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Artificial Oxygen Generator A Review

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Abstract:
Artificial oxygen generator is a process that can be applied to human body that will be able to transport oxygen where RBCs cannot reach at present. It is simply the RBCs substitute. Artificial oxygen generator or carrier is not the blood substitute but they serve to carry oxygen to tissues and are hemoglobin based on perflorocarbon.

Keywords: Artificial oxygen carrier, perflorocarbon- based oxygen carrier, hemoglobin- based oxygen carrier, etc

I. INTRODUCTION

Oxygen is an element on the periodic table. It is the third most common substance in the universe, although given the first two substances (hydrogen and helium) make up 99% of the atoms in the universe this statistic doesn't mean much. While we can extract oxygen from various substances chemically (such as splitting water into hydrogen and oxygen), there is no such thing as "artificial oxygen". The closest we could ever come to creating "artificial oxygen" would be to atomically alter an atom of one element such as hydrogen or helium so that its atomic structure resembles oxygen. This differs from methods for extracting oxygen as you would be creating entirely new atoms of oxygen that never before existed in the universe (as well as losing atoms of the original substance). Whilst theoretically possible, we can't yet actually do this - at least not on a commercial scale. When we can, we will be able to change any sort of substance from one atom to another, for example creating gold from lead! This is atomically very similar. This has actually been done already, but not on an economically viable scale. Even then, these new atoms would not be artificial substances; they would be normal atoms of the substance, just created by humans and not inside a star as occurs in nature.

II. METHOD

As stated, Artificial Oxygen Carriers do have the ability to dissolve significant amount of oxygen and carbon dioxide. With this, they improve the oxygen transport and oxygen unloading to the tissue. It can prove to be an alternative for filtering genetically different blood. Uses: Artificial oxygen carrier has been developed for two main purposes.

1) As bridge oxygenators, they function as alternative to blood transfusion as mentioned above.
2) Improvement of tissue oxygenation of organs with poor blood supply comprises the second important application. Also, it improves tissue oxygenation and function of organs with limited oxygen supply. Remember though, that it is only a substitute, and not a complete replacement. The difference between the red blood cells and Artificial Oxygen Carriers is that the AOC's are a much smaller molecule, smaller than the red blood cells, and can squeeze through capillaries that are smaller than the red blood cells, which is beneficial to people with smaller veins that need the help.

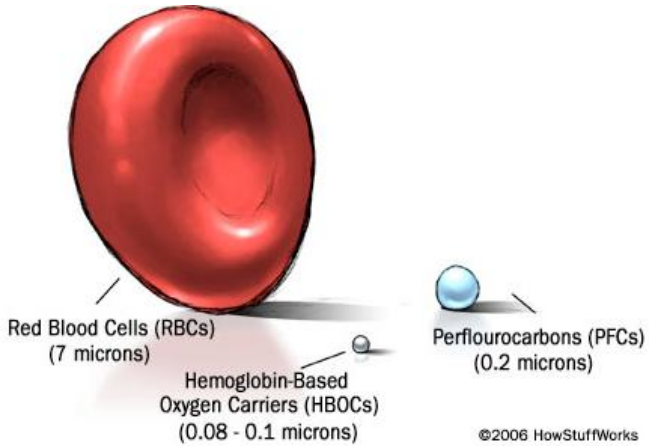

FIGURE.1. METHOD

A. *Abbreviations and Acronyms*

HBOCs – Hemoglobin-based Oxygen carriers
PFCs- Perflourocarbons

III. CHARACTERISTIC OF AOC

Blood transfusion systems have greatly benefited human health and welfare. Nevertheless, some problems remain: infection, blood type mismatching, immunological response, short shelf life, and screening test costs. Blood substitutes have been under development for decades to overcome such problems. Plasma component substitutes have already been established: plasma expanders, electrolytes, and recombinant coagulant factors. Herein, we focus on the development of red blood cell (RBC) substitutes. Side effects hindered early development of cell-free hemoglobin (Hb)-based oxygen carriers (HBOCs) and underscored the physiological importance of the cellular structure of RBCs. Well-designed artificial oxygen carriers that meet requisite criteria are expected to be realized eventually. Encapsulation of Hb is one idea to shield the toxicities of

molecular Hbs. However, intrinsic issues of encapsulated Hbs must be resolved: difficulties related to regulating the molecular assembly, and management of its physicochemical and biochemical properties. Hb-vesicles (HbV) are a cellular type of HBOC that overcome these issues. The in vivo safety and efficacy of HbV have been studied extensively. The results illustrate the potential of HbV as a transfusion alternative and promise its use for other clinical applications that remain unattainable using RBC transfusion.

IV. DISADVANTAGES OF ARTIFICIAL OXYGEN CARRIER

Hemoglobin-vesicles (HbV) or liposome-encapsulated hemoglobin (LEH) are artificial oxygen carriers that mimic the cellular structure of RBCs. In contrast to other liposomal products containing antifungal or anticancer drugs, one injection of HbV in place of a blood transfusion is estimated as equivalent to a massive dose, such as several hundred milliliters or a few liters of normal blood contents. The fluid must therefore contain a sufficient amount of Hb, the binding site of oxygen, to carry oxygen like blood. Encapsulation of Hb can shield various toxic effects of molecular Hbs. On the other hand, the liposomal structure, surface property, and the balance between the stability for storage and blood circulation and instability for the prompt degradation in the reticuloendothelial system must be considered to establish an optimal transfusion alternative.

V. LITERARY SURVEY

Oxygen is the most essential requirements of life, without which organisms could not survive on this Planet. Not only oxygen is the key to cellular respiration in all aerobic organisms, but also it has medical uses including oxygen therapy, high-pressure treatmnent, and protective suits for space and deep sea exploration. Artificial Oxygen generation can prove to be a "boon" for all of us. Since ages efforts have been made in this field. Following are some of the major advances made towards artificial generation of oxygen:

Artificial photosynthesis:

It is a chemical process that replicates the natural process of photosynthesis, a process that converts sunlight, water, and carbon dioxide into carbohydrates and oxygen; as a copy of a natural process it is biomimetic. The term, "artificial photosynthesis", is commonly used to refer to any method for capturing and storing the energy from sunlight in the chemical bonds of a fuel (a solar fuel). Photo catalytic water splitting converts water into hydrogen ions and oxygen, and is a major research topic of artificial photosynthesis. Light-driven carbon dioxide reduction is another process studied, that replicates natural carbon fixation. Research of this topic includes the design and assembly of devices for the direct production of solar fuels, photo electrochemistry and its application in fuel cells, and the engineering of enzymes and photoautotrophic microorganisms for microbial biofuel and biohydrogen production from sunlight. The following figure shows a photoelectric cell in a lab environment. Catalysts are added to the cell, which is submerged in water and illuminated by simulated sunlight. The bubbles seen in front of the cell are nothing but oxygen while those formed on back of the cell is hydrogen.

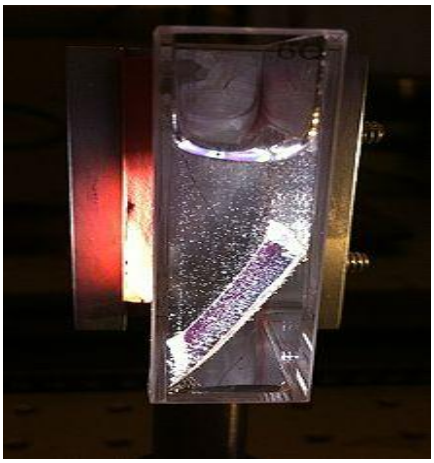

Figure.2.Artificial photosynthesis:

Artificial photosynthesis was first anticipated by the Italian chemist Giacomo Ciamician during 1912.[13]

In a lecture that was later published in Science [14] he proposed a switch from the use of fossil fuels to radiant energy provided by the sun and captured by technical photochemistry devices. In this switch he saw a possibility to lessen the difference between the rich north of Europe and poor south and ventured a guess that this switch from coal to solar energy would "not be harmful to the progress and to human happiness."[15] During the late 1960s, Akira Fujishima discovered the photocatalytic properties of titanium dioxide, the so-called Honda-Fujishima effect, which could be used for hydrolysis.[16] The Swedish Consortium for Artificial Photosynthesis, the first of its kind, was established during 1994 as collaboration between groups of three different universities, Lund, Uppsala and Stockholm, being presently active around Lund and the Ångström Laboratories in Uppsala.[17] The consortium was built with a multidisciplinary approach to focus on learning from natural photosynthesis and applying this knowledge in biomimetic systems.[18] Research of artificial photosynthesis is experiencing a boom at the beginning of the 21st century.[2] During 2000, Commonwealth Scientific and Industrial Research Organisation (CSIRO) researchers publicized their intent to emphasize carbon dioxide capture and its conversion to hydrocarbons.[19][20] In 2003, the Brookhaven National Laboratory announced the discovery of an important intermediate part of the reduction of CO_2 to CO (the simplest possible carbon dioxide reduction reaction), which could result in better catalysts.

Employed Research Techniques:

Research in artificial photosynthesis is necessarily a multidisciplinary topic, requiring a multitude of different expertise.[10] Some techniques employed in making and investigating catalysts and solar cells include:

- Organic and inorganic chemical synthesis.
- Electrochemistry methods, such as photo electrochemistry, cyclic voltammetry, electrochemical impedance spectroscopy Dielectric spectroscopy, and bulk electrolysis.

- Spectroscopic methods: fast techniques, such as time-resolved spectroscopy and ultra fast laser spectroscopy; magnetic resonance spectroscopies, such as nuclear magnetic resonance, electron paramagnetic resonance; X-ray spectroscopy methods, including x-ray absorption such as XANES and EXAFS, but also x-ray emission.
- Crystallography. Molecular, microbiology and synthetic biology methodologies.

Advantages, Disadvantages and Efficiency:

Advantages are-

- The solar energy can be immediately converted and stored. In photovoltaic cells, sunlight is converted into electricity and then converted again into chemical energy for storage, with some necessary loss of energy associated with the second conversion.
- The byproducts of these reactions are environmentally friendly. Artificially photosynthesized fuel would be a carbon-neutral source of energy, which could be used for transportation or homes.

Disadvantages are-

- Materials used for artificial photosynthesis often corrode in water, so they may be less stable than photovoltaics over long periods of time. Most hydrogen catalysts are very sensitive to oxygen, being inactivated or degraded in its presence; also, photo damage may occur over time.[9][73]
- The cost is not (yet) advantageous enough to compete with fossil fuels as a commercially viable source of energy.[3] A concern usually addressed in catalyst design is efficiency, in particular how much of the incident light can be used in a system in practice. This is comparable with photosynthetic efficiency, where light-to-chemical-energy conversion is measured. Photosynthetic organisms are able to collect about 50% of incident solar radiation, however the theoretical limit of photosynthetic efficiency is 4.6 and 6.0% for C3 and C4 plants respectively.[79] In reality, the efficiency of photosynthesis is much lower and is usually below 1%, with some exceptions such as sugarcane in tropical climate.[80] In contrast, the highest reported efficiency for artificial photosynthesis lab prototypes is 22.4%.[81] However, plants are efficient in using CO_2 at atmospheric concentrations, something that artificial catalysts still cannot perform.[82]

VI. CONCLUSION

At present, the rapid progress in science and technology around artificial oxygen carriers has advanced to a critical stage. Therefore, it can be assumed that these substances will be clinically available as substitutes for red blood cells within the next years. It can be expected that the major impact of hemoglobin- and perfluoro carbon-based oxygen carriers will be on the use as intermittent blood substitutes during or anticipating acute blood loss from surgery or trauma. However, further applications for artificial oxygen carriers are emerging which cannot fulfilled by red blood cells. Clinical studies are testing now the therapeutic abilities of artificial oxygen carriers in renal anemia, transplantation medicine, cancer therapy, sickle cell disease, treatment of septic shock, treatment of stroke, reduction of air embolism during cardiopulmonary bypass, and as an adjunct to respiratory therapy (‘liquid ventilation’) . In addition, use of artificial oxygen carriers in animal experiments aims at the improvement of oxygen supply in the microcirculation of organs suffering from ischemia. For the long term, biological engineering may increase desired pharmacologic properties of artificial oxygen carriers and widen their spectrum of indications.

VII. REFERENCES

For artificial Photosynthesis:

[1]. Magnuson, Ann; Anderlund, Magnus; Johansson, Olof; Lindblad, Peter; Lomoth, Reiner; Polivka, Tomas; Ott, Sascha; Stensjö, Karin; Styring, Stenbjörn; Sundström, Villy; Hammarström, Leif (December 2009). "Biomimetic and Microbial Approaches to Solar Fuel Generation". Accounts of Chemical Research. **42** (12): 1899–1909. doi: 10.1021/ar 900127h. PMID 19757805.

[2]. Armaroli, Nicola; Balzani, Vincenzo (2007). "The Future of Energy Supply: Challenges and Opportunities". Angewandte Chemie. **46**: 52–66. doi: 10.1002 /anie. 200602373

[3]. Giacomo Ciamician, The Photochemistry of the Future. In: Science 36, No. 926, (1912), 385-394, doi:10. 1126/science. 36.926.385.

[4]. Balzani, Vincenzo; et al. (2008). "Photochemical Conversion of Solar Energy". ChemSusChem. **1**: 26–58. doi:10. 1002/cssc.200700087.

[5]. Fujishima, Akira; Rao, Tata N.; Tryk, Donald A. (29 June 2000). "Titanium dioxide photocatalysis". Journal of Photo chemistry and Photobiology C: Photochemistry Reviews. **1** (1): 1–21. doi: 10.10 16/ S1389-5567 (00)00002-2. Retrieved 10 Janua ry 2012.

[6]. "Swedish Consortium for Artificial Photosynthesis". Uppsala University. Retrieved 24 January 2012.

[7]. Hammarström, Leif; Styring, Stenbjörn (27 March 2008). "Coupled electron transfers in artificial photosynthesis ". Philosophical Transactions of the Royal Society. **363** (1494): 1283–1291. doi:10.1098/rstb.2007.2225. Retrieved 24 January 2012.

[8]. “Artificial Photosynthesis". Csiro.au. 20 September 2005. Retrieved 2011-04-19

[9]. “Designing a Better Catalyst for Artificial Photosynthesis". Bnl.gov. 9 September 2003. Retrieved 2011-04-19.