COLORED FIRE

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A R T I C L E I N F O

Participated in IYNT 2022, Georgia

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A B S T R A C T

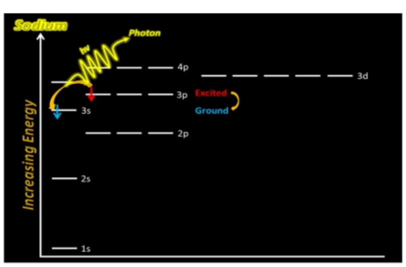
The flame can be easily painted using different chemicals. To identify the chemicals needed to obtain a particular color and check what color is obtained if a combination of these chemicals are used, several experiments have been done. All colored flames with different chemical substances are captured to compare with each other.

Keywords : *Flame, Chemical Substances, colored Fire*

1. Introduction

Are electrons excited by heat? Electrons can also be excited by electrical excitation, where the original electron absorbs the energy of another, energetic electron. The simplest method is to heat the sample to a high temperature. The thermal energy produces collisions between the sample atoms causing the atom's electrons to be excited.

When an electron in an atom has absorbed energy it is said to be in an excited state. An excited atom is unstable and tends to rearrange itself to return to its lowest energy state. When this happens, the electrons lose some or all of the excess energy by emitting light (Fig. 1).



http://ircamera.as.arizona.edu/Astr2016/lectures/spectroscopy.htm

Fig. 1: Radiation from excited atom

2. The Origin of Flame's Colors

We should know that the color of each flame is determined by the temperature of the material is used .

The temperature ranges from Red to White:

Red

Just visible: 525 °C (980 °F)
Dull: 700 °C (1,300 °F)
Cherry, dull: 800 °C (1,500 °F)
Cherry, full: 900 °C (1,700 °F)
Cherry, clear: 1,000 °C (1,800 °F

Orange

Deep: 1,100 °C (2,000 °F)
Clear: 1,200 °C (2,200 °F)

White

Whitish: 1,300 °C (2,400 °F)
Bright: 1,400 °C (2,600 °F)
Dazzling: 1,500 °C (2,700 °F)

As shown ,the lower the color temperature is and the warmer more reddish the color of the light will be and the higher the color temperature is the cooler more bluish the color of the light will be.

The white light source with a high proportion of red and a low color temperature will appear warmer.

The white light source with a high proportion of blue and a higher color temperature will appear cooler.

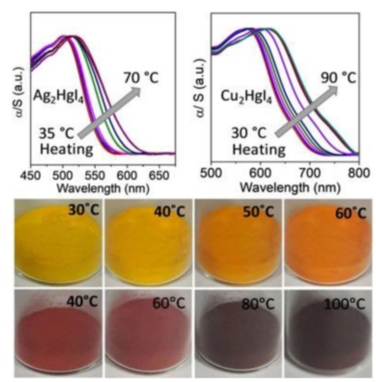


Fig. 2: The concepts of color temperature

3. Materials and Methods

All materials in this research are in Table (1).

Table 1: Chemical substances in our experiments

Material	Chemical Formula	color
1-Magnesium sulfate	$MgSO_4$	White
2-Potassium chloride	KCl	White
3-Copper chloride	$CuCl_2$	Green
4-Boric acid	H_3BO_3	White
5-Copper sulfate	$CuSO_4$	Blue
6-calcium chloride	$CaCl_2$	White
7-Strontium chloride	$SrCl_2$	White
8-Barium chloride	$BaCl_2$	White

4. Experiment

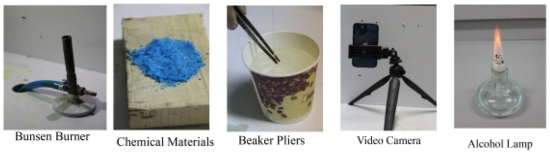


Fig. 3: Experimental Setup

All experiments have been done with different chemical substances and the flame's colors are observed in Bunsen burner and Alcohol lamp.

Flame's Color of Magnasium sulfate, $MgSo4$, is Blue and KCl is Purple, $CuCl_2$ is Green and boric acid flame's Color is light green so $CuSo_4$ flame's Color is Green also $CaCl_2$ flame's Color is Orange and $SrCl_2$ is Red.

Experiments are compared in different temperatures (Fig. 4).

Fig. 4: Flame's color with different chemical substances

Experiment with combined substances reslted in new color which depends on percentage of mixture of each substances. Combining the 33% manuseim solfate + 66% boric asid and making blue and green color is one of the experiments but the green color is more than the blue color because the percentage of boric acid is more than that of magnesium sulfate. Measuring the temperature of materials with a laser thermometer is recorded.

The results of all materials in my tests are in Table (2).

Table 2: The results

Material	Chemical Formula	Material color	Real color	Observed color	Bunsen Burner Flame temperature	Alcohol lamp Flame temperature	color temperature	Wavelength
1-Magnesium sulfate	$MgSO_4$	White	Blue	Blue	1500°C	260°C	1400 ~ 1500°C	450 ~ 495
2-Potassium chloride	KCl	White	Purple	Purple	1500°C	260°C	1200 ~ 1400°C	380 ~ 450
3-Copper chloride	$CuCl_2$	Green	dark green	dark green	1500°C	260°C	1400 ~ 1600°C	495 ~ 570
4-Boric acid	H_3BO_3	White	light green	light green	1500°C	260°C	1400 ~ 1600°C	495 ~ 570
5-Copper sulfate	$CuSO_4$	Blue	Green	Green	1500°C	260°C	1400 ~ 1600°C	495 ~ 570
6-calcium chloride	$CaCl_2$	White	Orange	Orange	1500°C	260°C	1000 ~ 1200°C	590 ~ 620
7-Strontium chloride	$SrCl_2$	White	Red	Red	1500°C	260°C	800 ~ 1000°C	620 ~ 750
8-Barium chloride	$BaCl_2$	White	light purple	light purple	1500°C	260°C	1200 ~ 1400°C	380 ~ 450

5. Conclusion

Different types of substances were tested to find temperatures and the excitation of materials on different flames. The best visible spectrum was on the Banzen Burner because it had a high flame temperature. But in the alcohol lamp, because the flame temperature was very low, the substances couldn't excite well and the visible spectrum was not produced as well as the Banzen-Burner.

References

[1] Yigithan Dedeoglu, B. Ugur Töreyin, Ugur Cidikbay, A. Enis CelinBilkent University, TR-06800 Bilkent, Ankara, TurkeyREAL-TIME FIRE AND FLAME DETECTION IN VIDEO

[2] Automatic quantification of colour proportions in dorsal black-and-yellow coloured amphibians, tested on the fire salamander (Salamandra salamandra) Eugenia Sanchez1,*, Sven Gippner1 , Miguel Vences1 , Kathleen Preißler1 , Isabelle J. Hermanski2 , Barbara A. Caspers2 , E. Tobias Krause3 , Sebastian Steinfartz1 and Friedrich-Wilhelm Kastrup

[3] Fredholm theory for the mean first-passage time of integrate-and-fire oscillators with colored noise input

[4] Carl van Vreeswijk and Farzad Farkhooi
Phys. Rev. E **100**, 060402(R) – Published 17 December 2019

DISEASE DETECTION FROM CHICKEN FECES ON A MOBILE PLATFORM USING DEEP LEARNING METHODS

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ARTICLE INFO

Gold medalist in BUCA IMSEF 2022

Awarded by Ariaian Young Innovative

Minds Institute , AYIMI

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ABSTRACT

The demand for poultry, which has been an important economic activity for humanity for thousands of years, is increasing due to many reasons . One of the most important factors that negatively affect poultry farming is pathogenic animal diseases. The detection of diseases in poultry is usually done through laboratory tests, the disease progresses and causes mortality in the time required for laboratory examinations. In this study, a mobile application was developed to minimize the mentioned problems and to enable poultry producers to obtain fast and reliable information about diseases that occur in their animals.

Keywords : *Chicken diseases, Deep learning, Mobile application.*

1. Introduction

In this study, a mobile application was developed to minimize the mentioned problems and to enable poultry producers to obtain fast and reliable information about diseases that occur in their animals. To be used in this mobile application, a deep learning model has been developed that can distinguish pseudo-plague (Newcastle strain), salmonella, and coccidiosis diseases in chicken feces through the data collected by processing the photographs taken from the feces of chickens with the help of tools such as artificial intelligence, machine learning, and image processing, which are widely used today. To train the deep learning model used, a dataset of 6812 photos consisting of chicken droppings was prepared for training deep learning models and models previously used for various purposes were trained through transfer learning. After the training, the models were evaluated comparatively and the model with the highest accuracy and efficiency ratio was selected for use in the mobile application. In addition, a panel has been developed in which users can get information about possible diseases that may be found in their chickens as a result of answering questions about the symptoms that can be observed in their chickens.

Poultry farming, which has been shown as one of the main economic activities of humanity for thousands of years, gains importance every year due to the advantages it provides for producers and consumers, and as a rapidly growing economic sector on a global scale, it is closely related to a large part of the world's population. Poultry farming, which stands out as an economic activity with a high-profit margin due to the competitive advantage that can be achieved even at local scales due to the low opportunity cost for the producers, is also frequently preferred by consumers due to its high nutritional value and relatively more economical conditions. Considering these reasons, it is seen that the demand for poultry farming is already increasing at exponential levels all over the world, and it is predicted that this trend will gradually accelerate in the future as well. So much so that since 1995, the demand for chicken meat in the world has doubled every 10 years; the egg and other poultry products market has achieved a growth of around one hundred and fifty percent on a global scale [2]. At the same time, the waste and other by-products generated after production are rich in elements such as nitrogen, phosphorus, calcium, and potassium that are necessary for soil quality and will increase product yield, a chicken produces 5 kilograms of waste that can be used as fertilizer annually, chemical agents rapidly pollute the currently limited resources. and due to reasons such as commercial fertilizers do not produce sustainable solutions for ecological balance, the poultry farming sector; gains a position that directly or indirectly affects the basic economic activities in many countries. In particular, the use of chicken manure in agricultural activities is expanding in Asia Minor and many African countries such as Pakistan, and Iran, where access to chemical fertilizers and reinforcing agents is limited [3].

As a sector that affects the entire food web in the ecosystem, poultry farming, like all other livestock sectors, is critically adversely affected by emerging animal diseases. As in many countries of the world, these diseases are viewed as the most important obstacle to sectoral development and competitiveness for Turkey. Although the breeders in Turkey do not have difficulty in reaching a certain quality in the final products to be exported, they lose their potential export opportunities due to widespread zoonosis and animal diseases and there are economic losses that will deeply affect the sector [1]. In addition, poultry diseases transmitted to other foods and water sources through agricultural processes in which the wastes produced by chickens are used as fertilizer pose a high danger to public health, especially to the people living in rural areas. Considering that poultry farming is in a more complex relationship with other economic activities, especially in developing countries where access to health services and protective measures is relatively inadequate, it is seen that this situation constitutes a major deficiency in terms of preventing epidemics that are currently on the agenda of the whole world. So much so that typhoid fever, which is a common chicken disease and a disease caused by Salmonella bacteria, has lost its power in countries such as the USA, Denmark, and Turkey, where the sanitary infrastructure has developed since the 2000s, but only in the border regions of Pakistan and Iran in 2017-2018. It has caused the death of hundreds of people by developing new mutations with a high mortality rate and antibiotic