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Chemical Effects of Light and Photography

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Abstract: ***This article discusses the chemical and biological effects of light and photography. Light is a form of energy known as electromagnetic radiation, and its expression at wavelengths and the unit of measurement, nanometer, is considered a separate characteristic. It ranges from very short wavelength to long wavelength radiation. Visible (normal / sunlight) light is the band of radiation that our eyes can see. Under the influence of light, the following processes can occur: the attachment of atoms to molecules, dissociation, photochemical reaction, synthesis reaction. This article discusses light and its chemical effects, as well as photography.***

Keywords: Photosynthesis. Photography, electromagnetic radiation, synthesis, photography, xerography, photography, photochemistry, eosin, erythrosine, methylene film.

I. INTRODUCTION

Any change in molecules is a chemical process. The chemical processes that occur under the influence of visible light and ultraviolet radiation are called photochemical reactions. There is enough light energy to destroy many molecules. This is the chemical effect of light. Photochemical reactions include: photosynthesis of carbohydrates in plants, decomposition of silver bromide in the photosensitive layer of a photographic plate, the formation of HCl when chlorine interacts with hydrogen in light, etc. Darkening of tissues and sunburn (darkening of human skin under the influence of ultraviolet radiation). can be examples of chemical exposure to light [1]. The modern scientific concept of light has evolved along with the development of light. As a result of this development of science, the camera and photography made photography a unique form of art. For example, the discovery of quantum physics led to the development of digital photography. In the center of the photo is the chemical effect of light. The word "photography" comes from the Greek words "foto" - light, "grapho" - drawing, writing.

Photography - painting with light, light painting - was not invented in a short time and not by one person [2]. The work of many generations of scientists from different countries of the world has been invested in this invention. People have long been looking for a way to get images that do not require a long and tedious work from the artist. Some conditions for this have existed for a long time.

II. MATERIAL AND METHODS

A. Photochemical Reaction

Reactions initiated by light are called photochemical reactions. The brighter the light, the faster the reaction. A photochemical reaction begins with the absorption of energy in the form of light. As a result of absorption of light by molecules, transitional excitation states arise, the chemical and physical properties of which differ significantly from the properties of the initial molecules. These new chemical compounds can decompose, transform into new structures, combine with each other or with other molecules, or transfer electrons, hydrogen atoms, protons or their electronic excitation energy to other molecules. Excited states are stronger acids and stronger reducing agents than the original ground states. The properties of photochemical reactions and excited states are also important in many industrial processes and devices. Both photography and xerography are based on photochemical processes [3]. For example, manufacturing semiconductor chips or printing newspapers.

B. The Process Of Photosynthesis

The most important chemical reactions under exposure to light and sun occur in many microorganisms, grasses, green leaves of trees and plants, giving us food and oxygen to breathe. Leaves absorb carbon dioxide from the air and break down its molecules into its constituents: carbon and oxygen. This occurs in chlorophyll molecules under the influence of the red rays of the solar spectrum. This process is called photosynthesis. Chlorophyll is a green pigment that accumulates in chloroplasts and in a fragile state together with protein substances. The presence of chlorophyll is a prerequisite for photosynthesis, that is, the formation of organic matter from carbon dioxide and water in the presence of sunlight. These energy-rich organic substances serve as food for all other organisms and ensure the existence of the entire organic world on Earth. In the past geological period, as a result of the photosynthetic activity of plants in the intestines and on the surface, huge reserves of reduced carbon and organic products have accumulated in the form of coal, oil, combustible gases, shale, peat, enriched with atmospheric oxygen.

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Photosynthesis can only occur under the influence of light of a certain spectral composition. The activities of the great Russian scientist K.A. Timiryazeva plays an important role in the study of the structure and significance of chlorophyll. The mechanism of photosynthesis has not yet been fully understood [4]. In conditions of photosynthesis, the presence of light-absorbing pigments (chlorophyll, etc.) in plants is used. it is the sequestration of carbon and carbon dioxide. Photosynthesis occurs in many microorganisms, grasses, green leaves of trees and plants, in chloroplasts, cell organelles that are responsible for photosynthesis. They are green due to the presence of chlorophyll, a green pigment that can form fragile compounds with protein substances. Under the influence of the red rays of the solar spectrum, the chlorophyll molecule splits the carbon dioxide absorbed from the air into carbon and oxygen atoms.

C. Basic Law of Photochemistry

One of the Vainyks contributions to the creation of real conditions for the creation of a method for converting an optical image into a chemical process in a photosensitive layer was this year's discoveries of the image of the young G. Schulze. In 1725, Bestuyev-Ryumin, who was preparing liquid medicinal compositions, discovered a change in the color of solutions of a single iron under the influence of sunlight. For two years, Posier Schulze proved that bromine salts are sensitive to light. Regardless of the grotto, a similar object, created in 1842. English scientist D. Herschel in 1843 American professor of chemistry D. Draper. That is why today the history of science is called the basic law of photoxymia, the Grotgus-Herschel-Draper law. Planck's theory has played an important role in the understanding and satisfactory interpretation of this law, according to which light is continuously studied by known and integral parts of energy assigned by quanta. Scientists and inventors from different countries began work on the chemical correction of the image of light in a pinhole camera only in the first third of the last century. The best results were achieved by the world famous Frenchmen Joseph Nisfor Nepsa, Louis-Jacques Mund Daguerre and Englishman William Fox Henry Talbot. They are considered the creators of photography. Nippes was the first in the world to fix the "sun chart". Focused on exploiting the hardening properties of asphalt when a thin layer is illuminated. In one of his experiments, Nips applied an asphalt solution of lavender oil to an abrasive pad that was placed in the sun under a transparent image. Asphalt varnishes in the areas of the plates with indistinct areas of the image of the mail were not exposed to sunlight and after exposure were melted in lavender oil. After processing and engraving, the plate is covered with paint. In the illuminated cloud, the varnish was doubled and the lavender oil washed away the unrefined areas of the varnish, resulting in a relevant image that was used as a cliché to copy from the original.

D. Photography

1) *First Staff In The World:* In the first third of the last century, scientists and inventors from different countries began targeted work on the chemical detection of light images in darkened cameras. The best results were achieved by the Frenchmen Joseph Nisfor Nips, Louis-Jacques Mandé Daguerre and the Englishman William Fox Henry Talbot, who are now famous all over the world. They are considered the inventors of photography.
2) *Painting by Niepce:* Leps was the first in the world to correct the "sun pattern". He focused on exploiting the properties of a thin layer of asphalt that hardens in illuminated areas. In 1826, using camera blackout, Niepce emerged from his workshop window on a metal plate covered with a thin layer of asphalt. He called the picture so - heliography (solar drawing). The exhibition lasted eight hours. The image was of very poor quality and the ground was almost invisible. But with that I started taking pictures.
3) *Talbot's Image:* In 1835, Talbot also recorded sunlight. It was a picture taken from the barred window of his house. Talbot used paper impregnated with silver chloride. The exhibition lasted an hour. Talbot received the world's first negative test. Attaching to it photosensitive paper prepared in the same way, he published a positive for the first time. The inventor called his method of shooting a calotype, which means “beauty”. Thus, he showed the ability to copy images and connected the future of photography with the world of beauty.
4) *Daguerre Photos:* Simultaneously with Niepce, the famous French artist Daguerre, the author of the famous Parisian diorama, worked on the method of fixing the image on an obscura camera. Working on the light images gave him the idea to correct the image. Together with Niepce Daguerre, he began work to improve heliography. By that time, the process was already reversed: a layer of silver was applied to the metal plates, and then the thoroughly cleaned surface of the silver was treated with iodine vapor. As a result of this treatment, a thin crystalline film of silver iodide that is sensitive to light is formed on the glass surface of the plate.

5) *Photos Fritzsche:* The first photographic images in Russia were taken by the famous Russian chemist and botanist, academician Julius Fyodorovich Fritzsche (1808 - 1871). These were photographs of plant leaves obtained by the Talbot method. At the same time, Fritsche proposed significant changes in this method. Fritsche's speech at a meeting of the St. Petersburg Academy of Sciences in 1839 was one of the first research papers on photography in our country and one of the first research papers on photography in the world.

E. Improvement and Development of Photography

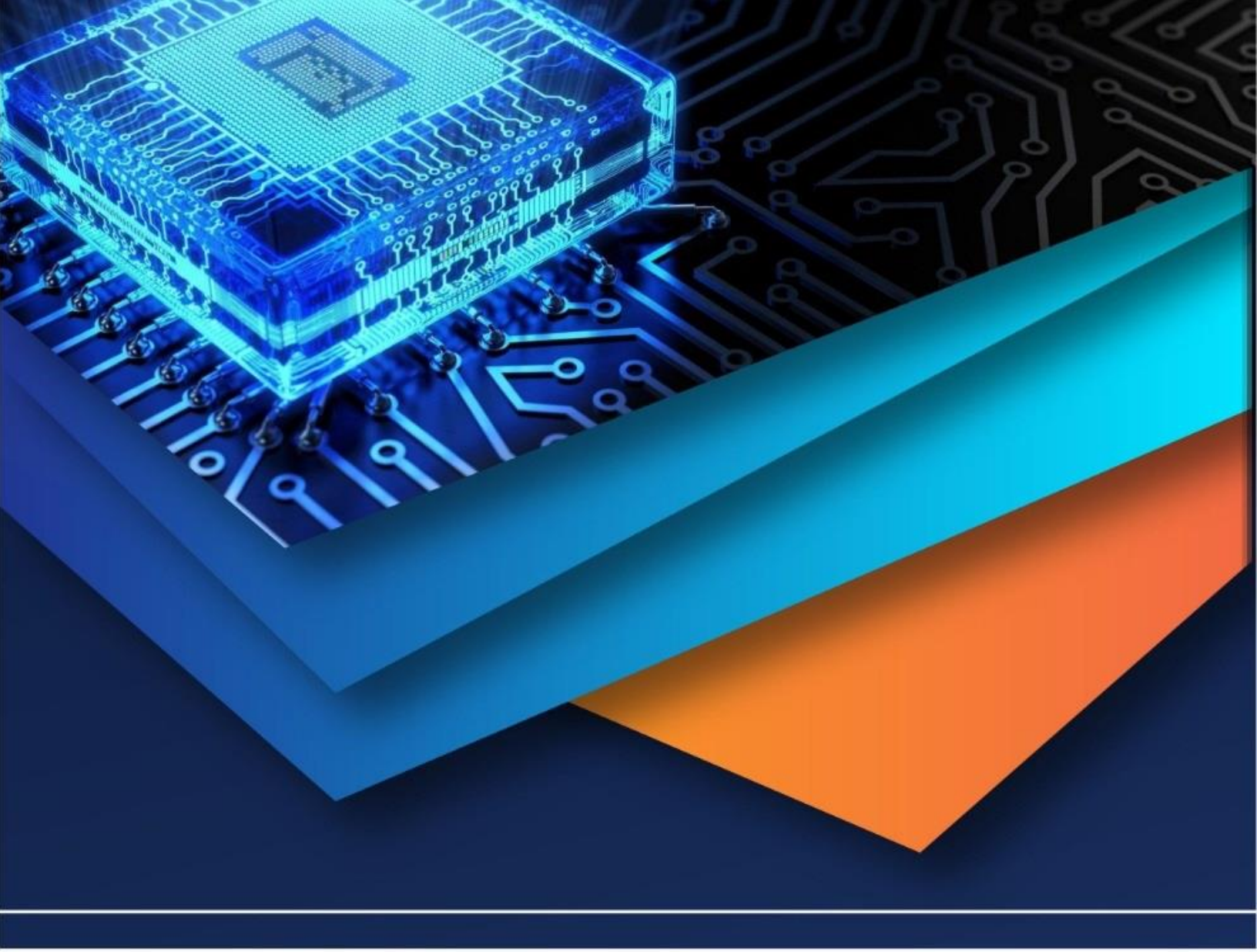
The success of photography was facilitated by the French physicists F. Fizot, A. Claude, the Hungarian J. Petzval, the Russian A. Grekov, the American S. Morse and many others. The daguerreotype period did not last long. The image on the silver plate was expensive, mirrored, copyable, and very difficult to see due to its brightness. The calotypic method had great advantages, so it was further developed. In the late 1940s, the inventor of the Niepce family, Niepce de Saint-Victor, used this method to replace the negative paper backing with glass coated with a layer of starch paste or egg white. The light was felt as a layer of silver salts. In 1851 the Englishman S. Archer covered the glass with collodion. Positives are printed on landscape paper. Photos could be repeated. More than twenty years later, Richard Maddox proposed photographing on dry bromine-gelatin plates. This improvement made the photo look like modern photography. In 1873 G. Vogel made orthochromatic plates. Later, anastigmatic lenses were developed. In 1889, D. Eastman began the production of celluloid films. In 1904, the first plates for color photography made by Lumiere appeared.

III. ANALYSIS AND RESULTS

The discovery and study of the phenomenon of photosensitization, which plays an important role in photobiological processes, helped to understand the mechanism of action of light. This phenomenon is the ability of certain substances to increase their photosensitivity. A number of dyes have such a photodynamic effect: eosin, erythrosin, methylene film, and others. Chlorophyll (in plants) and porphyrins (in animals) play the same role. An example of sensitivity to photographs is the following experiment. Photodynamic dyes are added to stop bacteria, cilia, or red blood cells. When these suspensions are dark, they have no effect on the substance. When the suspension is damaged, bacteria and cilia quickly die, and erythrocytes are hemolyzed. All of this is caused by the chemical and biological effects of light. Even today, the chemical reactions of light are widely used in industrial production and photography.

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