How To Make Lift For Shells Using Commercial Airfloat Charcoal

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Recently the question came up asking whether or not commercial airfloat charcoal could be used 'as is' to make lift powder for small fireworks shells, such as 3" diameter ball shells. A brief investigation was conducted to answer that question. It was found that, although not the ideal choice, 'airfloat' could indeed be used to make serviceable lift for the stated application. The following article details a relatively simple process to achieve the task. As previously stated, this was a brief investigation, so the batch size was limited to 300 grams of powder plus binder. It's reasonable to believe that this method could be further improved upon by changing ratios, processing, or binder.

For this batch size you will need:

210 grams of finely milled potassium nitrate.

60 grams of commercial mixed hardwoods airfloat charcoal.

30 grams of finely powdered sulfur, such as rubbermakers sulfur.

10 grams of finely powdered CMC (carboxymethylcellulose, sodium salt)

80 grams of very hot (not boiling) water.

It may be noticed that the ratios of black powder ingredients do not conform to the usual 75-15-10 formula. The ratios for this powder are 70-20-10 (+ binder). The CMC binder is commonly available from pyrotechnic suppliers, and also sees extensive use as a food additive.

The lift powder made by this process is granulated with a cheese grater using a hot water method, which allows much less water to be used. In addition, the drying time will be quite short, which helps make for a faster powder.

STEP 1)

Mix the above ingredients- except for the water- by hand, and pass through a 40 mesh screen twice. Blend by hand between screenings. The mixture should now be an even shade of grey. Place the mixture in a clean Ziploc brand medium freezer bag. Do not use a 'storage' bag. They are too thin to handle the heat of the water. Make an indentation in the middle of the powder large enough to accept the 80 grams of water that will be added.

STEP 2)

Heat a large cooking pot (5 to 8 litres) of water to almost boiling. Remove from the heat source, and cover to retain heat. Meanwhile, heat the 80 grams of water required for granulation in a small cup to almost boiling. Pour the partial cup of water into the 'well' in the bag of powder. Carefully zip the freezer bag so that it won't leak. Knead the powder and water mixture by hand, so that the water is evenly distributed throughout the mixture. If there is excess air in the bag, open the zipper and release some, being careful to not get any of the mixture on the zipper. Re-seal the bag, and spread the mixture roughly flat in the bag. Lay the bag in the pot of hot water, and replace the lid. Ideally, the water in the pot will be at 170 degrees Fahrenheit when the bag is added.

STEP 3)

After 10 minutes, remove the bag, knead the mixture briefly, and return it to the covered pot. Leave it for 10-15 more minutes. During this time, the texture of the mixture will have changed. It will have become less like powder, and more like a dough. Keeping the bag sealed, form the mixture in the bag into a ball. Use as much hand pressure as possible to really consolidate the mass into the most dense ball that can be formed by hand. The bag should have very little of the mixture adhering to it at this point.

When you are satisfied that the ball is properly compacted, cut the bag away. The next step would best be performed with snug rubber gloves on.

STEP 4)

Set the ball aside for up to 5 minutes, while spreading out a newspaper to grate the powder onto. During this time, the ball will become more stiff. If it doesn't, wait 5 more minutes, or until it does. Using the small holes in the grater, and holding the ball firmly, grate the powder onto the newspaper, moving the grater around to spread the powder evenly on the paper. Keep turning the ball, grating off one side, then the other, until the ball becomes more cubic in shape. This is important, because the texture is changing as the ball cools. The more even the grating, the more uniform the powder will be. Let the powder rest on the newspaper for 20-30 minutes.

STEP 5)

After the powder has rested, pour it from the newspaper onto a 6-8 mesh screen. Shake it through the screen, onto another newspaper. This will help break up any clumps, and help shape the grains. The grains are still quite fragile at this point. Spread the screened powder evenly into 2 into cardboard trays (like the 'flats' soda pop comes on), and dry in the direct sun. Do NOT use a heat source! The powder should be disturbed slightly with the edge of a piece of cardboard occasionally while drying, to minimize clumping. It should take 1-2 hours to completely dry the powder. Run it once more through the coarse screen to break up any lumps. Finally, shake the powder on a 20 mesh screen to remove fines. The fines can be saved, and added to the next batch. If done correctly, the fines should add up to 10-20 grams.

The lift is now ready to test. 25-35 grams of this powder should lift a baseball from a 3" ID mortar tube for a total flight time of 7.5 seconds or so. Adjust the amount of powder used to get this minimum flight time. A stopwatch is very handy for this testing. It is advisable to wear a helmet during testing. It would be wise to test 25 grams first, and work up from there. Pouring the powder loosely into the mortar tube is not recommended. It should be placed into a lift cup of

the appropriate size, to give the best idea of performance under normal conditions of use to lift shells. It is not recommended to use this powder for burst.

ADDITIONAL NOTES:

Drying black powder in the sun is the best way to get good strong powder. If the weather is not ideal, the powder mixture can be prepared ahead of time and stored until weather permits proper drying conditions.

DISCLAIMER:

It is assumed that the reader has some knowledge of pyrotechnics, and the inherent hazards of the craft. This is a brief explanation of a component process in the much more broad subject of the making of aerial shells. Certain general safety practices that are obvious to fireworkers have not been included in this brief tutorial. The author accepts no responsibility for actions taken by the reader.