

**INVESTIGATION OF DIFFERENT HALIDE IN
STRUCTURAL, CHEMICAL AND OPTICAL
RESPONSE ON LOW-DIMENSIONAL PEROVSKITE**

NURUL NAAFIZAH BINTI SULAIMAN

**BACHELOR OF SCIENCE (Hons.) PHYSICS
FACULTY OF APPLIED SCIENCES
UNIVERSITI TEKNOLOGI MARA**

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ABSTRACT

INVESTIGATION OF DIFFERENT HALIDE IN STRUCTURAL, CHEMICAL AND OPTICAL RESPONSE ON LOW-DIMENSIONAL PEROVSKITE

Metal halide perovskites (MHPs) have emerged as premier candidates for next-generation photovoltaics due to their superior optoelectronic properties; however, the commercial viability of traditional three-dimensional (3D) structures remains limited by their inherent instability under environmental stressors such as moisture and UV radiation. To overcome these limitations, this research focuses on the development of low-dimensional (LD) frameworks that utilize bulky organic cations (BOCs) to serve as hydrophobic barriers, thereby enhancing intrinsic stability. The primary objective of this study was to synthesize LD lead-halide perovskites using isomeric aminomethylpyridine (AMP) cations via a controlled reflux method and to evaluate their structural, chemical, and optical responses within half-fabricated solar cell architectures. Utilizing a methodology centered on an ambient air reflux process, the samples A1, A2, and A3 were synthesised successfully at 50–90°C in 40% HBr acid using PbI_2 and series of x-AMP isomers ($x = 2, 3$ and 4). Characterisation was performed using UV-Vis and FTIR spectroscopy. Sample A1 (2-amino(methyl)pyridine) exhibited the best performance, demonstrating the most significant red-shift in its absorption spectrum (peak at 363 nm) and the lowest electronic confinement with an optical bandgap of 3.75 eV. In conclusion, this research demonstrates that the 2-AMP-based perovskite exhibits the highest photo-response among the isomers, establishing it as the most effective candidate for the fabrication of stable, high-efficiency half-cell solar devices with an optimized Power Conversion Efficiency (PCE).

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