THE RELATIONSHIP BETWEEN CHEMISTRY, SOLAR CELL AND SOCIAL RESPONSIBILITY

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ABSTRACT

The purpose of this paper is briefly to explain the relationship between chemistry, solar cell and social responsibility. Energy is essential for economic and social development. The world is under the threat of global warming because of using non-renewable energy such as fossil fuels. The non-renewable sources of energy will be depleted one day. So, it is needed to use renewable energy sources such as solar, wind, geothermal energy. Renewable energy which has low carbon dioxide emission is clean energy. The solar energy is the major renewable energy source. The ultimate source of all energy on earth is the sun. Solar energy comes directly from the power of the sun and is used to produce electricity, to produce heat, and for light. Solar energy is easily available all around the world. Solar cells, also called photovoltaic cells, are electronic devices used to generate electricity directly from sunlight. Chemistry knowledge and chemicals are used in preparation of solar cell devices. Solar cells which have high energy efficiency are used to make life easier in modern society consuming large amounts of energy.

Key words: Chemistry, solar cell, social responsibility

INTRODUCTION

Chemistry and energy are important in our daily lives. Chemical reactions are everywhere in nature. We need energy to sustain our life. It is clear that energy requirement is essential when basic human needs such as lighting, cooking, space comfort, communication, cooling drinks and foods are considered (Moomaw,2011). Increasing energy demands, depletion of the carbon-based energy sources, and global warming have led to the interests in renewable energy sources. Sunlight provides a clean, safe, renewable and economic energy source for people. The Sun which is clean and cheap energy is already used by nature to sustain almost all life on Earth. Unlimited source of clean energy is used for solar cells to generate electricity directly from sunlight. Energy is a significant factor for economic development and social prosperity of countries. The relationships between chemistry, solar cells and social responsibility are to use clean energy, increase productivity of energy for solar cell, produce suitable materials for solar cell efficiency, and encourage consumers' using energy efficient products. And dye-sensitized solar cells (DSSC) have a significant potential as low-cost devices for generating electricity (Lee,2009, Nazeeruddin, 2011).

CHEMISTRY-ENERGY

Some chemical reactions take place in human body. Also, chemical reactions are everywhere in nature. For example; photosynthesis, synthesis of Vitamin D, digestion process, aerobic respiration, anaerobic respiration. Protein is the major functional and structural component of all the cells of the body. The basic unit of protein is amino acids. Proteins are synthesized from amino acids containing $–NH_2$ and –COOH groups. Energy which is the capacity to do work is one of the most fundamental parts of our lives.

There are two types of energy known renewable and non-renewable. Several concerns arise from the utilization of non-renewable energy resources, such as insufficient supply energy sources, and other factors related to health and environmental issues such as air pollution, carbon dioxide emission and green house effects. We know that fossil fuels which are non-renewable are limited and will be depleted one day. The use of fossil fuels has contributed to the recent increase in the greenhouse gas effect and CO_2 emissions, as well as global warming (Abdullah,2014). Therefore, researchers started to use renewable energy sources (Ahmad,2015).

Renewable energy is an energy that comes from sources that are naturally replenished (Marcellus Shale, 2011). Renewable energy technologies produce cost-effective energy by converting crude form of energy into useful forms (Dubey, 2014). Solar light is the most important source of regenerative energy (Meissner,1991). Sunlight provides a clean, safe, renewable and economic energy source for people. Also, the sun is the source of all life on the Earth. Solar energy is the most abundant of all energy resources. Advantages of solar energy are that it is unlimited supply and cause no air and water pollution. Energy is essential for

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economic and social development and improved quality of life (Kaygusuz, 2003). Home heating and producing electricity are primary areas of utilization of solar energy.

The solar energy potential of TURKEY is shown in figure 1. Turkey has a high potential for solar energy due to its advantageous geographical position (Topkaya, 2012). Turkey is located between Europe and Asia, bordering the Mediterranean, Aegean and Black Seas. Turkey is making an effort to use of its geographic location as a transit country (Çapık, 2012).

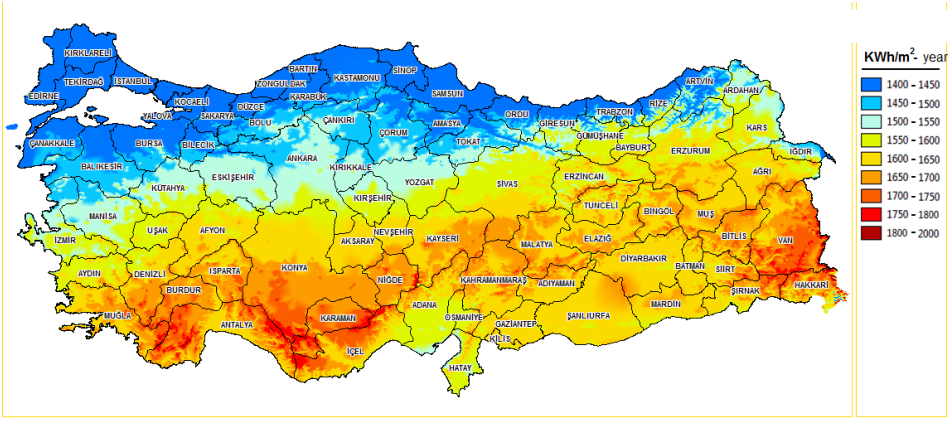

Figure1. Solar energy potential map of TURKEY (Demir, 2012)

SOLAR CELL

Solar cells, also called photovoltaic cells, are solid electronic devices used to generate electricity directly from sunlight by using an unlimited source of clean energy (Birel,2015). The main goal of all energy transformations is to provide energy services that improve quality of life (Sims,2007). The typical solar cell consists of titanium dioxide (TiO_2), dye called as sensitizer, an electrolyte as shown in figure 2. Chemistry is used in preparing solar cell device. TiO_2, dye and electrolyte are chemicals. Also, chemistry knowledge is needed to understand the working principle of solar cell. After illuminating with sun light, electron movements start. When illuminated, light is absorbed by the dye adsorbed on the surface of the TiO_2 transparent film. It leads to the excited sensitizer. Excited sensitizer transfers an electron within a short time into the conduction band of the semiconductor, TiO_2. This leads to an effective charge separation. The injected electron flows through the semiconductor network to arrive at the back contact and then through the external load to the counter electrode to reduce the redox mediator. The oxidized sensitizer is regenerated by accepting electrons from the iodide ion. The triiodide redox mediator diffuses towards the counter electrode and is reduced to iodide. This completes the circuit (Birel, 2015). Organic solar cells appear to be a highly promising and cost-effective alternative for the photovoltaic energy sector (Mishra,2009).

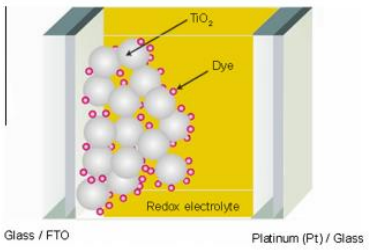

Figure 2*. Typical structure of dye sensitized solar cell (Ahmad,2015)*

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The relationships between chemistry, solar cells and social responsibility are to use clean energy, increase productivity of energy for solar cell, produce suitable materials for solar cell efficiency, and encourage encourage consumers' using energy efficient products.

Energy is a significant factor for economic development and social prosperity of countries. As Human society requires more energy, the lack of fossil energy and its pollution on the environment has given rise to a serious contradiction among energy provision, environment protection and economic development. Therefore, renewable energy such as solar, wind, hydropower, and biomass and geothermal are potential sources to meet global energy requirements (Çapık, 2012).

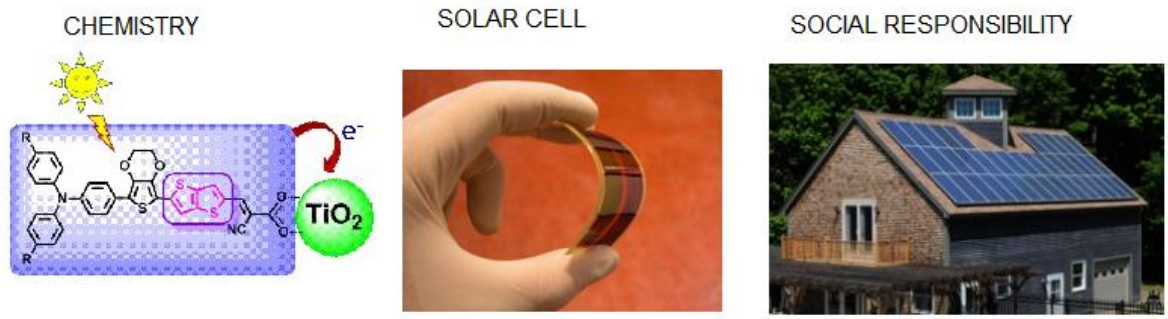

Figure 3.Schematic illustration of relationship between chemistry, solar cell and social responsibility (Kumaresan, 2014; Glowack, 2012; Report, 2013)

Organic or inorganic chemicals are used to prepare solar cell device. Photovoltaic cell is inexhaustible, does not lead to secondary environmental pollution, has no exhaust that produces green-house gases, and has zero nuclear waste by-products (Ahmad,2015). Also, it is important to lower the cost of electricity produced from photovoltaic cell technology.

Pollution depends on energy consumption (Kalogirou, 2004). Global warming is the increase of Earth's average surface temperature due to the effect of greenhouse gases. Greenhouse gases are carbon dioxide, methane, nitrous oxide, ozone, chlorofluorocarbons and water vapor. Due to the consumption of fossil fuels such as coal and oil, increased levels of greenhouse gases in the atmosphere are causing higher global temperatures. So, the world is under the threat of global warming. Global warming can lead to increased flooding, sea level rise, serious storms and heat waves. Extreme storms harm public health (pollen allergen) and air quality. Global warming's effects are floods, storms, heat waves, air pollution, water-borne infections, sea-level rise. Briefly, the reflections of global warming on daily life are seen as climate change and drought signals. Studies of the production of clean, sustainable and low-cost energy have gained speed because of the reasons such as limitation of fossil fuel resources and increasing the amount of money to be paid to purchase this energy type. For this purpose, solar cells which convert solar energy to usable energy have become the focus of attention.

Generally, the social benefits of solar energy systems can be divided into three categories: energy saving, generation of new working posts and decrease of environmental pollution. One area that seems to be of considerable importance in many countries is the ability of solar energy technologies to generate jobs as a means of economic development of a country. The most important benefit of renewable energy systems is the decrease of environmental pollution. This is achieved by reduction of the air emissions due to the substitution of electricity and conventional fuels. The most important effects of air pollutants on the human and natural environment are their impact on public health, on agriculture, on buildings and historical monuments and on forests and ecosystems (Kalogirou, 2004).

With solar electricity generation, no fuel is consumed, no pollution and no green house gas are created. It is great promise for solving global warming.

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