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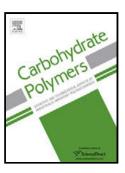
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## ACCEPTED MANUSCRIPT

Comparison of chitosan and chitosan nanoparticles on the performance and charge recombination of water-based gel electrolyte in dye sensitized solar cells

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#### **Abatract**

In commercialization of liquid dye-sensitized solar cells (DSSCs), whose leakage, evaporation and toxicity of organic solvents are limiting factors, replacement of organic solvents with water-based gel electrolyte is recommended. This work reports on utilizing and comparison of chitosan and chitosan nanoparticle as different gelling agents in preparation of water-based gel electrolyte in fabrication of dye sensitized solar cells. All photovoltaic parameters such as open circuit voltage ( $V_{oc}$ ), fill factor (FF), short circuit current density ( $J_{sc}$ ) and conversion efficiency ( $\eta$ ) were measured. For further characterization, electrochemical impedance spectroscopy (EIS) was used to study the charge transfer at Pt/electrolyte interface and charge recombination and electron transport at  $TiO_2$ /dye/electrolyte interface. Significant improvements in conversion efficiency and short circuit current density of DSSCs fabricated by chitosan nanoparticle were observed that can be attributed to the higher mobility of  $I_3$ -due to the lower viscosity and smaller size of chitosan nanoparticles.

#### **Highlights**

- Chitosan nanoparticles synthesized by ionic gelation and ultrasonication methods.
- The effect of chitosan size on performance of DSSC in water electrolyte investigated.
- Photovoltaic parameters of fabricated DSSCs measured and the results compared.

**Keywords:** Biopolymer; Chitosan nanoparticle; Water based electrolyte; Dye Sensitized Solar Cells; Electrochemical impedance spectroscopy.

#### 1. Introduction

One of the most important issues that has obsessed present worldwide research is related to the future energy crisis, because of the growth of energy consumption and limited nonrenewable

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