Sketch "B" shows the placement and dimensions of the openings in the lid. Be sure to leave the center piece as that provides rigidity to help prevent warping of the lid.



Sketch "C" is for the opening in the bottom. The bottom now becomes the back of your kiln, with the opening to be at the point closest to the ground. Mount the collar and flange to this opening with all eight of the 1/4" bolts. Space the holes equidistant and fasten with the flange inside the kiln with the collar sticking out.



Mount the elbow and pipe to stick straight up. (See sketch "D"). Fasten the elbow to the collar with two of the metal screws and fasten the pipe together with two screws at each joint.

Your kiln looks complete now but the next part is very important. You need a trench to place your kiln in. Make it a few inches wider than the barrel on both sides, and deep enough to come halfway up on the sides. It should be long enough to accommodate your pipe in back and have a gentle slope at the front. The air intake at the front must be at the bottom, so you need the slope for air and access. Dig a small pit in the bottom off the trench and fill with gravel, chat or oyster shells. This provide a drain for rain water. (See sketch "D"). When you have your kiln in the trench, pack dirt in around it firmly, on the sides and back to ground level. Remove any rocks larger than gravel size or you will have hot spots that will cause your kiln to burn through in a short time. It is better to have no rocks at all.

### LOAD AND FIRE YOUR KILN

Your kiln is now complete. Remove the front and you are ready for loading. The starting of your load must be done carefully to allow 2.5 to 3 inches of air space at the bottom. Place a few long pieces crossways, then crisscross the first couple of layers. Then if you have small pieces or chunks, just dump them in. Pack in as much as the kiln will hold and replace the front with the vent at the bottom. The rim around the front must seal because control of the air flow is important. The intake and exhaust openings are precise to allow the right amount of air flow. If there is a leak around the rim, you will get a too fast or uneven burn.

As the load must burn from the back to front, I use an oil soaked rag on a piece of stiff wire. Light it and shove it through the vent, under the pile, clear to the back. Leave the wire there. It can be removed later.

Here is where skill and a little practice comes in: With the damper open, let your fire get a good start, then close off the damper part way. You want just enough air for the fire to smolder without flames but not go out. As the heat builds up in your kiln, the smoke gets thicker and yellowish as it becomes laden with gases and chemicals from the wood. As the heat builds up in your kiln, close the damper gradually until eventually it is completely closed. Smoke will still come out of the pipe around the damper and from the front vent too. It will take several hours to complete the "burn". The burn time will vary according to several factors; Moisture content, hardness of the wood, how much wood is in the kiln and how densely it is packed in. My burn time has been varying from 3.5 to 6 hours. My first burn took four

hours, a pot of coffee and several chewed fingernails. I was rewarded with over twenty pounds of charcoal.

As you monitor your kiln you will be able to tell when the heat has reached the front. As this occurs, poke around through the vent once in awhile. When you see a lot of coals near the front, the burn is complete. Block the vent with a board or piece of tine and pile dirt completely over it to seal out the air. Close off the pipe at the rear by using a pie tine with dirt or rocks in it to keep the wind from blowing it off. A little smoke will still seep out but that is okay. When the front closed properly, there will be no draft and fire will still smother out.

Wait until the kiln is completely cool before opening it. Hot charcoal will re-ignite upon exposure to air and your efforts will be wasted. A little patience here will be rewarded with several pounds of charcoal. The wood you started with contains about fifty percent carbon, so you will notice a considerable reduction in volume. That "loss" went up the stack as smoke. You will have several pieces, especially near the front, that aren't completely burned. They are known as "brands". They occur where the heat wasn't sufficient, or are larger pieces that didn't have enough time to complete. Just put them aside and put them in with your next load to complete. You will also have some small pieces known as "fines" that are too small for your grille. Save them until you have a bucketful and make "briquettes".

## BRIQUETTES

To make briquettes you'll need some starch from the grocery store and some molds: Margarine bowls, muffin tines, short cans or 'most anything. Crush or grind the small pieces of charcoal as fine as you have the patience for. The finer the better, but some lumps are okay. Cook the starch to a thick paste and mix in the charcoal. The thicker a mix the better, but mix it well. Pour or dip into the molds and that's all there is to it. After the mixture sets, dump the briquettes out and let them completely dry. Depending on the weather, it may take a couple of days for them to be dry all the way through. The starch will burn smokeless and odorless and you don't waste any of your charcoal. You also don't have any extra "junk" in your briquettes. In our research we discovered that the commercially made briquettes we buy at the store probably contain earth coal as fill for extra weight and even raw sawdust for "smoke". Of course, starch is the binder that is used commercially too. Your briquettes will burn clean and with no more smoke than the rest of your charcoal. If you wish to have smoke, it can be had by putting any kind of meat sauce directly on the burning charcoal.

## COMBUSTION PROCESS

Even though the process of making charcoal has been reduced to a very simple operation, a lot has been going on inside your kiln. Let's consider what your kiln has accomplished.

The basic principal of charcoal is incomplete combustion. When wood is heated to a temperature of about 259 degrees Celsius (482 degrees Fahrenheit) or higher, it quickly decomposes to form gases, vapors and solids. If heating takes place in the presence of sufficient air, combustion is complete or nearly so and the only residue is ash. If, however, the air supply is restricted, combustion is incomplete, the volatile elements are driven off as "smoke" and charcoal and ash remain as solid residue.

In this smoke that is driven off are a number of non-condensable gases and condensable vapors. The principal gases are carbon monoxide, hydrogen, methane, carbon dioxide, oxygen and nitrogen. The vapors are water-acids, alcohols, tars, oil and other organic compounds.

A small amount of these gases and vapors remain in the charcoal but well burned charcoal contains from 75 to 95 percent carbon. With most of the gases and chemical gone up in smoke, a charcoal fire then is a much safer one from a health standpoint.

The temperature of 250 degrees Celsius is to be considered the minimum at which carbonization begin. Your kiln is designed in such a way that the temperature can go much higher, to 357 degrees Celsius (700 degrees Fahrenheit). At this temperature carbonization is rapid and some skill and practice is required to know just how much draft is required and when to stop the burn. Placement and size of the intake and exhaust vents in relation to the size of the kiln combined with skill are the keys to the proper decomposition of the wood.

This decomposition is known as an "exothermic" reaction because the process drives off the gases and vapors and leaves behind the desired product. There is a rough division of the exothermic reaction into three stages: 1) before, 2) during, and 3) after the decomposition of the wood. The first stages consists mostly of drying the wood while the heat is building up in the kiln at the start of the burn. Because the temperature buildup is at the top of the chamber, the pile burns from the top down and from the back to the front for a complete reaction. When the temperature reaches the proper level, stage two begins and decomposition commences. Stage one moves on through the pile and stage two right behind and during stage one. Stages three is the completed charcoal and will not be consumed as long as there is not sufficient enough air to cause a flame in the heat chamber. Obviously, all three stages are present at the same time in the kiln except at the start of the burn. Also, you will notice a considerable heat loss from the exposed areas of your kiln. Where this loss would become critical is in the lower half of your kiln. This is prevented by the soil your kiln is burned in as it insulates against the heat loss. Not incidentally, the soil packed in around the exhaust stack seals against uncontrolled air draft at the joints of the pipe and the collar to the barrel bottom.

If you wish to go to the extra cost and effort the same effect can be accomplished by placing your kiln in a large box with a minimum of four inches of dirt between the kiln and box sides and bottom. This would prove advantageous in several respects: The entire unit could be raised above the ground for easier access to the front, the unit would be semi-portable, and it could be used by apartment dwellers or other who either can't or do not desire to dig a trench in their yard

Our research continues and as we develop new techniques or methods, we hope to keep you informed. At the present time we are developing a kit of complete materials and a briquette press....

We would be pleased to hear from you. Please address all correspondence to:

Valentine Chemical  
Home Charcoal  
PO Box 773  
Fayetteville, AR 72702  
email: [rlea@comp.uark.edu](mailto:rlea@comp.uark.edu)

(The contact information was current on July 11, 2000.)