

“ALTERNATE ENERGY SOURCE USING PLANTS INSTEAD OF PHOTO-VOLTAIC CELL-AN INNOVATIVE SOLUTION FOR POWER CRISIS”

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ABSTRACT: Today in India which is a developing nation has a greater demand for power. Electricity being a primary need for every being there is a rising demand is seen in India overtaking the production quantity. Since India is an upcoming nation large industries have started to build their industry in India which consumes more power so increasing the demand. This innovative paper, “solar cells from grass” is a new and green idea for producing little power in house for small appliances.

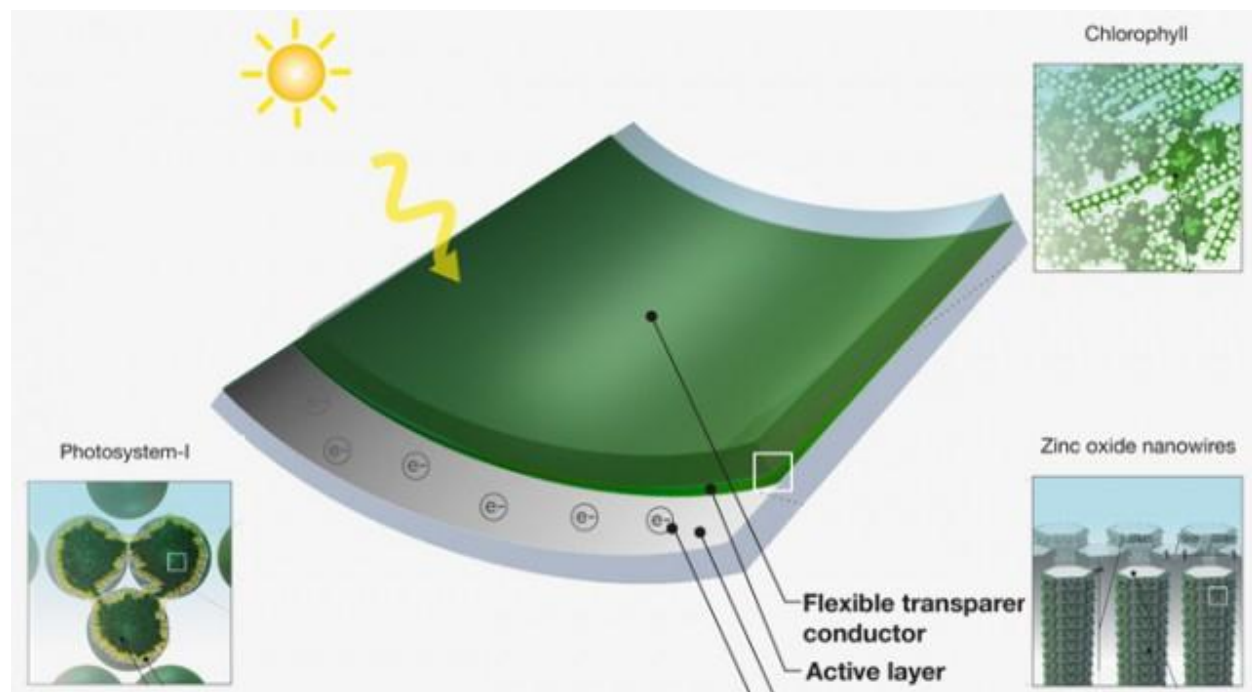
INDEX TERMS: Alternate energy source, chlorophyll, plants, and sunrays.



INTRODUCTION:

Today in India which is a developing nation has a greater demand for power. Electricity being a primary need for every being there is a rising demand is seen in India overtaking the production quantity. Since India is an upcoming nation large industries have started to build their industry in India which consumes more power so increasing the demand. This innovative paper, "solar cells from grass" is a new and green idea for producing little power in house for small appliances. This source doesn't require any fossil fuels or any non-eco-friendly materials. So this will reduce the demand by feeding it to small appliances. This cannot be used for heavy applications but can satisfy smaller ones. This process mainly doesn't depend on

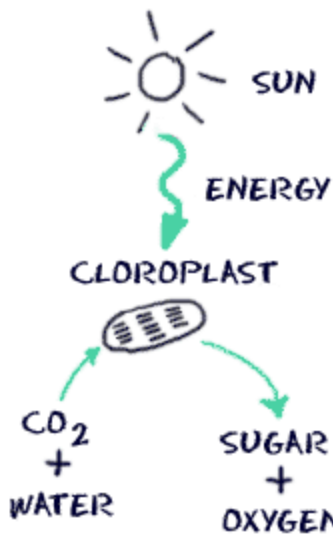
climate mostly. The process involves with the source of green plants which is very abundant in India. The basic process of photosynthesis which is carried out by plants for food synthesis is the process that sucks the solar energy and converts it into chemical energy. The main cell that is responsible for photosynthesis is chlorophyll. The basic idea is to extract the chlorophyll from the plants. These cells are stabilized and spread on a glass substrate that's covered in a forest of zinc oxide nanowires and titanium dioxide sponges. When sunlight hits the panel, both the titanium dioxide and the new material absorb light and turn it into electricity, and the nanowires carry the electricity away. In essence, it has replaced the layer of silicon in conventional photovoltaic cells with slurry of photosynthesizing molecules.



PHOTOSYNTHESIS:

PART I: THE SUN AND LIGHT

Not all of the light from the Sun makes it to the surface of the Earth. Even the light that does make it here is reflected and spread out. The little light that does make it here is enough for the plants of the world to survive and go through the process of **photosynthesis**.



Light is actually energy, electromagnetic energy to be exact. When that energy gets to a green plant, all sorts of reactions can take place to store energy in the form of sugar molecules.

Remember we said that not all the energy from the Sun makes it to plants? Even when light gets to a plant, the plant doesn't use all of it. It actually uses only certain colors to make photosynthesis happen. Plants mostly absorb **red** and **blue** wavelengths. When you see a color, it is actually a color that the object does NOT absorb. In the case of green plants, they do not absorb light from the green range.

PART II: THE CHLOROPLAST

We already spoke about the structure of **chloroplasts** in the cells tutorials. We want to reinforce that photosynthesis happens in the chloroplast. Within this cell **organelle** is the chlorophyll that captures the light from the Sun. We'll talk about it in a bit, but the chloroplasts are working night and day with different jobs. The molecules are moved and converted in the area called the **stroma**.

PART III: THE MOLECULES

Chlorophyll is the magic compound that can grab that sunlight and start the whole process. Chlorophyll is actually quite a varied compound. There are four (4) types: a, b, c, and d. Chlorophyll can also be found in many microorganisms and even some prokaryotic cells. However, as far as plants are concerned, the chlorophyll is found in the chloroplasts. The other big molecules are water (H_2O), carbon dioxide (CO_2), oxygen (O_2) and glucose ($C_6H_{12}O_6$). Carbon dioxide and water combine with light to create oxygen and glucose. That glucose is used in various forms by every creature on the planet. Animal cells require oxygen to survive. Animal cells need an aerobic environment (one with oxygen).

PART IV: LIGHT AND DARK REACTIONS



SOME REACTIONS ONLY HAPPEN IN LIGHT WHILE OTHERS CAN OCCUR IN DARK.

The whole process doesn't happen all at one time. The process of photosynthesis is divided into two main parts. The first part is called the **light**

dependent reaction. This reaction happens when the light energy is captured and pushed into a chemical called ATP. The second part of the process happens when the ATP is used to make glucose (the **Calvin Cycle**). That second part is called the **light independent reaction**.

Procedure for extracting chlorophyll from plants:.

1. Put leaves in the cup, pour in boiling water until it covers the sample. Leave for ~30 sec – 1 min. Remove leaves from water and dry them with paper towel.

Boiling water kills the cells and destroys enzymes which can promote chlorophyll degradation. It also breaks chloroplasts which makes chlorophyll extraction easier.

2. Take the leaves and remove petioles and central veins – this parts of leaf do not contain a lot of pigments. Throw them away. Cut the rest of the leaf material into the small 1-2 mm pieces. Spread them evenly on the foil and put it in the oven for 20 minutes at temperature 104F (40C). Have a cup of tea.
3. Put dry leaf pieces in the mortar (make sure mortar and pestle are perfectly dry!) and grind them. Continue until they turn into uniform yellow-green powder.

Grinding breaks cell walls and at the same time increases area of the surface. Leaf grinds will release more pigment.

4. Put powder in a test tube with tight lid. Add few ml of solvent, close the lid and shake

Note: try to use reasonably small amount of solvent. Five to ten ml is a good volume. Solvents are toxic and the less you deal with them the better. Make sure that your working place is well ventilated!

5. Have a cup of coffee. After coffee break check your chlorophyll. There should be emerald-green slightly opalescent liquid on top of dark green powder (which will sink to the bottom of the test tube) This is it. Chlorophyll is extracted. At the moment it's pretty diluted and solution contaminated with fine debris from the broken cells. Remains of chloroplasts and other cell components are floating in liquid making it slightly foggy. To wrap this experiment nicely we would recommend clean and concentrate extracted pigments.

Since we don't have centrifuge let's make time and gravity work. In other, more scientific words we'll do *sedimentation of the leaf cells debris* (two more jars/test tubes needed).

Here is how:

1. Wait for another 10-15 minutes for the leaf powder to settle on the bottom of the test tube.
2. Extremely carefully pour 90% of emerald-green liquid into second test tube. Close with tight lid. Put it in a cool dark place for few hours (24 is a good number).
3. Very carefully pour 90% of the liquid from the second test tube to the third test tube. This time leave it open and place it in well ventilated place. Check it from time to time. All used solvents are pretty volatile. After a while most of solvent is gone and what left is a pretty clean and concentrated plant pigments extract.

To check the composition of the extracted pigments put drop of the extract on the chromatography plate....

Physical Properties of Zinc Oxide :

Occurrence – Zinc oxide (zincate) rarely occurs in nature, particularly in a crystalline form. It is usually orange/red in color due to manganese impurity. The best known locale is the Sterling Hill – Franklin mining area of New Jersey, USA. <http://franklin-sterlinghill.com>

Crystal Structure - Zinc oxide has the wurtzite hexagonal crystal structure. Commercial zinc oxides show this crystal structure under electron microscopic examination. The precise shape of the crystal depends on the method of formation. In regular zinc oxide these vary between acicular needles and plate shaped crystals. Zinc oxide can be induced to form a very large variety of crystalline shapes using specialized deposition methods, this is a very active area of research.

Molecular Weight – 81.37

Color – Pure microcrystalline zinc oxide is white. Single crystal zinc oxide is colorless. Zinc oxide turns lemon yellow on heating and reverts to white on cooling.

Relative Density – 5.607

Melting Point – Zinc oxide sublimates at atmospheric pressure at temperatures over 1200C. Under high pressure a melting point of 1975C has been estimated.

Vapor Pressure @ 1500C = 12mm.

Refractive Index – $w = 2.004$, $e = 2.020$

Heat of Sublimation between 1350C and 1500C – 129 Kcal/mole (vapor not disassociated) and 193 Kcal/mole (vapor associated).

Heat Capacity, Cp = 9.62 cal/deg/mole @ 25C

Heat, $\Delta H = -83.25$ Kcal/deg/mole @ 25C
Free energy of formation, $\Delta F = -76.1$
Kcal/degC/mole @ 25C
Entropy, $S = 10.43$ cal/degC/mole

Coefficient of Thermal Expansion = 4×10^{-6} /degC

Electrical Conductivity – In its normal form, zinc oxide is an n type semiconductor, ie conductivity by electrons. This conductivity is thought to be due to a stoichiometric excess of zinc ions which occupy interstitial locations in the crystal lattice. By doping with other elements to replace either the zinc or the oxygen, the conductivity can be varied over a very wide range. Even with controlled doping it has proven to be very difficult to reproducibly make p type zinc oxide. For many semiconductor devices it is necessary to make pn junctions, it is only recently that p type zinc oxide has been made successfully.

Rectification – Single crystals of zinc oxide can act as rectifiers. This is the origin of ‘crystal sets’, very early radio receivers.

Optical Properties – Zinc oxide is transparent to visible light but strongly absorbs ultra violet light below 3655 A. The absorption is stronger than other white pigments. In the visible region wavelengths, regular zinc oxide appears white, however, rutile and anatase titanium dioxide have a higher reactive index and hence has a superior opacity.

The band gap energy (between valence and conducting bands) is 3.2 ev, this corresponds to the energy of 3655 A photons. Under ultra violet light zinc oxide is photoconductive. This was the basis of the historical Electrofax photocopying system.

The combination of optical and semiconductor properties make doped zinc oxide a candidate for new generations of devices. Solar cells require a transparent conductive coating, indium tin oxide and doped zinc oxide are the best materials.

Chemical Properties
Zinc oxide is amphoteric, that is it reacts with both acids and alkalis. With acid it reacts to form familiar compound such as zinc sulfate. With alkali it forms zincates.

The following reaction is extremely important in zinc pyrometallurgy- $ZnO + CO = Zn + CO_2$.

ENVIRONMENTAL BENEFITS

Global: This project reduces greenhouse gas emissions by reducing the community's reliance on diesel and kerosene for energy services. Currently, 80% of the community's energy needs are met by the solar-wind hybrid system.

Local: Reduced use of diesel leads to less local air pollution.

LIVELIHOOD BENEFITS

Health: The introduction of the renewable power system has allowed the community to begin to refrigerate food and medicine items on a more regular basis. Today, the community has five shared refrigerators that operate for 24 hours. In addition, the reduced use of kerosene for lighting means better indoor air quality.

Education: The local school now has light, as well as a photocopier, which improves children's ability to study and learn.

Information access: The new power system enables the community to access television and radio, thereby improving their connection with the outside world.

Community building: The mosque now has power, making it possible to use a microphone for the call to prayer, and for prayer sessions to be held in the evenings.

Security: With lighting, community members feel safer moving around at night.

NEED FOR RESEARCH

The key to cost reductions of this order is, of course, the right sort of support for innovation and development - something that has been lacking for the past and, arguably, is still only patchy at present. Research and development efforts in solar, wind, and other renewable energy technologies are required to continue for:

- improving their performance,
- establishing techniques for accurately predicting their output
- reliably integrating them with other conventional generating sources

Economic aspects of these technologies are sufficiently promising to include them in developing power generation capacity for developing countries.

CONCLUSION

My project can be implemented in my home. It gives very clean energy and free energy from renewable sources. And also the generation cost is very low with compared to conventional sources. So it reduces the global warming and other impacts.

Clearly, humankind has to set a different course in its need for energy, one that involves less intrusive sources such as solar, wind and geothermal energy. They are energy sources that don't harm the planet and will never run out.

The clock is ticking down but there's still time. Humankind has proven to be resourceful and prudent in the past. It needs to be again in the crucial areas of energy and the environment in order to assure sustainability for future generations.

REFERENCES

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