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Mini Review

Breaking the "Photosynthesis Problem" into Separate Light and Dark Units Leads to an Environmental Catastrophe and the Death of Earth's Civilization

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Abstract

Human agricultural activity is in antagonistic contradiction with the evolutionary development of land plants. The excessive use of mineral fertilizers takes a special place in this contradiction, thus leading to an environmental catastrophe and the death of Earth's civilization. The key negative value for understanding of this issue was separation of the photosynthesis problem into light and dark processes in studies held in the eighties of the 20th century. As a result, the research on photosynthetic carbon metabolism stopped globally, which made it impossible to understand the mechanisms of photosynthesis regulation and assimilate export from plant leaves under changing conditions. The author presented his concept on this issue and substantiated the ways out of this situation.

Introduction

In the early eighties of the 20th century, the photosynthesis problem was artificially divided into two separate and independent directions, the light and dark processes. For that reason, I was not allowed then to present a report on photosynthetic carbon metabolism to the conference on photosynthesis. Consequently, research on photosynthetic carbon metabolism has almost stopped throughout the world. The research of photo process mechanisms has not progressed much due to plants productivity since it is their nature to protect the chloroplast structures from photo destruction by excess energy of light quanta. As we know, plants use only one percent of quantum energy during photosynthesis. The rest is dissipated. Therefore, photo processes are not directly related to the production processes regulation.

Yet, at the same time, our research has proved [1,2] that the key link in photosynthesis regulation is extracellular (in the plant leaf) enzyme invertase, not chloroplast. It increases the osmotic capacity of the extracellular water media in the leaf (with reduced light, increased nitrate nutrition or removal of some plant organs consuming photosynthesis products), hydrolyzing the transport product of photosynthesis - sucrose. As a result, the stomata close and reduce the CO_2 flow into the leaf, harmonizing the light and dark processes of photosynthesis [3,4].

The change in the pH of apoplast solution has a specific effect on invertase, which depends on the degree of carbohydrate direction of photosynthesis metabolism in mesophilic cells due to disbalance of the light and dark photosynthesis products formation in the leaf. The link of metabolism with the export function of leaf is the main instrument of photosynthesis regulation in vivo. This knowledge allowed us to substantiate immediately the origin of occurrence and development of the environmental disaster on Earth due to the excessive amount of mineral fertilizers used in agriculture, which are washed out of the soil into rivers, seas and oceans, leading humanity to an environmental disaster [5]. The increased amount of mineral fertilizers (primarily nitrates) in the ocean water increases the non-carbohydrate direction of photosynthesis in algae and in the ocean (World map) Figure 1.

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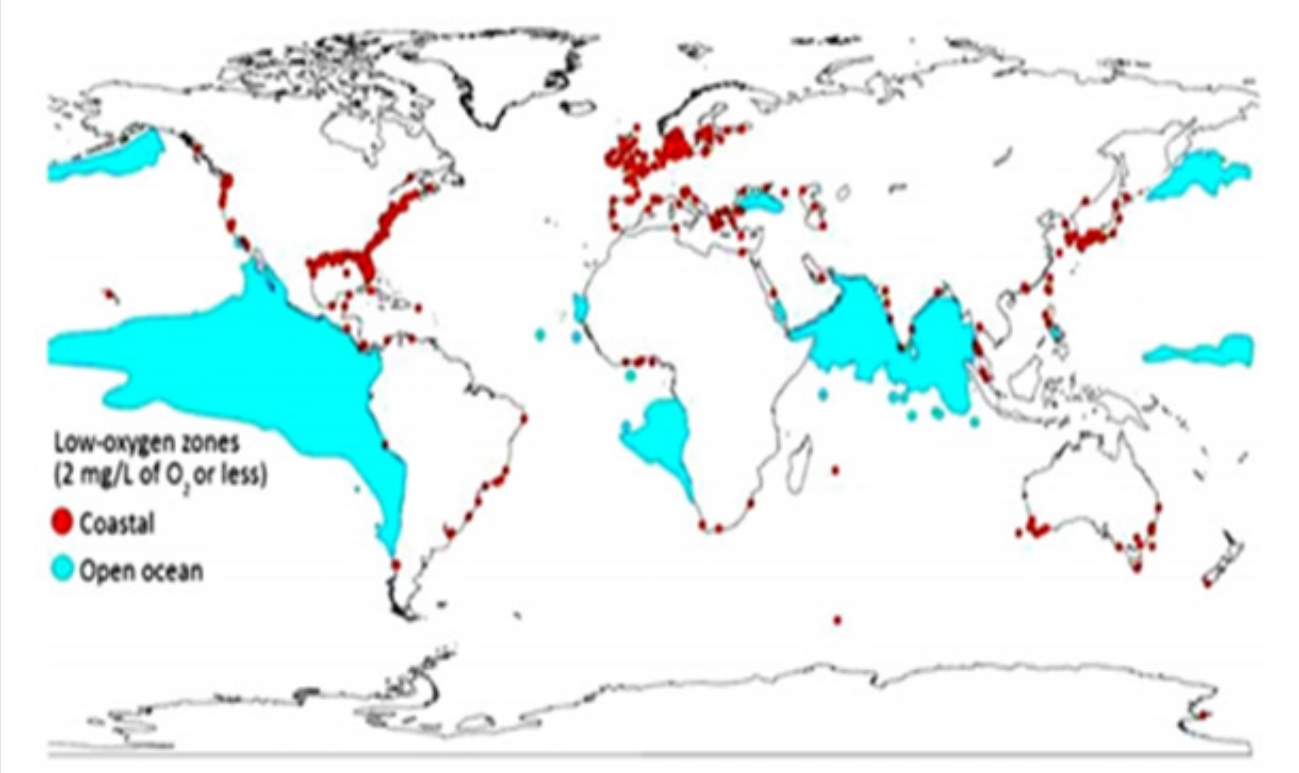

Figure 1: World map with dead zones in the ocean. Low oxygen zones are spreading around the world. Red dots indicate locations on the coast where oxygen has fallen to 2 milligrams per liter or less, and blue areas indicate areas with the same low oxygen content in the open ocean. (RJ Diaz/phys.org).

World map with dead zones in the ocean. Low oxygen zones are spreading around the world. Red dots indicate locations on the coast where oxygen has fallen to 2 milligrams per liter or less, and blue areas indicate areas with the same low oxygen content in the open ocean. (RJ Diaz/phys.org). This causes relative reduction in oxygen formation in water (while ocean is the main supplier of oxygen to the atmosphere) and makes algae (with a high protein content) a good food for bacteria, which feed on the algae tissues and consume oxygen in the water, hindering the life of marine animals. Which is most important, they reduce CO_2 fixation by shellfish during shell synthesis and limy earth formation, this is the main way to reduce CO_2 in the atmosphere. The result is the disappearance of the Great Barrier Reef in the Pacific Ocean. Meanwhile this particular Reef served as a barrier to tsunami wave on its way to Southeast Asia.

Excessive use of mineral fertilizers in agriculture (primarily nitrates) not only washes them out of the soil into rivers and further into the ocean, but also is carried away by the wind to the forests with the dust. By the same mechanism, nitrates inhibit the export of sugars from leaves to roots and thus reduce the weight ratio of roots/leaves in trees. Under these conditions, the flow of water from the soil to the leaves also decreases. Water is transported up only through the bark tissues instead of transportation along the entire stem. Thus, trees become more drought and fire unstable. Xylem dries and bursts into flames first at the slightest fire situation due to its dry and dead cells. We offered a way out, that is an immediate cessation of the use of mineral fertilizers, activation of sugars outflow from leaves to roots, and symbiosis of plants with microorganisms. Therefore, it is required to suppress (complex compounds with ammonia) the activity of apoplast invertase and increase sugars flow to the roots. In response to final changes in biochemical and structural processes caused by fertilizers already in the ocean (including the difficulty of mollusc sections formation), sea currents direction and speed change. We can see it in the radical change of the Gulf Stream (see Google - "The future of the ocean: The Gulf Stream made a hole in the global warming") and, as a result, our weather. All the above disrupts the place and strength of dynamic pressure on the Earth's crust, resulting in an increased volcanic activity. Therefore, the concentration of oxygen reduces, while carbon dioxide concentration increases in the atmosphere, which tends to the exhaled concentration of CO_2 (4%) in land animals. Proximity to this value (which, as you can see, is quite near) will obstruct cell decarboxylation during respiration and cause death of all animals on Earth Figure 2.

Figure 2: Australia on fire.

Dead animals (especially in ocean deeps) will become oil fields in billions of years. Why? Further decomposition of dead bodies by aerobic microorganisms is possible, but in the absence of oxygen in the atmosphere it will be gradual oxygen withdrawal from more oxidized compounds. While released energy and certain organic compounds will be used for own metabolism. Our long-term research of photosynthesis regulation mechanisms allowed us to find a way out of this situation [3,4]. We developed and proposed the ways to change the agrotechnics of growing agricultural plants without fertilizers, which increase soil fertility without reducing the production process (by increasing the organic matter mass and symbiosis of plants with soil microorganisms). After all, the 2-meter black soils of Russia were formed in nature without any fertilizers. For the last 100 years, half of the organic matter of our black soils was lost [6]. To restore them, we only need to direct more photosynthetic products to the roots. And most importantly, this would not reduce photosynthesis since photosynthesis depends on the "demand" for photosynthetic products. The more is "demand", the more is photosynthesis [7].

So, if humanity wants to continue its existence, then it is necessary to stop the production of mineral fertilizers, which spends about half of all human energy resources, to develop symbiosis of plants with microorganisms and to increase the export of sugars from leaves to roots by suppressing apo plastic invertase in the leaves. The rationale for this concept is found in our cited works.

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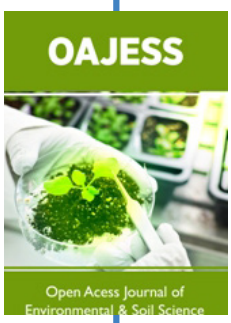

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