

INTEGRATION OF ISLAMIC RELIGIOUS EDUCATION AND NATURAL SCIENCE ON PHOTOSYNTHESIS EXPERIMENTS

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Abstract

Purpose: This study aims to determine the material integration of Islamic religious education and natural science on photosynthesis experiments.

Methodology: This research is library research. Data obtained from a literature review. The analytical method used is conceptual-descriptive.

Findings: The results of the study show that there are two topics of natural science material experiments closely related to scientific cues on QS. Yasin verse 80, QS. Nuh verse 16, and QS. Thaha verse 53. Those topics are about light and photosynthesis. Light (an-nur) is one of the names of letters in the Qur'an. Photosynthesis experiments can explain the relationship of light interpretation materially. Sunlight is the main source of energy for the life of all living things in the world. For plants especially those with chlorophyll, sunlight greatly determines photosynthesis. Photosynthesis is a basic process in plants to produce food. The food produced will determine the availability of energy for plant growth and development. Low light intensity has three choices, namely: reduction of respiration speed, increase in leaf area to obtain a larger surface absorption of light; and increased photosynthetic velocity per unit of light energy and leaf area.

Applications: This study can be used by Islamic education institution for education, research, and community services.

Novelty/Originality: This study is the integration between scientific cues and natural science experiment material.

Keywords: *Integration, Islamic religious education, natural science, photosynthesis.*

INTRODUCTION

Islamic religious education is compulsory for all levels of Indonesian Islamic formal educations. The Qur'an is one of the materials taught in Islamic Religious Educations. The Qur'an contains scientific cues that need to be interpreted. Natural science can be its alternative interpretation. Integration in education is very important. Knowledge is closely related to what is in the world and what is in the world is written in the Qur'an, as scientific cues. So, the integration of Islamic religious and natural science is one form of developing education in order to achieve educational goals.

The command to study science is found in the Quran Surah Al-A'raf verse: 58

وَالْبَلَدُ الطَّيِّبُ يَخْرِجُ نَبَاتُهُ بِإِذْنِ اللَّهِ رَبِّهِ وَالَّذِي خَبَثَ يَخْرِجُ إِلَّا نَكِدًا كَذَلِكَ تُصَرِّفُ الْآيَاتِ لِقَوْمٍ يَشْكُرُونَ

meaning:

"And good soil, the plants thrive with the permission of Allah; and infertile soil, the plants only grow miserable. Thus we repeat the signs (of our greatness) for those who are grateful"

According to [Shaykh Thanthawi Jauhari](#) said that the verse explained the majesty of Allah SWT. In the explanation in his interpretation, he called on Muslims to study the science of plants, both men and women from now on, in order to become caliphs on earth, and began to study the sciences in a good way from basic, middle, up, like residents of Yaman, Europe, and America.

Plants are identical to the green color. This shows that the plant is chlorophyll. Plants that chlorophyll undergo a process of energy transfer, from solar energy is converted into chemical energy commonly called the photosynthesis process. In this process, sunlight energy (photon energy) is captured and converted into chemical energy ([Wirahardikusumam, 1985](#)). Photosynthesis is the opposite of the respiration process. In the photosynthesis process that is reacted in the form of CO₂ and H₂O into sugar with the help of sunlight energy. Richmond (Edward, 2010) says that light is the main requirement of microalgae because phototrophic organisms use light as energy. Light is one of the photosynthetic rate factors because the absorption of light by pigments affects the division of photosynthate to other parts of the plant ([Baharsjah in Saifulloh, 2017](#)).

Photomorphogenesis is the growth and development of plants that are directly controlled by light and not photosynthetic dependent ([Ting, in Saifulloh, 2017](#)). This study aims to provide a link between learning Islamic education with natural science. This integration is possible because the influence of photosynthesis in science is also found in the Qur'an. That way this research will link the two.

LITERATURE REVIEW

Strategies to Main Redox Homeostasis During Photosynthesis Under Changing Conditions

Electron transport combined with ATP production, further reactions are needed to adjust the amount between NADPH and ATP with actual. Turnover D1, statistics, releasing non-photochemical energy, xanthophyll cycles, cyclic electron transport, chlororespiration, and Mehler reactions are some chloroplast poisoning systems, which are often used to increase electricity flow. The next pathway, involving cell compartments, such as malate valves, alternative oxidases (AOX), cycle Q in the electron transport chain, and photorespiration, also contributes and produces a flexible ATP / e ratio. During photosynthesis, the flux is adjusted continuously for each step depending on usage. Whereas the redox cycle is the basis, fine-tuning by individual metabolism in each case that is used as a forward feed or feedback. So there are general principles in this fast and flexible basic system.

Diffraction of laser: Tafsir from "light upon light"

This research is to provide a laser diffraction process that correlates closely with the meaning supported by "Light on the Light" in QS. An-Nur verse 35 through orthopraxy studies. Light is passed through a very small hole, a diffraction process can occur. In diffraction, white light will be adjusted according to the wavelength made from alcohol. in the Huygens principle, each light will become a new light source. In physics, the process of light sources is called "Light on the Light".

Lessons from nature about solar light harvesting

Photosynthesis is highly regulated by the rate of reaction and needs to be changed to overcome the variations in daily light and to overcome environmental stresses that successfully fix CO₂. Indeed, even plants that grow faster than using stimuli are absorbed by light-harvesting complexes. Photosynthetic light-harvesting complexes are multi-chromophoric assemblies that are used to complement and focus photo-stimuli under the associated radiation to be sent to the reaction center. They provide an exceptional model system to facilitate the planning of energy transfers in well-defined structures.

Comparison of Photosynthesis Speed on Green Mustard Plant (Brassica Juncea) by Organic and Inorganic Fertilizers

The results of the study increased the oxygen pressure of plants (mustard greens) which were fertilized in a bright reaction of 0.123hPa / s while in plants (mustard) which were given inorganic fertilizer of 0.028hPa / s, it was seen that organic plant oxygen pressure was greater compared to inorganic plants so that the speed of photosynthesis of plants (mustard) with organic fertilizer is faster than plants (mustard) with inorganic fertilizers. In the dark reaction, the average oxygen pressure of an organic plant experiences a decrease to -0.104 hPa/s while in an inorganic plant -0.037hPa /s.

Carbon metabolite feedback regulation of leaf photosynthesis and development

Feedback regulation of photosynthesis serves to balance the flow of carbon in order to ensure growth, survival, and completion of the life cycle through the optimized allocation of resources. The feedback mechanisms are complex and interactive probably involving the integration of numerous signals that arise from carbon and nitrogen metabolism downstream photosynthesis. The regulation of glycolytic carbon flow by nitrogen is an obvious source of signals that signal carbon to nitrogen balance. Thereregulationalsooperates at the whole leaf level in terms of leaf development and senescence. Such complex mechanisms that underpin the regulation of metabolism provide tools with which to engineer changes in the activities of numbers of enzymes that are likely to be necessary to achieve significant changes in metabolic flux.

The Affect of Intensities of The Light and The Types of Soil on The Growth and Yield of Green Bean(VignaRadiatalL.)

The intensity of light is different from the type of soil that can increase vegetative growth of plants and flower growth, this is evidenced by the speed of flowering in green bean plants at a light intensity of 45% faster than the light intensity of 100% and 25%. The light intensity of 45% is able to provide optimal light requirements in green bean plants which can increase plant growth and growth. Related to green bean plants require light that is in accordance with the needs of the plant, if the light needed to be absorbed, the flower formation will increase if the plant is too full to receive light and will also be faster in the formation of green bean plant flowers. This plant containing green beans is a C3 plant that requires light in less than 12 hours. Also states that C3 plants only request radiation for a maximum of 12 hours so that the plants can flower. In addition, the intensity of light that is too high will affect the activity of leaf stomatal cells in reducing transportation so that plant growth is inhibited, while the intensity of light that is too low will produce photosynthetic products that cannot increase plant growth is inhibited ([Sudomo,insaifullah 2009](#)). Other factors that influence growth and development are genes and hormones ([Sudjadi in Saifullah 2006](#)).

EFFECT OF WATER AVAILABILITY ON GROWTH OF GREEN BEAN (Phaceolusradiatus)

The availability of water in green bean plants influences physiological and metabolic processes in plants. The plant's first response in response to a condition of water deficit or severe water stress is to close the stomata. Closure and/or narrowing of the stomata inhibits photosynthesis. The second response is a decrease in leaf chlorophyll concentration

and lack of water that will affect the content and organization of chlorophyll in chloroplasts in tissues. The effect of water stress on plant growth is reflected by smaller leaves.

The Effects of Light Intensities and Daminozide Concentrations on the Climate and the Growth of Potted Chrysanthemum

The results of the research showed that, (1). Seventy-five percent of light intensity (25% of shading) gave optimum light intensity, air temperature, and relative humidity to the growth of the plant. (2) There was an interaction effect of light intensities and daminozide concentrations mainly on leaf area and relative growth rate. (3) Fifty-five percent of light intensity and 500 ppm daminozide concentration produced the shortest plant and the faster appearance time of the first branch. (4) Two hundred and fifty part per million daminozide concentration produced the highest results in the number of leaves per plant and dry weight of shoot.

The Ferredoxin/Thioredoxin System of Oxygenic Photosynthesis

The photosynthetic Fdx/Trx system, a regulatory mechanism linking light to the activity of associated enzymes, allows an organism to use absorbed light-energy efficiently in a spectrum of biosynthetic reactions related to the assimilation of carbon dioxide and the formation of cellular energy reserves in the form of starch or other storage products.

METHODOLOGY

This research method uses a literature study that aims to obtain information and integrate science and Islam. Steps taken include collecting library data, reading and recording things related to the study, and comparing the literature which is then processed and yields conclusions. The data used are secondary data derived from textbooks, scientific article journals, literature reviews that contain the concept under study. Read the abstracts of existing research to ascertain whether the problems discussed are in accordance with the discussion to be solved in the study. Record important parts of the literature relating to research problems. Then conclude and integrate these studies.

RESULTS

Q.S Yassin verse 80:

الَّذِي جَعَلَ لَكُم مِّنَ الشَّجَرِ الْأَخْضَرِ نَارًا فَإِذَا أَنْتُمْ مِنْهُ تُوقِدُونَ

Which mean :

"That is God who made you fire from green wood, then suddenly you lit (fire) from the wood".

In the above verse, there is a scientific meaning assessed by [Zaghlul an-Najjar](#) that the value of the verse makes the tree green as a source of fire. Where the verse seems contradictory because fire can be raised (in certain ways) from trees that are still green (wet and moist) which will actually make the fire itself die. According to [Zaghlul an-Najjar](#), this surah describes a very exciting process that occurs only in green plants which is commonly referred to as photosynthesis. Where in science the process requires the help of sunlight and involves CO₂ and H₂O which after oxidation produces glucose and oxygen.

Living things on earth need oxygen to breathe and glucose for their energy intake. And carbon dioxide is produced from the respiration process of living things, vehicle smoke, factory smoke. In order to be able to change carbon dioxide, it requires the role of chlorophyll which is owned by plants that are green. Dye stuffs that cause green plants are very important in photosynthesis. Where the process can convert carbon dioxide into oxygen.

Krofil is termed [Zaghlul an-Najjar](#) *asyukhtur* and calls chloroplasts as *plastids*. *Plastids* are one of the cell organs (algae or plants). This organelle is known as its common form, chloroplasts, as the site of photosynthesis. The organ plastids are owned by plants only and have double membranes so that there are an outer membrane and a deep membrane in the leaves of plants. Chlorophyll in chloroplasts is formed with the help of sunlight which is used as a decomposition of water in oxygen gas. The above verse explains the amazing scientific facts about the biosynthesis process or what we commonly know as photosynthesis.

Based on the book in one of the essays, [Zaghlul an-Najjar](#) explained the scientific verses understood by desert people at the time of Rasulullah (saw). The meaning of *syajadoh* is firewood or *affar* and *markh* tree. And he understands that the verse explains the energy derived from organic materials that will be made into oil or gas such as coal, firewood, charcoal, straw. All types of energy derived from organic materials are the result of photosynthetic processes from green plants.

God gives plants the ability to store solar energy and then is used to synthesize water. Plants take carbon dioxide gas through photosynthesis and photosynthesis in the form of oxygen will be used by humans and animals to breathe. This process occurs in energy exchange between plants and humans and animals.

Thus it can be concluded that in the verse there is a meaning that explains photosynthesis as explained by [Zaghlul an-Najjar](#). Where is the meaning *"That is God that makes you fire from green wood"* stores the implicit meaning that is where

firewood comes from green plants (chlorophyll), and plants that chlorophyll carry out photosynthesis? In this process, there is an exchange of energy from carbon dioxide and water with sunlight so that it can become oxygen and glucose that is needed by living things. And what can regulate it is only from the will of God. Humans can make green paint but to make chlorophyll only God can create it. The verse also shows one of God's grace.

After the verse explains about photosynthesis there are verses that can affect growth. Where plant growth is regulated through the process of photosynthesis rate. The main factors of photosynthesis are light, water, and nutrients in the soil (nutrients). These factors are also found in the following verses:

Light: The need for light as a source of life energy for living creatures that exist on this earth has been implicitly explained by Allah SWT in Al-Qur'an surah Nuh verse 16:

وَجَعَلَ الْقَمَرَ فِيهِنَّ نُورًا وَجَعَلَ الشَّمْسَ سِرَاجًا

meaning:

"And He made the moonshine in Him and He made the sun a lamp" (QS Nuh: 16)

The above verse explains that the sun as a lighted lamp, in the science of the sun is a source of light, in contrast to the moon which only reflects light from the sun, the sun is radiating to the earth so that people can see objects that are affordable by their eyepiece (Shihab, 2002). The above verse also shows that humans need light to be able to see so that they can carry out the activities of life, as well as plants that need light as energy for photosynthetic activity. From the results of Saifulloh's research (2017) Based on the response of plants to the duration of sun exposure, plants can be classified into three groups. First, long day plants such as alfalfa, barley, wit and so on. These plants can flower for 13 hours or more.

Second, short-day plants are called C3 plants such as rice, beans, soybeans, nuts and so on. These plants for flowering require sunlight for a maximum of 12 hours. Among the two groups of long day plants and short days, there is a third group, namely neutral day plants. Neutral plants are flowering processes not affected by the duration of the sun's radiation, for example, neutral plants are cabbage, corn (Ashari, in Saifulloh, 2017).

Treatment of different light intensities in several types of soil to plant height occurred interaction at the age of 4MST. Light intensity is 25% better than 100% light intensity on regosol soil. This is caused by the absorption of sunlight which is only slightly focused on the growth of plant height quickly. However, for growth and development, it is better not only on plant height. Light intensity that is too high will affect the activity of leaf stomata cells in reducing transportation so that it can cause growth retardation in plants, while light intensity that is too low will produce photosynthesis products that are not maximal which results in stunted plant growth.

From the research above the intensity of light gives different effects on the type of soil used. If the intensity is too high or too low, it will affect the process of growth and the rate of photosynthesis. And if there is no light at all, photosynthesis will not occur. Given that the photosynthesis process goes through the energy of sunlight. It can be concluded that sunlight is very important for the rate of photosynthesis with an appropriate portion.

Water Against Growth and Photosynthesis: Water is one element that also plays a role in photosynthesis. This is because water is the source of life. The discussion of water is explained in the words of Allah Q.S Thaha verse: 53

الَّذِي جَعَلَ لَكُمُ الْأَرْضَ مَهْدًا وَسَلَكَ لَكُمْ فِيهَا سُبُلًا وَأَنْزَلَ مِنَ السَّمَاءِ مَاءً فَأَخْرَجْنَا بِهِ أَزْوَاجًا مِنْ نَبَاتٍ شَتَّى

meaning:

"He who has made for you the earth as hope and made for you on the earth traveled, and sent down to you on the earth walk and bring down from the sky the rain. So we grow it with rainwater of various types from various plants "

From the verse above Thanthawi Jauhari explains that in this verse is a miracle of plants. He said that "From fertilizer, then from something small and weak can become big and green. This is due to rain or drizzle which even though the spill can make it resistant to moisture.

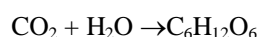
Based on the explanation, he discussed the biological process of plant growth from seeds to green trees. With the presence of chlorophyll in chloroplasts absorption of sunlight is converted into chemical energy, and chemical energy is mixed with water that is absorbed by the plant and the capture of carbon dioxide in the environment turns into oxygen and glucose then beneficial for living things on earth.

According to Felania (2017) Growth is a balance between carbon acquisition and expenditure in respiration. In drought conditions, the balance of plants undergoes changes that can lead to disruption to growth (Felania, 2017). Water availability is one of the abiotic factors that can interfere with plant growth. If the water content is insufficient for the plant, the water that becomes the raw material for photosynthesis will be applied to the substances produced because the transport of nutrients in the leaves will be hampered. According to (Song, Nio and Banyo, Yulia in Felania, 2017) it is usually

indicated by the decrease in leaf chlorophyll concentration. Due to the decrease in chlorophyll concentration in leaves when lacking water is related to photosynthetic activity and decreases the rate of photosynthesis in plants, and the chlorophyll organization in chloroplasts in plant tissues is also affected. The availability of water in the growth process affects the physiological and metabolic processes in plants. The first response when the water deficit condition is limited is by closing the stomata. Stomatal closure carbon dioxide resulting in decreased concentrations in the leaves, which can result in inadequate intake of carbon in the leaves so that the plant experienced a decline in growth and the longer it will die as the process of the photosynthesis inhibited (Anggriani, Novita et al, 2015). The second response is the decrease in leaf chlorophyll concentration reflected by smaller leaves (Felania, 2017).

From the research of Felania (2017) in the influence of water for plant growth, growth is very much related to the process of carbon in photosynthesis and its output. Water shortages result in the enclosure and/or constriction of stomata which ultimately inhibit photosynthesis. From the results above it can be concluded that water is very important in photosynthesis. Where the water in the Qur'an is also explained as a source of life, and photosynthesis is a process that greatly influences the growth of plants that produce oxygen which is needed by living things.

Type of soil (nutrients contained in it): Besides light and water, soil also affects photosynthesis in plants. According to Hasbiah ST and Farhatul Wahidah Giving fertilizer can increase nutrients in the soil, both micro and macronutrients that can help in various metabolic processes in plants, one of which is photosynthesis. Photosynthesis is a biochemical process of carbohydrate formation by plants, especially in plants that contain chlorophyll. These plants photosynthesize using nutrient, carbon dioxide, and water and with the help of light energy (Hasbiah and Wahidah, 2003). Carbon (C), Oxygen (O₂) and Hydrogen (H) are ingredients for the formation of plant body tissues, which form H₂O, H₂CO₃, and CO₂. Carbon is an important ingredient in building organic matter because the dry matter in plants consists mostly of organic matter. Carbon Element (C), absorbed in the form of CO₂ gas which is then used in photosynthesis:



Without CO₂ the process will be hampered so that the growth and production of plants will also be hampered. Just as with the element Carbon (C), Hydrogen (H) is also the main element of the development of organic matter, the element H is absorbed by plants in the form of H₂O.

According to [Hasbiah and Wahidah \(2003\)](#) The results of the study increased the oxygen pressure of plants (mustard greens) which were fertilized in a bright reaction of 0.123hPa / s while in plants (mustard) which were given inorganic fertilizer of 0.028hPa / s, it was seen that organic plant oxygen pressure was greater compared to inorganic plants so that the speed of photosynthesis of plants (mustard) with organic fertilizer is faster than plants (mustard) with inorganic fertilizers. In the dark reaction, the average oxygen pressure of an organic plant experiences a decrease to -0.104 hPa/s while in an inorganic plant -0.037hPa /s.

From these data, it can be seen that the decrease in oxygen pressure on plants (mustard) which is fertilized organically is greater than that of plants (mustard) which are given inorganic fertilizer where if the greater the number of oxygen pressure decreases, the faster the plant enters the dark reaction phase.

The above research shows the importance of nutrients in the photosynthesis process. That way, if the elements needed in photosynthesis are available in a soil, the photosynthesis process will be faster so that the type of fertilizer is also noticed.

CONCLUSION

The results of the study indicate that in the growth of photosynthesis process discussed in science and it is also in the language of the Qur'an the letter Yasiin verse: 80 with implicit meaning which is then clarified by the interpretation of [Zaghlul an-Najjar](#) and [Thanthawi Jauari](#) all that grows through a process that is invisible to the eye and all that shows signs of the greatness of Allah SWT. And in the photosynthesis practicum above there are several factors that affect the rate of photosynthesis which is also discussed in fragments of the Al-Qur'an verse. Explanation of the fragments above shows that the link between science and science in the Qur'an is very close. Even in the Al-Qur'an there are also applications that can be applied in everyday life. Thus learning Islamic Education can be integrated with learning Natural Sciences, especially in photosynthesis practicum.

LIMITATION AND STUDY FORWARD

This study has limitations which are still only literature research and have not been experimented on in this study. This research needs to be carried out in further research, which consists of research in more research or simple experiments related to this research in order to strengthen this research.

CONFLICT OF INTEREST AND ETHICAL STANDARDS

This research contains no conflict of interest with the current organization and no unethical practices followed during the study.

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