Polverone, Revisited by Jason Land

This article was originally printed in 2003. The first half of the article described how we came to the conclusion we did. This was an effort by me to prove to everyone that this method does indeed work for lift, and break. Well, now we've done one better, and an entire show segment using nothing but polverone was shot this year at the 4F. It's well known around here that these methods work, and we're using them very effectively.

We've learned some more aspects and pieces and parts to the method since last time, so I thought it time to revisit the ideas here. That, and we have plenty of newer members who weren't around when it was originally printed.

You may be asking yourself, why should I make my own lift and break, and why should I use polverone? If you do not have a Manufacturer's License, you must use homemade lift and break. In the past, everyone used 2Fa. Unfortunately, it was illegal then, and they're enforcing it now. So, you must make your own lift and break. Now, why polverone? There are 3 useful methods for making black powder;

1) "CIA" method – This method is messy and not very useful by most accounts. Many started with this, but I don't know of anyone that continued making it.
2) Pressed & Corned – This is the method that many people across the country use. It's how commercial powder is made, and it's an excellent method for making very useful BP. However, it requires the use of "hot" charcoals, and is very labor intensive. Many people still use this exclusively, but most of them have made corning machines to do the grunt work for them. Without one of these machines, this method is a huge amount of work. And because of the "hot" charcoals, is more expensive to make.
3) Polverone – Lift & Break grade polverone can be made with commercially available air float charcoal. Making large quantities is quick and easy, and doesn't take much more than a decent ball mill. You can use "hot" charcoal if you like, but it's not necessary. You can make your break grade polverone so hot, you won't need any 'booster' (flash, H3, whistle mix) in your break charge.

Testing your polverone is very important in order to get a useful baseline to compare it to. If you build the tester at the end, you can compare your finished polverone with 2Fa, which lets you know where you stand on your powder's power. Is it lift, break, or fill powder? The tester will let you know.

There are a couple of factors that will affect how powerful your polverone ends up;

1) How your comp was milled – You should already know how to use your ball mill, I could go on and on about ball mills, but that's another article. If you're using heavy media (lead, brass, SS), you should mill your charcoal and sulfur first for an hour (or whatever your mill's optimum time is), then add your KNO3 and dextrin to the mill, and mill it for another hour and a half (or whatever your mill's optimum time is). If you are using ceramic media, your times will vary. You can shorten your mill time by doing the S +AF Charc together first, or you can just mill all of it together for a much longer period. Times vary greatly from mill to mill and how efficient your jar is. I am currently using one of the large ball mills found on www.pyrosupplies.com with ceramic media (it won't turn a jar full of my favorite heavy media) and it takes 5.5 hours for a 15lb batch.

2) Type of charcoal you used – Commercially available air float charcoal is fine for polverone. This is readily available from Larry at a very nice price. Much hotter grades of polverone can be made with the so-called "hot" charcoals. Willow, pawlonia, china berry, maple, etc. Stan is a great source for some of these. If you use all "hot" charcoal, you don't have to watch you KNO3 crystal size quite as much. If you still watch your crystal size, you can create some extremely hot polverone using these exotic charcoals.

3) The purity of nitrate used – KNO3 is a funny thing. We've been using Champion brand KNO3, Green house grade for a few years now, and it's beautiful stuff. It can be difficult to find though. Haifa brand nitrate is terrible. The amount of impurities is disgusting. Food grade nitrate, available from www.skylighter.com makes wonderful polverone. Tech grade nitrate available from Larry is also very good. Just try to get the purest grade of nitrate available to you. Keeping in mind, we use fertilizer grade that happens to be very pure.

4) Potassium nitrate crystal size – This, potassium nitrate crystallization was the breakthrough on the hot polverone. Without taking this into account, you have fill powder every time. Large KNO3 crystals burn slowly, smoldering along the way. So the smaller you can make the crystals, the faster the powder burns.. to a point. If they're too small, the powder won't have much structure. That's where the trade off happens, the more water you use, the harder the grain becomes. The less water you use, the more fragile the grain becomes. KNO3 crystals grow as the moisture that they were solved in evaporates. The longer the liquid remains in the comp, the larger the crystals can grow. By limiting the amount of water you add to it during processing, and then drying it as fast as possible, you can keep the KNO3 crystals under control. If your polverone takes more than a day to dry, it most likely won't be very good.

In picture 1, you will see the standard supplies for making polverone;

1) A large mixing bowl or bucket, the mixing bowl pictured will hold approximately 3 kilos of comp. I tend to make larger batches than this, so I use a galvanized wash-tub, obtainable from your local hardware super store. You can also use a plastic tote box, as many of us have many of them lying around.

2) Rubber gloves, good rubber gloves are indispensable accessory for any shop.

3) Water, H2O, I wouldn't use tap water, but since it's not a color comp, almost any other water will probably do. I use drinking water because I buy it by the case.


Picture 1

3) Dextrin, Approximately +1.5 – 2% Dextrin will be fine for this purpose. Add this to your mill with KNO3.

4) Ball milled 75/15/10, (KNO3/AF Charcoal/Sulfur)

5) ¼" hardware cloth screen frame for grating, this must be sturdy, you will be grating the wet comp through this screen. It should also be long enough to get a good long pull across the screen. My screen is 2' x 18" and is made of 2"x2" pine for the base, with 1"x2" cap sandwiching the screen between itself and the 2"x2". The 2"x2" allows for 1-1/2" drop of the wet and grated comp from the grating screen to the drying screen. I don't know if this is optimum, but it has worked very well for us.

6) Window screen on a frame, here after called a drying screen. This should be at least as large as your grating screen but doesn't need to be as sturdy. I made mine to fit my bread rack collection, 2' x 22". These are made to maximize air flow around the comp. I used 1x3's on the 22" ends and 1x2's on the 2' sides. The window screen you use should, of course, be aluminum. Each screen of this size will hold approximately 500-600g of polverone.

Now that you have all the tools, it's time to get dirty! Place the 75/15/10 and binder into the mixing bowl, or bucket, or what ever you have to mix this stuff. Here's the part where you have to watch what you do. Adding the water can make or break great polverone. Add too much, and the finished product will have giant KNO3 crystals and

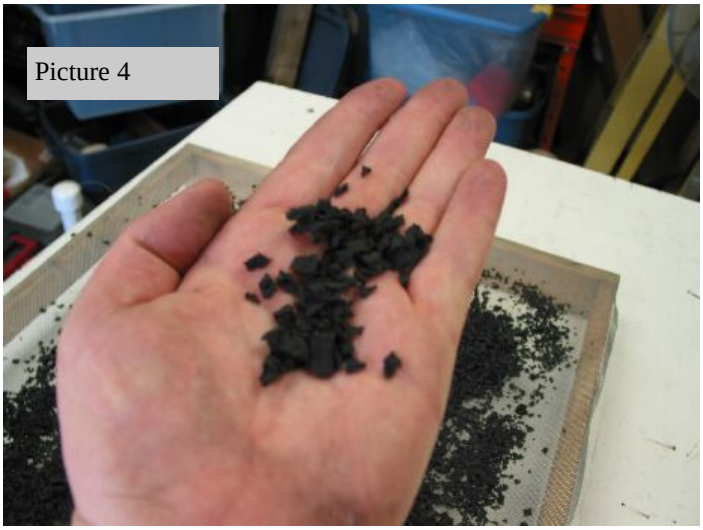
burn slowly. As anyone who's ever made charcoal stars can tell you, it only takes a couple of extra ml of water to turn a charcoal comp to soup! With the Champion brand KNO3, and commercial AF charcoal, 18% water seems to work well. But, in one of my experiments, I tried Haifa KNO3, and 18% water was way too much, it turned to soup. In yet another experiment using Pawlonia charcoal instead of AF, the comp needed an extra 4% of water to get to the right consistency. So, I would start at +15% water and mix the contents until it's all damp. You shouldn't be able to see dry spots in your comp. Here's how you tell if it's wet enough, take a bit more than a handful of the thoroughly moistened comp and pack it tight like a snow ball. It will start to look like a big black potato, and that's what we call this lump of moistened comp, the potato. Once it's packed pretty firm, begin smacking it back and forth between your cupped palms. Now, holding the potato in your hand, hit it somewhat hard with the heel of your other hand. You should feel the ball morph in shape slightly. If it doesn't give at all, it needs more water. If it crumbles to dust, why'd you even try to pack it? If it gives so much that big cracks form in it, then there's too much water. You'll get the feel for this after a few batches.

Once you have the potatoes right, it's time to grate them through the ¼" hardware cloth. With the drying screen placed on the table, and the grating screen placed on top of the drying screen (see picture 2), place the potato at the far end of the screen, and pull back towards you putting pressure on the potato as you go. Sort of like a cheese grater motion. What comes out should almost look like ribbons with ragged edges. Here, we see the importance of having the right amount of water in the system. Too much water and you will get a sheet of ribbons, that while they dry hard, will not be very fast. Too little water, and you get lots of fines, the resultant ribbons will be shortened to chips as well. With the optimum amount of water, your ribbons will be about ½" in length and the fines produced will be minimal. I wish I had a picture of this process, but I would have needed help with the camera, and as this is the most labor-intensive part of the process, my help was suspiciously absent. Continue to grate the potatoes until the screen is covered in a thin layer of polverone. It is important that you have a thin layer, and as I said earlier, only about 500-600 grams will fit on a screen of the size I use. See picture 3.


Picture 2


Picture 3

Drying your wet polverone quickly is a crucial step. The ideal drying situation is a nice, hot, sunny day. Under these conditions, your polverone will dry in 2-3 hrs, and will be very fast. While we do have our fair share of these types of day here in Florida, we aren't always so lucky. When the weather doesn't cooperate, we need to make due with what we have. A drying box, like the one on www.passfire.com is perfect for drying this


Picture 4

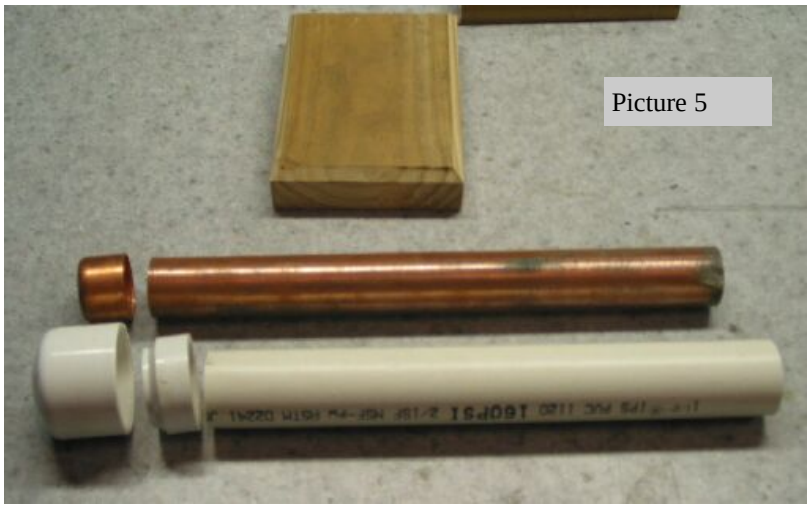
comp in 3 hrs or under. Of course not all of us have a drying box either, and a good fan inside your workshop will do the job in a pinch. If it's cold out, and you have no way to heat the air, I wouldn't recommend making polverone. It will dry slowly and make a very poor product. Anything under 6 hrs of drying time seems to make acceptably fast polverone.

Once the drying is done, you will notice that the polverone has formed into sheets of small chip and ribbons. These must be sized. I use the ¼" hardware cloth again, and force the polverone through it, back onto one of your drying screens. The fines under 16 mesh will fall through the drying screen and voila, you are sized enough. You can see the finished sizes in picture 4. Traditional sizes of black powder don't really apply here, because the density is vastly different. I wouldn't recommend using the fines in anything other than rockets, spollettes or prime. They make the batch unpredictable, and since the polverone is already in the vicinity of Goex, you need to stay as predictable as possible.

Polverone does have advantages and drawbacks. For one, the grain that is produced by the above method isn't very sturdy, but it's very fast. Adding more water will make a sturdier but slower grain. The fastest polverone is excellent for break, but usually too fast for lift. I usually try to make two different varieties, fast and light for break, and slower and sturdier for lift. This will occur to you once you have some experience with it. The fastest and lightest polverones will degrade in performance after 3 or 4 months if not kept absolutely dry. This is presumably from atmospheric moisture seeping into the comp and allowing the superfine crystals to grow together. Currently, using fertilizer grade KNO3, my polverone costs me about 80 cents per lb to make.

The one problem that you can't overcome, is having to test your polverone once it's dry. To aid in that respect, we have come up with a tester that you can build with little difficulty. If we all build similar testers, and make this sort of a standard, we can all easily compare our polverone without much explanation. In picture 5, you will see the following items, available at most hardware stores:

2" PVC Hard Cap
2" x 1-1/2" PVC Bushing
1-1/2" copper cap
15" of 1-1/2" copper pipe type K or L
13-3/4" x 1-1/2" Irrigation PVC (must be 'irrigation' PVC)
A piece of 2x6 about 12" long for the base
Some solder and flux
A torch
A wood screw
PVC Glue


Picture 5


Picture 6

First, glue the PVC bushing into the 2" hard cap so that it's flush with the edge of the cap. Next glue the 1-1/2" irrigation PVC into the bushing that is already in the cap. This is your launcher. The finished PVC assembly should weigh 270g +/- 3g. It's important that the weight is within those limits to remain consistent. Next, drill a hole in the center end of the copper cap big enough for your wood screw to fit in. Place the cap, with your newly drilled hole in the middle of the 2x6. Screw it down to the wood. Solder the 1-1/2" copper pipe into the cap. The result should look like picture 6. Now you are almost done. Once the copper pipe is cool again, place the PVC launcher over the copper pipe, as in picture 7. Somewhere below the bottom of the pipe, about ½" up from the board, drill a hole large enough to fit a piece of visco.

This tester design will give fairly accurate results using a stop watch. The way you use it, is to place 4grams of your finest polverone into the copper tube. Place a decent length of visco into the fuse hole. Put the PVC tube back over the copper tube, and light the visco. It helps to have someone else who has a fast reaction time hit the start button on the stopwatch when the lift fires, and press stop when the PVC hits the ground. For accuracy, you will need to do this at least 3 times for every batch. A variation of .25 seconds seems acceptable. The baseline for this particular tester is, as always Goex 2Fa, which gets 5 seconds of flight time, lift to dirt. The polverone used for the club this year was all 5 seconds for lift grade, and 6 seconds for break grade. If your tester hits 7 seconds or more, the results are too unpredictable. If your polverone is that hot, which is easily achieved using these methods, just know that you have some great break on your hands. Good luck, and remember not to use the tester near your vehicle, or house. That PVC comes down hard, and it loves windshields!

-Jason


Picture 7

2007 Additional info:

A word on using polverone as lift. Polverone burns differently than 2Fa, and this can cause some problems with the traditional lift calculations. 2Fa releases it energy over a longer period of time than this fast polverone, because it has to burn from the outside in. Fast polverone on the other hand, is porous, and burns all at once. Because of this, when you hear shells lifted with polverone, it sounds like a boom instead of the longer thump that 2Fa produces. Traditional 2Fa lift calculations say to use 1oz/lb up to 10lb, and after that add 1/2oz per lb over 10lbs. With polverone (5 second polverone), the break point is closer to 5lbs. After 5lbs, you need to start backing off the old oz/lb rule. For much larger shells, make a slower polverone (use a little more water) and use it 1 for 1. For instance, this year's 12"

ball shells were lifted with 4 second powder, and treated as if it were 2Fa. If you're shell is less than 1lb, use a full ounce of 5 second or better polverone.

One day I was talking to Greg about polverone and realized the most important thing polverone was missing, was consistency. How could you make the same shells over and over without consistent break charge? You can't. The solution is to stop depending on the weather to dry your polverone. A drying box will set you free. A polverone drying box needs heat, light, and lots of moving air. If you touch your wet polverone, you'll see that it feels cold. Well, there's no such thing as hot or cold, there is a lack of energy (cold), or an abundance of energy (heat). Your wet polverone is cold because it's sucking up energy wherever it can get it. So feed it, with fans (kinetic energy), heat (convection), and light (infrared). I first realized just how much energy it was eating when I saw how far the temperature dropped in my drying box. Starting with a 115F drying box, if I load it with stars, it stays a 115F drying box. Same with drying shells. Load it with polverone, and the temperature drops immediately to 90F. My drying box is big, so you probably don't need what I have in there, but I have a dehumidifier, 2 – 100w light bulbs, 2 fans (one large one facing directly downward), and a heat lamp on a timer that is only used for polverone. This is a fairly elaborate drying box, but I can tailor my polverone to my needs and consistently make whichever grade I want.

So try your hand at polverone, you'll be amazed at how easy it is to make. Don't be scared by the drying box, or making large quantities. It's very easy to make 1 kilo at a time and for most hobbyist purposes, that's all you need. Good luck, and have fun.

-Jason