THESIS ABSTRACT

Title	:	PERFORMANCE OF BLACK POWDER USING DIFFERENT CHARCOAL TYPES AS PROPELLANT FOR FIREWORKS AERIAL SHELLS: AN ASSESSMENT
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Statement of the Problem

The general objective of the study is to assess the performance of black powder using different types of charcoal as propellant for fireworks aerial shells. Specifically, the researcher answered the following problems:

1. What are the properties of black powder in terms of:
   - 1.1 Physical Properties
     - 1.1.1 Moisture Content
     - 1.1.2 Particle size
   - 1.2 Electro-Chemical Properties
     - 1.2.1 Electrical Conductivity
     - 1.2.2 Burning rate (sec/gm)
2. What are the properties of charcoal in terms of:
   - 2.1 Particle size
   - 2.2 Moisture content
3. How is the performance of black powder affected by using different types of charcoal from the following sources:

3.1 Coconut shell

3.2 Coconut husk

3.3 Bamboo tree

3.4 Camachile trunk

4. How significantly different is the performance of the black powder in giving maximum propelling action through the use of different types of charcoal mentioned in Question #3?

5. Based from the findings, what are the precautionary measures to be followed by the makers of the black powder?

Experimental Procedure

The study was done inside a pyrotechnic factory located at Bgy. Conchu, Trece Martires City, Cavite. Licensed Pyrotechnician assisted in the conduct of the research. Twelve (12) units each of four (4) different sizes, 2", 3", 4" and 6" aerial shells were used.

Coconut shell, coconut husk, bamboo tree and camachile tree were converted to charcoal. The charcoal served as one of the raw materials for the production of black powder. The black powder served as the propellant for fireworks aerial shells. Performance in terms of the height attained by the aerial shells during flight was measured using an improvised apparatus called The Quadrant. It was set-up at the firework factory and measurement was done using the formula: tan (degrees) = opposite side/adjacent side. The height was measured in meters. The results of the research were

evaluated using One Way Anova with a follow-up test, Comparison of Means: The Tukey Method to find out levels of difference.

Findings

The results of the study revealed the following:

1. A comparison between the different black powder chemical compositions: KNO_3 = 75%; S = 10%; C = 15%, KNO_3 = 70%; S = 10%; C = 20% and KNO_3 = 65%; S = 10%; C = 25% and burning rate showed significant difference between black powder that used coconut shell and camachile trunk, coconut shell and coconut husk, coconut shell and bamboo tree, bamboo tree and camachile trunk. No significant difference exists for coconut husk and bamboo tree, coconut shell and camachile trunk.
2. There is a significant difference between the performance of black powder on 2" and 4" aerial shells in all black powder samples. However, a significant difference exists on 3" aerial shells on black powder samples that used camachile trunk and coconut husk, camachile trunk and bamboo tree, camachile trunk and coconut shell, and coconut shell and coconut husk. No significant difference exists between coconut shell and bamboo tree, coconut husk and bamboo tree. Moreover, there is a significant difference on 6" aerial shells that used camachile trunk and coconut husk, camachile trunk and bamboo tree, camachile trunk and coconut shell. No significant difference exists between coconut shell and coconut husk, coconut shell and bamboo tree, and coconut husk and bamboo tree.

Conclusions

Based on the results of the study, the following conclusions were made:

1. Black powder can be locally manufactured using locally available materials.
2. Black powder chemical composition, KNO_3=75%; S=10%; C=15%, was the best chemical composition with regards to burning rate.
3. Camachile trunk can be used to produce charcoal for black powder production as propellant for firework aerial shells.
4. The makers of black powder to ensure safety both from humans and property should follow precautionary measures carefully.
5. The performance of black powder can be measured in other ways.

Recommendations

Based on the findings of the study, the following recommendations are hereby suggested:

1. The physical and chemical properties of black powder and charcoal should be further studied. More advanced and sophisticated equipments can be used.
2. The method should be improved in terms of the following:
    a. Charcoal Production
        2.a.1. Removing the moisture content and volatile materials.
        2.a.2. Maximizing the fixed carbon content.
        2.a.3. Lowering the ash content.
    b. Black powder Production
        2.b.1. Processing, sifting and drying methods.

2.b.2. Storage method.

3. Other wood materials should be used to make charcoal for use in black powder.
4. There should be an increase in the number of aerial shells to be fired. Additional large-sized aerial shells should also be tested.
5. The use of more advanced equipment for measuring the height of the aerial shells is recommended.