1. INTRODUCTION

With increasing global energy consumption and environmental pollution, traditional fossil energy sources cannot meet the sustainable development of human society. The utilisation of clean, renewable energy sources has become a prerequisite for the development of human society. Among a variety of new energy technologies, solar power is undoubtedly one of the most promising technologies. A solar cell is a device that converts light energy directly into electrical energy via photovoltaic effects or photochemical reactions. In 1839, the French physicist Becquerel discovered the photovoltaic effect for the first time. In 1876, British scientists Adams et al. found that a selenium semiconductor could produce electricity when it was radiated under sunlight [1]. In 1883, Fritts successfully prepared the first semiconductor/metal junction solar cell with a piece of germanium coated with a thin layer of gold although the efficiency was only ~1%. In 1954, Pearson et al. from US Bell Labs developed the first piece of crystalline silicon solar cell and achieved a conversion efficiency of 4.5%, thus beginning a new era for the utilisation of solar power [2]. The monocrystalline silicon/polycrystalline silicon solar cells currently employed in industrial applications have achieved a photovoltaic conversion efficiency of more than 20% [3, 4]. However, such silicon-based solar cells are characterised by a high cost, harsh preparation conditions, and serious environmental pollution. Cadmium telluride and copper indium gallium selenium thin-film solar cells have achieved a high efficiency of photovoltaic conversion in the laboratory, but the industrial applications are restricted by the high production cost, environmental pollution, and other problems [5]. In recent years, dye-sensitized solar cells, as the representative of the third-generation solar cells, have achieved a photoelectric conversion efficiency of more than 13% in the laboratory and have developed rapidly due to their significant advantages, including low cost, simple process, and high efficiency [4]. However, dye-sensitized cells still have two disadvantages. Firstly, in order to ensure the full absorption of sunlight's energy, the absorbing layer is thick (>10 μm) because it is difficult to achieve complete light absorption using a thinner absorbing layer in the solid-state cells [6, 7]. Secondly, organic dyes cannot avoid the phenomenon of light bleaching. These two problems have prompted researchers to develop excellent all-solid dye materials. A perovskite is any material with the same type of crystal structure as calcium titanium oxide (CTiO3). Known as the perovskite structure ABX3. The term perovskite compounds of the generic formula $A_{1-x}B_xMnO_3$ where A and B can be a trivalent or divalent element, mostly rare earth (La, Pr, Nd, Sm) or alkaline earth (Sr, Ni, Ca, Pb, B).

In 2009, Japanese scientists Kojima et al. found that the organic metal halide perovskite was similar to dyes and can absorb sunlight. The perovskite can be applied in the dye-sensitized solar cells with a liquid electrolyte as a sensitizer to achieve power conversion efficiency (PCE) of 3.8% [8]. In 2012, Kim et al. reported all-solid-state perovskite solar cells with a PCE of 9.7% for the first time [9]. Because of the high efficiency and low cost, perovskite solar cells have attracted extensive attention from researchers worldwide and have developed rapidly in recent years. So far, the highest conversion efficiency has been 22.1% in 2016, which was certified by the National Renewable Energy Laboratory (NREL) [10, 11]. Further improvements in the performance of perovskite solar cells are expected to break the bottleneck of conversion efficiency and production cost. As one of the most promising novel photovoltaic cells, perovskite solar cells are of great scientific value and practical significance.

2. Objectives:

- To prepare $(AgNo3)_{0.5}$ $(BN)_{0.5}$ (MnO_2) Nanoperovskite by ball milling method.
- To carry out FTIR spectroscopy to analyse the functional groups of prepared (BN, AgNo3, Mno2) nanoperovskite.
- To carry out the XRD analysis to measure the structural properties of synthesised (BN, AgNo3, Mno2) nanoperovskite.
- To carry out UV – Vis and Photoluuminscence spectroscopy to measure the optical properties of synthesised (BN, AgNo3, Mno2) nanoperovskite.
- To carry out FTIR and infrared light to scan test samples and observe chemical properties for the synthesized nanoperovskite.
- To carry out photo catalytic activity by substances that alter the reaction rate when exposed to UV/visible light.
- To carry out antimicrobial used to study the antibacterial activity of the synthesized perovskite nanoparticle.

3. Methodology:

The nano (BN, AgNo3, Mno2) perovskite sample has prepared from high purity Boron nitride, silver nitrate and manganese dioxide by conventional solid state reaction technique followed by the ball milling technique. The stoichiometric ratio of the base materials have measured and grounded. The mixture has grinded calcinated twice at

450^{0}C for 2 h in muffle furnace. Further, the calcinated powders have subjected to high energy ball milling with intermediate grounding. A small amount of milled powder has taken out from the bowl after various time of milling to check the formation of nanostructured material. Finally, sample has used for XRD, UV, FTIR, photoluminescence like further characterization. We characterize photo catalytic activity by the catalyst was dispersed into 100 mL of dye solution in a glass beaker and visible lamp used as the light source (Light spectrum of lamp is presented in Supplementary Information). Before irradiation, the suspension was stirred for 30 min in the dark to ensure the adsorption/desorption equilibrium between the dye and catalyst. At fixed time intervals (every 1 h), 5 mL of suspension was taken from the reaction beaker and centrifuged to remove the particles. Finally, calculate the power and efficiency of nanoperovskite material coated solar cell.

References:

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