Academic Journal of Polymer Science
ISSN: 2641-8282

Juniper PUBLISHERS key to the Researchers

Mini Review
Volume 5 Issue 3 - September 2021
DOI: 10.19080/AJOP.2021.05.555661

Academ J Polym Sci

Use of Conjugated Polymers for Photocatalytic Hydrogen Production

Savas Gurdal[1]* and Sermet Koyuncu[2]

[1]Science and Technology Application and Research Center, Canakkale Onsekiz Mart University, Turkey

[2]Department of Chemical Engineering, Canakkale Onsekiz Mart University, Turkey

Submission: August 31, 2021; **Published:** September 07, 2021

***Corresponding author:** Savas Gurdal, Science and Technology Application and Research Center, Canakkale Onsekiz Mart University, Turkey

Abstract

Hydrogen production from renewable energy sources has become an application that has started to be used frequently and hydrogen can be produced using photovoltaic solar energy. In this way, modules for the electrolysis of water without emitting carbon dioxide or requiring fossils fuels can be produced. Ensuring the optimum match between the electrolyzer and the photovoltaic system is very important for hydrogen production. However, the energy efficiency is low in the solar energy water seperation, this conversion rate can be improved by the design of new materials. Catalyst systems consisting entirely of conjugated polymers (CP) have started to be used as a new generation photocatalyst for hydrogen production from solar energy. Linear polymers with optical and electronic properties, aqueous solutions including planar polymers, triazine/heptazine polymers and other related organic conjugates have been recently produced for hydrogen production. Semiconductors with a particular focus on rational manipulation composition has been mentioned. In this summary, conjugated polymers with strong optical and electronic properties, which is used for hydrogen production recently, are mentioned.

Keywords: Hydrogen; photocatalysis; conjugated polymers; solar energy; photocatalytic

Introduction

Due to the continuous increase in population and industry, the global energy demand is increasing. For the climate change and limited fossil resources, it is necessary to use the sun as an energy source. Hydrogen production from water and solar energy can be a source for sustainable energy [1]. In this way, modules for the electrolysis of water without emitting carbon dioxide or requiring fossils fuels can be produced. The stored hydrogen can be used later when it needs energy. However, the energy efficiency is low in the solar energy water seperation, this conversion rate can be improved by the design of new materials. Conjugated polymers as photocatalysts due to the precise tunability of their optoelectronic properties make them more attractive to produce hydrogen from solar energy. Development of photocatalytic systems, mainly containing a semiconductor, absorbs photons for the generation of light-excited electrons and holes for water splitting reactions, Which is worked most at last decades. In recent years, many inorganic semiconductor photocatalysts have been studied in this field. Compared to these, organic semiconductor catalysts with energy levels that enable photocatalytic water splitting have been much less studied [2].

Conjugated materials can absorb visible light due to their delocalized p-structure. Due to this feature, it has led to its use in organic electronics and organic photonics applications [3]. Collective properties that CP's provide for energy conversion, they have an key advantage over small molecule organic dyes. CPs' electrical conductivity and rate of energy migration provide amplified feasibility for their application in artificial photosynthesis. CPs have very strong photonic and electronic properties, so CPs are widely used in light emitting diodes, transistors, photovoltaic cells and sensors. Effective use of CPs can be achieved by in-depth research in artificial photosynthesis applications [4]. Photocatalysts adapted for hydrogen production in aqueous solutions from conjugated organic polymers that can be synthesized via Suzuki couplings, tirmerization reactions and Schiff base reactions. These linear polymers with optical and electronic properties, aqueous solutions including planar polymers, triazine/heptazine polymers and other related organic conjugated polymers have been recently produced for hydrogen production.

Conjugated Polymers which reported in the literature for the photocatalytic H2 evolution are;

- **i.** Carbon-Nitride-Based Polymers
- **ii.** Planarized Conjugated Polymers
- **iii.** Linear One-Dimensional Conjugated Polymers
- **iv.** Other Conjugated Polymers
  - **a.** Benzothiadiazole-Based Conjugated Polymers
  - **b.** Polyimide-Based Polymers
  - **c.** Imine-Linked Conjugated Poly(azomethine) Networks
  - **d.** Covalent Organic Frameworks
  - **e.** Pyrene-Based Conjugated Polymers
  - **f.** Bipyridyl-Based Conjugated Polymers
  - **g.** Covalent Triazine-Based Frameworks

Key features of the CPs for the photocatalytic processes are visible-light activity, namely robustness and nontoxicity [3].

Conclusion

Organic semiconductor catalysts with energy levels that enable photocatalytic water splitting have been much less studied compared to many inorganic semiconductor photocatalysts have been studied in this field. Catalyst systems consisting entirely of conjugated polymers (CP) have started to be used as a new generation photocatalyst for hydrogen production from solar energy. In this review, We mentioned photocatalysts which are adapted for hydrogen production in aqueous solutions from conjugated polymers. In the future, we will be seeing synthesis and fabrication techniques to produce hydrogen from solar energy with conjugated polymers.

References

1. Carmen GL, Mariam B, Miguel GM, Freddy EO, Fernando F, et al. (2020) Hybrids Based on BOPHY-Conjugated Porous Polymers as Photocatalysts for Hydrogen Production: Insight into the Charge Transfer Pathway. ACS Catal 10(17): 9804-9812.
2. Tao X, Zhao Y, Mu L, Wang S, Li R, Li C (2018) Bismuth tantalum oxyhalogen: a promising candidate photocatalyst for solar water splitting. Adv Energy Mater 8(1): 1701392.
3. Guigang Z, Zhi An, Xinchen W (2016) Conjugated Polymers: Catalysts for Photocatalytic Hydrogen Evolution. Angew Chem Int Ed 55(51): 15712-15727.
4. Braun D, Heeger AJ (1991) Visible-Light Emission from Semiconducting Polymer Diodes. Appl Phys Lett 58(18): 1982-1984.

DOI: 10.19080/AJOP.2021.05.555661

 How to cite this article: S Gurdal and S Koyuncu. Use of Conjugated Polymers for Photocatalytic Hydrogen Production. Academ J Polym Sci. 2021; 5(3): 555661. DOI:10.19080/AJOP.2021.05.555661