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Carbon Capture By Iron

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ABSTRACT:

During this time of civilization, industries are necessary in man's life for his survival, but they highly depend on power and release toxic heavy fumes. The industries like food processing, steel, textile, pharmaceutical, transport, mining, … all are highly demanded by man.

The world's population keeps increasing creating more demand for industrialization. The space for industrial expansion and human settlement is obtained by cutting trees.

The action of cutting trees has exposed the bare land to direct solar radiations, and the rate of carbon dioxide gas consumption by trees reduced. The industries increase on the air pollution because of the reduced number of trees but more industries are constructed.

Air pollution cause greenhouse effects like; **global warming** (***in 2024 the global average temperature exceeded 1.5 degrees Celsius above the pre – industrial levels)***.

The results of climate change like wild fires double the air pollution by burning and emitting more carbon dioxide gas.

Man cannot do away with industrial revolution but to think of an absolute solution to excessive industrial emissions.

This research paper is a hope in helping to provide a cheap alternative for carbon capture and safe carbon storage.

The observations and conclusions in this report were made basing on clear practical laboratory results.

Rusting of Iron metal needs water and oxygen gas as conditions for the rusting reaction to occur. Iron has been discovered to possess unique character. Iron reduced a metal carbonate to pure metal, and carbon powder, and itself oxidized to form rust using hot boiling water in an anaerobic system.

The reaction is very fast, powerful, and cheap in terms of power and raw materials.

PURPOSE OF RESEARCH:

To discover the scientific solution to climate change through chemical treatment of carbon dioxide gas.

OBJECTIVES:

- To promote environmental awareness among people.
- To discover a chemical reaction that consumes carbon dioxide gas.
- To balance the atmospheric carbon dioxide gas to a net zero.

RESEARCH METHODS:

- Laboratory tests and experiments.
- Internet research.
- Consultation (Tr. Nakabuye Ritah Lwanga – St. Mary's S.S Namaliga - Bombo).

- Library (Advanced Level Inorganic Chemistry by A. Holderness).
- Laboratory (St. Daniel Comboni College Kasaala, St. Mary's S.S Namaliga – Bombo).

1. INTRODUCTION.

Sustainable Development Goal (SDG) 13 is a call to all people for Action towards Climate Change. COP 29 has proved that the solution to climate change is not banning the extraction and licensing of more companies dealing in fossil fuels; but we must get clean ways of using fossil fuels.

From the year 2023 many parts of the World have been experiencing Greenhouse effects like; ***Global warming, wild fires, floods, landslides, air poisoning, Outbreak of diseases related to floods or UV Radiations, water shortage or unclean water, massive displacement of people,*** *and* ***famine*** among others.

Net Zero Carbon is a state in which the total amount of Carbon dioxide gas produced from animal respiration, decaying matter and man's activities like Industrialization and combustion, is just enough for all the green plants to use during the process of photosynthesis.

Excess amounts of Carbon dioxide gas in the atmosphere results into greenhouse effects like global warming and changes in climate patterns.

There is hope however, in Ssonko's Exclusive Carbon Capture – SECC.

This new innovation has successfully shown that excess carbon dioxide gas, stored in a simple form of a carbonate, can be destroyed in rusting process, instead of direct capturing of carbon dioxide gas, Liquefy and inject it in the rocks.

2. ORIGIN OF IRON RUSTING

The process of Iron rusting was observed and studies were carried out by many scientists.

Source: "NATURE, May 31, 1906"

The first view taken of the atmospheric corrosion or rusting of Iron was that; Rusting was due to a simple process of oxidation.

- In 1871, **Crace Calvert** was the first scientist who described rusting in using many experiments.
- In 1888, **Professor Crum Brown** based on Crace Calvert's descriptions on rusting and he suggested that, the first stage in rusting of iron is the production of iron (II) carbonate **($FeCO_{3\,(s)}$);** When Iron reacted with carbonic acid. The water vapor in the atmosphere reacted with the carbon dioxide gas (0.03%) in the air to form carbonic acid, according to the chemical equation:
  $\boldsymbol{Water + Carbon\ dioxide\ gas \rightarrow Carbonic\ acid;}$ $\boldsymbol{H_2O_{(l)} + CO_{2\,(g)} \rightarrow H_2CO_{3\,(aq)}.}$ The ferrous carbonate produced later reacted with oxygen in the presence of water to form rust **($Fe_2O_{3\,(s)}$)**

NOTE: , Professor Crum Brown did not account for the disappearance of Carbon, when iron (II) carbonate ($FeCO_{3\,(s)}$); oxidized to form rust ($Fe_2O_{3\,(s)}$).

- In 1898 however, **Professor Dunstan**, a lecturer at the Royal Artillery Institution, explained that, iron in presence of oxygen and water, first produced iron (II) oxide and hydrogen peroxide.

$$\boldsymbol{water + oxygen + iron \rightarrow iron\,(II) oxide + hydrogen\,peroxide;}$$

$$\boldsymbol{Fe_{(s)} + \frac{3}{2}O_{2\,(g)} + 2H_2O_{(l)} \rightarrow FeO_{(s)} + 2H_2O_{2\,(aq)}}$$

The portion of hydrogen peroxide later converted the ferrous oxide into ferric oxide (rust), and the process continues in a similar order.

- The current explanation for the origin of iron rusting has been developed by different scientists including **Drs. Jowett and Goulding, Dr.G.T. Moody,** and **Albert Holderness,** among others**….**

- ***SSONKO'S SPECIAL explanation FOR IRON RUSTING.***

In an anaerobic system, Ferrum readily attacks any oxygen rich substance like a carbonate of a metal lower than Iron itself in electro chemical series, to form Ferric oxide hydrated (rust), and Carbon at a very high rate.

NOTE: This is a special case for the theory of Iron Rusting, just as Archimedes' Principle has got the Law of Floatation as a special case for Floating bodies.

Iron rusting to occur Oxygen gas and Water are the only necessary conditions. However, in this system oxygen gas was provided in a carbonate form, and water was also provided. Rusting took place in a way of imitating the Nitrogen cycle.

In a chemistry text book titled;

Advanced Level Inorganic Chemistry,

by A. Holderness

under content No. 11. (The d-block elements); Pages (432 – 448),

Figure 1, carbon captured in rust

RUSTING OF FERRUM:

Rusting of Ferrum (Iron metal) is a very complex subject; indeed, it is not yet fully explored, and its potentials were underestimated.

Conditions necessary for rusting to occur according to A. Holderness, are ***only*** liquid water and oxygen.

In water, Ferrum exhibits cathodic areas and anodic areas. This makes a cell but which is at short circuit.

Oxidation of the Ferrum occurs at the anode

$2\ Fe_{(s)} \rightarrow 2Fe^{2+}_{(aq)} + 4e^{-}$ and

Reduction takes place at the cathode

$$O_{2\,(g)} + H_2O_{(l)} + 4e^{-} \leftrightarrow 4OH^{-}_{(aq)}$$

$2H^{+}_{(aq)} + 2e^{-} \rightarrow H_{2\,(g)}$

It means that a cell is created using;

- Ferrum as electrodes, (Anode and Cathode) and
- Water as an electrolyte.

Electrons flow through the metal from the anodic points to the cathodic points. Obviously, if an electrolyte such as common salt is present in water, current will flow more freely in the circuit and corrosion will be more rapid.

Ferrous Ions from the anode react with hydroxide ions from the cathode to form ferrous hydroxide.

$2Fe^{2+}_{(aq0} + 4OH^{-}_{(aq)} \rightarrow 2Fe(OH)_{2\,(s)}$

The ferrous ion in oxidation state of (+2), is regarded as unstable because it was formed when Ferrum lost two electrons in the $4S^2$ sub-Orbital; leaving six electrons in the $3d^6$ sub-Orbital.

To attain stability, Ferrous ions are rapidly oxidized to Ferric ions by losing one electron in the $3d^5$ sub energy level.

Air rapidly oxidizes Ferrous hydroxide to Ferric oxide hydrated (Rust).

$$2Fe(OH)_{2\,(s)} + \frac{1}{2}O_{2\,(g)} \rightarrow Fe_2O_3.2H_2O_{(s)}$$

ADVANTAGES OF RUSTING ON ENVIRONMENT:

- It conserves the environment by decomposing iron and steel metals.
- It conserves the environment by consuming carbon dioxide gas in rusting under specific temperatures and pressure.
- Rust fixes Iron mineral and oxygen gas into the soil, hence improving soil properties (fertility).

Figure 2, shows how heavy industries contribute highly to damage the atmosphere

3. COMBUSTION FUMES TO MALACHITE.

BACKGROUND

This is a system which describes how to treat greenhouse gases immediately from the source before the gases are released into the atmosphere.

The toxic fumes from combustion are not allowed to escape into the space but trapped in a temporary storage.

Treatment starts by allowing the fumes to pass through different chambers at controlled rates, to reduce toxicity before release.

Greenhouse gases comprise of Carbon dioxide gas (CO_2) 76.0% - 79.4%, Methane gas (CH_4) 11.5% - 16.0%, Nitrous oxide (N_2O) 6.0% - 6.2%, other gases include Chlorofluorocarbon (CFC), etc. The composition of these gases may differ from factory to factory, but the major component with the highest percentage composition is Carbon dioxide gas (CO_2) 76.0% - 79.4%.

The process of treating these gases undergoes six (6) stages.

Stage 1 is separation stage, it is aiming at trapping and screening out pure Carbon dioxide gas only. The stage is unnecessary for the gases from coal power reactors.

Stage 2 is water dissolving, water dissolves carbon dioxide gas to form carbonic acid.

Stage 3 is caustic treatment stage; the soda caustic reacts with Carbon dioxide gas to form carbonates and bicarbonates of soda.

Stage 4 is detoxifying stage: Activated Carbon, the form of Carbon adsorbs toxic gases.

Stage 5 is clean fume release stage, at this stage, the level of toxicity has reduced and the fumes are less harmful to the environment.

Stage 6 is precipitation of Malachite; the sodium carbonate produced in stage 3 is reacted with Copper (II) Sulphate to produce Malachite.
The treatment of fumes from combustion is capable of lowering the degree of toxicity before they are allowed into the space.

COMBUSTION FUMES TREATMENT
The fumes can be cut by 50%, by capturing the carbon half the length of the day a factory operates.
The system comprises of six (6) stages:

STAGE ONE

Figure 3 web image, is an illustration for trapping fumes at the outlet

Collection, transportation and separation of Carbon dioxide gas.
The fumes are collected and directed into different chambers for purification.
Stage 1 (a). Condensation chamber. The low temperatures condense water vapor to liquid water, reducing the vapor impurities.
Stage 1 (b). Filtering chamber: They (dry gases) pass through a porous layer to trap dust and other solid particles.
Stage 1 (c). Burning flame chamber: The flame burns the combustible gases like methane, and unburnt fuel is fully converted to carbon dioxide gas.
STAGE TWO
Water dissolving.
Carbon dioxide gas is soluble in water.
The reaction results into carbonic acid. The partially pure gases are forced to pass through different water containers for effective dissolving.

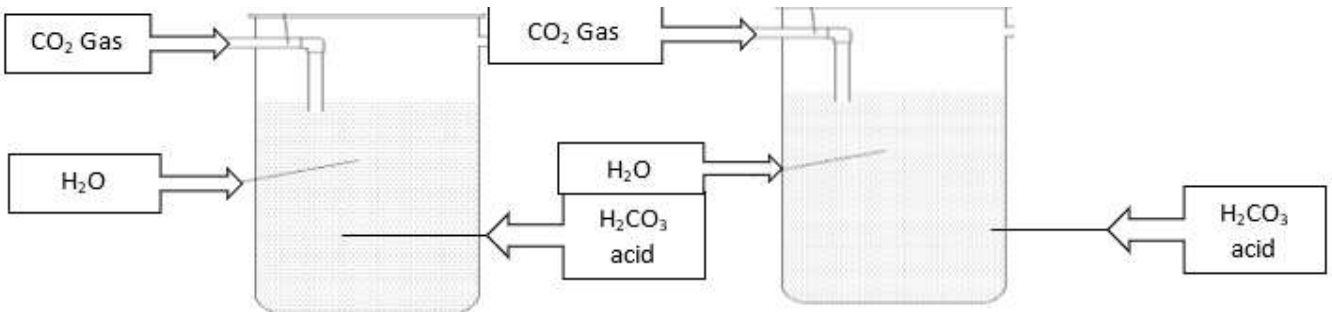

Figure 4 web image, carbon capture in Carbonic acid

$water + carbon\ dioxide\ gas \leftrightarrow carbonic\ acid$

$H_2O_{(l)} + CO_{2\,(g)} \leftrightarrow CO_3H_{2\,(aq)}$

One mole of water (18.0g) react with one mole of Carbon dioxide gas (44.0g) to produce one mole of Carbonic acid (62.0g)

STAGE THREE

Caustic treatment chamber,

The Carbon dioxide gas reacts with the hydroxides of Natrium to form bicarbonates and carbonates of soda.

In limited amounts of carbon dioxide gas.

Soda caustic reacts with carbon dioxide gas to form washing soda.

Washing soda is used in hard water softening and in soap production.

$Carbon\ dioxide\ gas + soda\ caustic \rightarrow washing\ soda + water$

$CO_{2\,(g)} + 2NaOH_{(aq)} \rightarrow Na_2CO_{3\,(aq)} + H_2O_{(l)}$

One mole of carbon dioxide gas (44.0g) react with two moles of soda caustic $(40.0\ g)\ x\ 2 = 80.0g$, to form one mole of washing soda (106.0g) and one mole of water (18.0g)

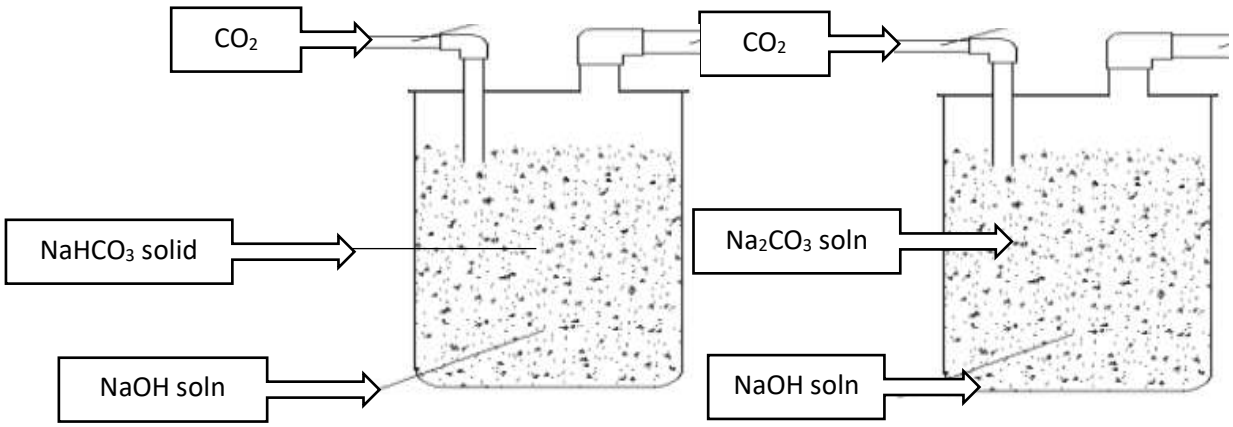

Figure 5 web image, carbon capture in washing soda and bi carbonates of soda

In excess amounts of carbon dioxide gas,

bicarbonates of soda are formed.

$Carbon\ dioxide\ gas + washing\ soda + water \rightarrow Bicarbonates\ of\ soda$

$CO_{2\,(g)} + Na_2CO_{3\,(aq)} + H_2O_{(l)} \rightarrow 2NaHCO_{3\,(s)}$

One mole of carbon dioxide gas (44.0g), react with one mole of washing soda (106.0g) and one mole of water (18.0g) to produce two moles of bicarbonates of soda $84.0g\ x\ 2 = 168.0g$

The bicarbonates of soda are used in bakery.

STAGE FOUR

Activated carbon chamber,

The activated carbon adsorbs all forms of toxins.

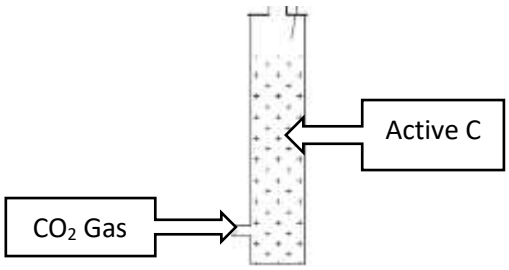

Figure 6 web image, carbon capture by adsorption

STAGE 5

Stage 5 is clean fume release stage

The gases are clean and safer to be released into the space, and another circle for trapping is repeated.

STAGE 6

Stage 6 is precipitation of malachite,

Malachite is one of the forms in which Copper (II) Carbonate exists.

The sodium carbonate produced in stage 3 is reacted with Copper (II) Sulphate to produce Malachite.

$$\text{Copper (II)sulphate solution} + \text{sodium carbonate solution} \rightarrow \text{Malachite}$$

$$2Cu^{2+}_{(aq)} + CO^{2-}_{3\,(aq)} + 2OH^{-}_{(aq)} \rightarrow CuCO_3.Cu(OH)_{2\,(s)}$$

CONCLUSION

The treatment of fumes from combustion is capable of lowering the degree of toxicity before the fumes are allowed into the space.

The system is capable of lowering the level of greenhouse gases by more than a half. It can be achieved by passing a policy for all heavy Industries to carbon capture half the length of period the machines keep operating a day

The raw material is Carbon dioxide gas which is obtained as a free waste gas.

4. INTRODUCTION TO SECC.

SSONKO'S EXCLUSIVE CARBON CAPTURE (SECC).

Carbon dioxide gas to Carbonate to *Rust* and *Carbon*.

Figure 7, green copper (II) carbonate changed to brown rust, and carbon powder.

WHAT OTHER SCIENTISTS DID NOT OBSERVE WITH RUSTING.

"During the process of rusting, Iron has not only got the power to readily form Carbonates, but it can also use the carbonates, to extract out Oxygen gas and cause rusting to take place under special conditions."

BACKGROUND:

- It started with an idea of thinking about a scientific method which can imitate the process of photosynthesis.
- Initially the author thought about an enhanced artificial system which can replace a plant leaf, modified to take up carbon dioxide gas at a very high rate, in huge volumes and in return produce Oxygen and food, or other consumable organic or Inorganic compounds.
- In Nitrogen Circle, Plants can obtain Nitrogen not directly as Nitrogen gas, but from salts of nitrates. The author thought that there is a possibility for a process which requires oxygen gas (like rusting), under special conditions to extract oxygen from an oxygen carrier like a carbonate, nitrate or sulphate, if a carbonate is the only option for survival or attaining stability. A carbonate was preferred compared to Sulphates or Nitrates reason being the gases associated with Nitrates and Sulphates would confuse the results or interfere with the system stability, which needed strict pressure monitoring. It should be noted that also the author's focus was on "Carbon."

SSONKO'S SPECIAL explanation FOR IRON RUSTING.

In an anaerobic system, Ferrum readily reacts with water ($\Delta T \geq 90℃$) *to form Ferrous hydroxide, which is unstable. The ferrous hydroxide will by all means seek for stability by attacking any oxygen rich substance like a carbonate of a metal lower than Iron itself in electro chemical series. Therefore, forming Ferric oxide hydrated (rust) and Carbon, at a very high rate.*

NOTE: This is a special case for the theory of Iron Rusting, just as ***Archimedes*' *Principle*** has got "***the Law of Floatation***" as a special case for Floating bodies.

Iron rusting to occur Oxygen gas and Water are the only necessary conditions. However, in this system oxygen gas was provided in a carbonate form, and water was also provided. Rusting took place in a way of imitating the Nitrogen cycle.

5. MECHANISM OF THE SYSTEM

Two moles of Iron readily react with four molecules of water to form Iron (II) hydroxide (ferrous hydroxide), according to the following chemical equation.

$2Fe^{2+}_{(aq)} + 4OH^{-}_{(aq)} \rightarrow 2Fe(OH)_{2\,(s)}$

2 moles of the ferrous hydroxide react with a mole of the wet copper (II) carbonate and reduces it to produce a mole of Pure Copper metal and a mole of carbon powder, the ferrous hydroxide itself oxidized to form rust, releasing a mole of excess oxygen gas, and a yellow dye stained the glass reactor walls.

$2Fe(OH)_{2\,(S)} + CuCO_{3\,(S)} \rightarrow Fe_2O_3.2H_2O_{(S)} + C_{(S)} + Cu_{(S)} + O_{2\,(g)}$

The reaction takes place under an anaerobic condition (in an airtight system), with hot boiled water (because boiled water lacks oxygen and hot temperatures provide sufficient activation energy), and the system uses special electrodes.

The system is denied one condition which is oxygen but provided with water.

AN INVESTIGATION ON THE EFFECT OF A WET – CARBONATE ON IRON MATERIAL

Materials required.

(1) Clean iron wool.  – 112.0g

(2) Copper (II) carbonate powder.  - 124.0g

(3) Clean graphite electrodes.  - 20 Pieces

(4) Heat Source. 

(5) Clean water.  – 1500ml

(6) Air – tight glass container. -  2000ml capacity

(7) Timer. 

(8) Thermometer 

Procedure:

- Measure 1500ml of clean water and boil it to above $100^{O}C$, using any heat source.

- Share the iron material into 4 equal parts of 28.0g each piece. Repeat the same on copper (II) carbonate powder, into 4 equal parts of 31.0g each. Do likewise to the graphite electrodes, divide them into 5 bundles each of 4 graphite rods.
- Arrange the above components in the glass container into layers of Iron, Carbonate, and graphite, and repeat to form four (4) equal compacted big layers.
- Immediately add 1500ml of deoxygenated boiling water to occupy $\frac{3}{4}$ the volume of the glass container.
- Cover the container's **lid tightly** after **a few seconds**. To avoid any external air into the system and to allow any air to expand and escape form the system respectively.
- Set a timer and measure eight (8) minutes and observe.

Observations.
When clean iron was placed in a system containing boiled water, graphite rods, and oil added on top of water to prevent external oxygen; and the system made air tight.
The iron was observed to keep remaining clean.

Figure 8, is a controll experiment, using copper electrodes, without a carbonate

However, when clean iron was placed in a system containing boiled water, graphite rods, Cupric carbonate and oil added on top of water to prevent oxygen from outside; and the system made anaerobically air tight.

OBSERVATIONS.
- A deep red solid substance was produced almost instantly.
- The light blue color of Cupric carbonate gradually vanished, forming Brown – Red insoluble compound.
- Black insoluble substance was observed.
- Gold-like substance was deposited on the electrodes of graphite rods, and on the surfaces of Ferrum.
- The system is highly exothermic.
- The oil on top of the system was attacked.
- The level of water reduced.
- A very strong yellow pigment stained the walls of the glass reactor.
- Bubbling of a colorless gas.

6. RESULTS ANALYSIS

Figure 9, all the products of the experiment.

Interpretations of the results:

1. Brown / Red Product.

This is Rust which was produced. The disappearing of copper II carbonate yielded Iron III oxide hydrated (Rust).

Analytical qualitative tests with kalium hexacyanoferrate (II), and Kalium thiocyanate confirmed ferric ions, but tests for ferrous ions showed negative results with kalium hexacyanoferrate (III)

2. Green copper II carbonate.

The iron extracted oxygen from the said carbonate. This affected the color properties of the substance, observed in the vanishing of the light blue color of the cupric (II) carbonate due to the formation of ferric oxide hydrated (rust/Hematite), a substance with different properties compared to Malachite.

It is Rust because of the following explanations:

- The product was very stable with diluted mineral acids like Nitric acid, Hydrochloric acid, and Sulphuric acid. This is enough to suspect an oxide. If any carbonate was present, bubbling of a colorless gas that turns lime water milky would be observed. However, the substance dissolved in fuming hydrochloric acid and only on boiling.
- The system lacked any gaseous products, meaning carbon dioxide gas was not evolved, however, the system preferred oxygen gas production because, bubbling of a colorless gas was observed at electrodes of graphite. This may be interpreted that, the energy frequency in the system was just

sufficient to cause the chemical reaction to proceed in the direction favoring the formation of Oxygen gas. The reaction releases a lot of oxygen gas bubbles at the graphite electrodes.

- The rusting nucleated from the points of contact between the electrodes and a carbonate.

3. Black powdered compound.

This is carbon (Charcoal), from a carbonate. Ferrum has got power to discharge Carbon during this reaction. On boiling the Hematite in concentrated hydrochloric acid, the black substance was observed to be very stable, confirming carbon. Hence Carbon Capture. Carbon may be used in making activated carbon.

4. Gold-like metal.

This is copper metal discharged at the electrodes and deposited. The confirmatory test for copper was performed and it was present. The copper metal was first dissolved in concentrated nitric acid, forming a light blue solution and brown fumes were evolved. This confirms copper metal. This innovation greatly promotes the copper mining industry.

5. Copper coating.

Clean Graphite rods *copper coated graphite rods*

The system coated electrodes with copper during the reaction in a way of opposing the reaction from proceeding. The reaction will continue until all the electrodes are completely coated with copper. At this point, copper cannot attack copper (II) carbonate, the reaction will reach completion.

The copper coated electrodes were washed with concentrated nitric acid; brown fumes were released and a green solution formed. The sample solution turned brown with potassium iodide solution. A test with dilute ammonia turned to blue precipitate and later dissolved in excess aqueous ammonia to form a deep blue solution. This confirms that copper was deposited at the electrodes.

The deposition of copper metal at the electrodes is in the way of obeying

Le Chatelier's Principle:

Le Chatelier's principle states that if a dynamic equilibrium is disturbed by changing the physical conditions, the position of equilibrium shifts to counteract the change to reestablish an equilibrium.

If a chemical reaction is at equilibrium and experiences a change in pressure, temperature, or concentration of products or reactants, the equilibrium shifts in the opposite direction to offset the change.

In this system, the copper metal accumulates at the surfaces of electrodes, in a way of opposing the chemical reaction from proceeding.

6. Water level.

The level of water reduced, initially, the level of water was above the graphite and iron. However, after the chemical reaction, the water level was observed to be below the graphite and iron at the top of the system. This is because some amount of water was consumed in forming Ferrous hydroxide.

7. Heat energy of the system.

Heat is released during the chemical reaction leading to rise in temperatures of the reactor. The system is extremely powerful to an extent that iron is observed to turn hot red and at some points iron burn out to almost ash.

8. Oil on water surface.

The oil was observed to change in its properties like viscosity, appearance was like creamy clouds. However, after the system has settled following the completion of the reaction, the properties seemed (appeared) to be retained.

NOTE: Oil is a compound which might confuse the observations and the results. It also makes the products difficult to handle. It was used in the first experiments but later on it was dropped out.

8. Yellow pigment.

The yellow dye is suspected to be composed of some impurities in iron like sulphur.

The process released heavy yellow fumes which stained the walls of the glass reactor. This stain is a very strong dye, which can be extracted and used for commercial purposes. The dye can only be dissolved in concentrated hydrochloric acid, and it turns light green solution. The pigment is used for art and craft.

Bubbling of a colorless gas.

The colorless gas is suspected to be excess oxygen gas from the dissociation of copper carbonate. Oxygen gas can be extracted and used in hospitals.

7. PARTICLE THEORY (Molecular explanation).

- The water was ionized by an electric current produced by a chemical cell. In the system, two molecules of Iron were oxidized to release 4 electrons. These electrons produced a current which reduced the water. The electricity has got power to ionize the water molecules into it's pure hydroxide ions and hydrogen ions.
- Water ionized itself as follows: Water is regarded as an amphoteric molecule because it can behave both as an acid and as a base by either donating or accepting a proton.
- I.e. $H_2O_{(l)} + H_2O_{(l)} \rightleftharpoons H_3O^+_{(aq)} + {}^-OH_{(aq)}$
- Therefore, Water ionized into hydroxyl ions and hydroxonium ions,
- The hydroxide ions were consumed when water reacted with Ferrum to yield ferrous hydroxide, this left the system with more hydroxonium ions compared to hydroxide ions in the system. The said ions are responsible for acidic ph.

- This enhanced the properties of water as an electrolyte, to resemble the electrolyte of dilute mineral acids or dilute salt solutions.
- The first ferric ions in nucleation, started to create a very high electric field due to high charge density of ferric ions; which polarized the water molecules.
- All the above explanations, imply that water became a better electrolyte than dilute mineral acids or salt solutions. This in combination with better electrode types (like graphite or copper) enhanced the cell performance.
- The high energetic water particles collided with iron, and copper II carbonate particles, releasing energies sufficient to activate a chemical reaction leading to the formation of Rust.

8. SYSTEM ENERGY SOURCE.

Figure 10, some of the essential materials used in the experiment

ELECTROLYTIC CHEMICAL CELL

- The system gets most of its energy from a chemical cell. It is composed of electrodes; iron and graphite rods and water electrolyte.
- The cell short circuit released energy with enough frequencies to break the carbon – Oxygen bonds.
- A pair of Cuprum and Ferrum as electrodes showed good results, in a chemical reaction, it produced Potential Difference (p.d) of 0.45 V, however, a pair of Graphite and Ferrum produced a p.d of 0.95 V. Graphite or Platinum was favored for the above reason, and also because the system released a lot of copper when copper electrodes were initially preferred.
- It implies that, an idea of introducing a pair of graphite (or Copper) and Ferrum in the system made an efficient cell; which produced enough activation energy (currents), required for the reaction to take a path that leads to the production of rust.
- It was possible to think that a carbonate would be decomposed to carbon dioxide gas by the acidic PH system created by Ferric ions (Iron III ions). At the same time also the consumption of the hydroxide ions in the system left the system with more hydroxonium ions in the system. However, despite all those possibilities, the system favors the reaction which leads to the extraction of oxygen gas. The oxygen gas is the one which reacted with the ferrous hydroxide to form hydrated ferric oxide (rust).
- Carbon capture by this method is not direct. The method starts by converting the carbon dioxide gas into a carbonate. The carbonate is later reacted using Ssonko's Exclusive Carbon Capture.

THE DOUBLE DISCHARGE CHEMICAL EQUATIONS.

Single stage equation,

$Ferrum + copper\ (II)\ carbonate + water \rightarrow Ferric\ oxide\ hydrated + carbon + copper$

$2Fe_{(s)} + CuCO_{3\,(s)} + H_2O_{(l)} \rightarrow Fe_2O_3.H_2O_{(s)} + C_{(s)} + Cu_{(s)}\ Exothermic\ reaction$

Two steps equations.

$$2Fe^{2+}_{(aq)} + 4OH^{-}_{(aq)} \rightarrow 2Fe(OH)_{2\,(s)} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (i)$$

$$2Fe(OH)_{2\,(S)} + CuCO_{3\,(S)} \rightarrow Fe_2O_3.2H_2O_{(s)} + C_{(s)} + Cu_{(s)} + O_{2\,(g)} \ldots\ldots\ldots (ii)$$

Two moles of Ferrum metal $Fe_{(s)}(56.0g\ x\ 2\ ), = 112.0g,$ completely react with one mole of copper carbonate ($CuCO_{3\,(s)}$124.0g) and one mole water ($H_2O_{(l)}$ 18.0 g) to form one mole of Ferrric oxide mono hydrate ($Fe_2O_3.H_2O$ 178.0 g), one mole of charcoal (C=12.0g) and one mole of Cuprum (Cu=64.0 g).The reaction releases one mole of oxygen gas ($O_{2\,(g)}$ $32.0\ g$), heavy yellow fumes.

The oil on top of the system was attacked. The oil properties changed during the chemical reaction because the system was adjusting itself towards excess energy and changes in pressure. The system gave out its excess energies to the oil, the oil later released that energy on cooling, regaining part of its properties.

WATER TEMPERATURE

The temperature of water (100^0C) also was essential in initiating a chemical reaction. The reaction with cool water was extremely slow.

ELECTRIC CHARGE

- The electricity of the system magnetized iron particles because the final product exhibited magnetic properties. This is another evidence that the system had very high electric energy, which must have rearranged iron particles into magnetic domains.
- The high power of the system is again explained in very strong bonds created, the bonds looked like metal welds.

Figure 11, iron nails strongly bonded.

PRESSURE DIFFERENCE

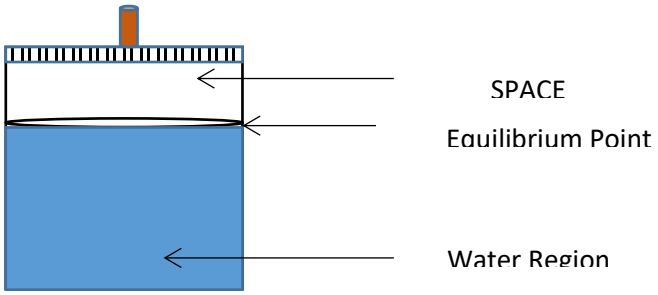

Figure 12, indicationg the two regions in the system

The system is divided into two regions.

Upper Space Region: This region is a space which is occupied by hot gases, (Steam, air and Oxygen). The water vapor and other gases expand rapidly in a limited space. The upper space exerts very high pressure to the water surface. This creates a very high pressure difference in the system. The space has very high pressure compared to the water atmosphere. This is observed from a gas bubble which is very stable in water, but collapses on crossing the water – space boundaries.

There is no magnetic effect on Iron in the upper space region.

N.B The minimum space is good for fast reaction, but small space collapses the reactor due to very high pressure build up.

The outer walls of the glass container keep sweating.

The water region: This region has no air/oxygen. It contains water, graphite, Iron and an oxygen carrier. It produces oxygen gas at the graphite electrodes at a very high rate.

In this space, there is magnetic effect on Iron. There is no life in the water.

The oxygen gas released in the water ascends with very high force and it creates pressure difference in the system by reducing the volume of the space in the rector.

The very high pressure difference in the system causes the water to boil and rapidly expand. This energy is sufficient to force rusting in oxygen deficient conditions, like at the moon; if there is any oxygen rich substance.

9. THE FOREIGN ELECTRODE

The chemical reaction forms five major products namely;

- Rust
- Carbon
- Oxygen gas
- Pure Copper Metal
- Yellow Dye

Copper is the only metal product which is also a very good conductor of both electricity and heat. The copper metal particles accumulate to form a clear pure copper metal. This an unexpected electrode that

bridges between graphite and Iron electrodes. The copper – conductor bridge produces a strong electric short circuit, which rapidly increases with the increase in the rate of copper deposition at the electrodes.
Copper being a perfect conductor of electricity, the rate of chemical reaction does not fall but proceeds, until the reaction has reached completion. The reaction can also proceed as long as the iron particles are slightly in excess of copper (II) carbonate particles; even though some parts of Iron and Graphite surfaces might be copper plated.
The strong electric short circuit can be observed from crystal clear burnt points inside the system. The burnt regions are characterized by clear signs of burnt wire with some form of ash.

10. RECOVERY OF THE IRON FROM RUST.

Figure 14, rust before reduction

Figure 14, Iron after reduction.

- Ferrum can be recovered from ferric oxide by the reduction reaction between ferric oxide and hydrogen gas.

2 moles of Ferric oxide are reduced by hydrogen gas to produce 4 moles of pure Ferrum metal; and 6 moles of hydrogen gas are oxidized to form 6 moles of water, according to the chemical reaction below.

$$2Fe_2O_{3\,(s)} + 6H_{2\,(g)} \rightarrow 4Fe_{(s)} + 6H_2O_{(l)}$$

N.B:
Hydrogen gas was produced from water electrolysis, in which water splits into Hydrogen gas And Oxygen gas using direct currents. Oxygen gas and hydrogen gas are very vital gases for many industries like hospitals need oxygen gas, and hydrogen gas is the next potential source of green energy.
The Ferrum recovered is then replaced back into the system, and the water also taken back into the system.
In short, the system is very cheap and self-sustaining.
After regaining Iron, it can be separated by using magnetism. The remaining is the mixture of carbon powder and copper.
The copper can be extracted by dissolving in an acid to remain with carbon powder only.
The carbon powder is used in electrical installation for earthing the electrode conductor and in it is also applied in cooking with charcoal briquettes.
Note:
The mixture of copper and carbon can also be a new innovation as a better "***earthing carbon mixture***", during electrical installation.

11. WHY LUNAR - RUSTING?

Figure 15, web image showing rust at the moon

This question seeks for an explanation behind the wonder of the rusting of the moon.

SECC, may be of much help in suggesting the causes for the rusting of the moon. The predictions were made basing on practical Laboratory Observations, in several experiments performed under conditions similar to those at the moon.

Relationships between the conditions as used in the "Iron – Hot wet Carbonate system," and the moon system.

1. OXYGEN

There is no life at the moon, implying that the moon has got no Oxygen gas. However, the moon is rich in Oxides and Silicates; which are Oxygen rich substances. It is therefore, suspected that, the Oxides are the potential sources of oxygen gas for the rusting of the moon.

In "Iron – Hot wet Carbonate system," a carbonate of a metal lower than Iron in reactivity series was used as the oxygen carrier.

N.B: Oxides and most carbonates are insoluble powders, but when wet Iron can reduce the metal carbonate to pure metal, and itself oxidized forming rust.

2.RELATIONSHIPS IN ELEMENTS

(a) Iron metal

The moon is abundant in Iron metal which undergoes rusting. Iron sponge was used in the system as a rusting material. Iron is also abundant on earth. Iron industry will develop more.

(b) (i). Platinum and Graphite

The moon is also rich in Platinum.

Platinum and Graphite in electrolysis function as inert electrodes. Therefore, they do not undergo anode decay, but just function as effective electrodes.

The system used Graphite but the moon has got Platinum. Platinum is also available on earth but more expensive compared to graphite.

(ii). Elements below Iron

Copper (Cu), Silver (Ag), Mercury (Hg) and Gold (Au)

Copper at the moon is rare but silver, mercury and gold exist at the moon. Silver is capable of forming silver (I) oxide (Ag_2O), AND Mercury on the other hand can be able to form Mercury (II) oxide (HgO).

It is assumed that, if the reaction took place with copper (II) carbonate, it is most likely to proceed with Copper (II) oxide, and therefore, it holds true for all oxides of metals below Iron in electrochemical series.

(C). WATER

The moon has some water but in solid state, molecular and hydroxyl.
The system used liquid hot boiling water.
N.B According to the particle theory of matter, high temperatures can melt the ice, boil the water and cause evaporation.

(d) TEMPERATURE AND PRESSURE

(i) Temperatures

The day temperatures on the moon are above 120^0C.
The system used very hot boiling water, whose temperatures are very close to the moon's day temperature.

(ii) Pressure

The pressure at the moon is very low.
In relation to the system pressure difference explanation, there is low pressure in the water section, where rusting takes place.

Note:

According to the comparisons made in this chapter, the conditions which caused the chemical reaction to take place in "Iron – Hot wet Carbonate system", the moon might be rusting during the day. This conclusion is drawn due to the fact that the moon fulfills all those conditions during the day time.
However, atmospheric corrosion, takes place during the night time on the earth.
The rusting of the moon in relation to our system of "Iron – Hot wet Carbonate system"; the rusting of the moon is caused by high pressure difference between the earth system and the moon system. The high pressure difference due to industrial emissions is compared to the emission of oxygen gas in the system, which destabilized the system pressure, forcing the iron rusting to take place in presence of an oxygen carrier and water at high temperature, in oxygen free environment, just as it is the case at the moon.
The impact of pollution of the atmosphere with heavy fumes from industries might be the major cause for the rusting of the moon, due to excessive heats and excess pressure from the toxic gases.

12. CONCLUSION.

Ssonko's special explanation for iron metal rusting *has given rise to* ***SECC – Ssonko's Exclusive Carbon Capture.***

This is a hope in fighting climate change because there was no chemical reaction which could consume carbon dioxide gas apart from a piece of Burning magnesium, which is very delicate to handle. At the same time, it is the only chemical reaction able to decompose a carbonate without releasing Carbon dioxide gas, like reactions with mineral acids. It is cheap to convert the carbon dioxide gas into a substance simple to handle, say a carbonate, and later on we use the SECC innovation to completely convert the gas into a much more stable form of pure carbon powder in rusting system.
There is a direct relationship between carbonates and rusting, as observed by *Professor Crum Brown.*
Ssonko's special explanation for iron metal rusting, *might answer the question why the moon is Rusting! The moon is well known to lack Oxygen gas, yet the oxygen gas is also a necessary condition for Rusting.*
Professor Crum Brown does not account for the disappearance of Carbon when Ferrous Carbonate oxidized to Rust. This theory explains it through the double discharge of carbon and Copper in the system.

In conclusion; **Ssonko's Exclusive Carbon Capture** implies aggressive exclusion of carbon from carbon dioxide gas, captured as a carbonate. On the other hands the paper title means " use of excessive force of an IRON ARM to store carbon in a more stable state, hence "Carbon Capture by Iron."
The chemical reaction is very fast and cheap in terms of power consumption, and the availability raw materials like waste carbon dioxide gas, Iron and copper.

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