# UNIVERSITI TEKNOLOGI MARA

# SYNTHESIS, CHARACTERIZATIONS AND CONDUCTIVITY STUDY OF POLY(*p*-PHENYLENEVINYLENE) (PPV) DERIVATIVES

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Thesis submitted in fulfillment of the requirements
for the degree of
**Master of Science**

**Faculty of Applied Sciences**

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## Candidate's Declaration

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

In the event that my thesis is found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree and agree to be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

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# ABSTRACT

In this study, poly(*p*-phenylenevinylene) (PPV) was chosen as a subject due to its interesting conductive and electroluminescence properties. These features enable the PPVs to be a good candidate for polymer light emitting diodes (PLEDs) that have a huge potential in solar panels including photovoltaic cell applications. This thesis is divided into five main chapters. The first chapter gives a brief introduction to PPVs and the second chapter is a review on the synthesis of PPVs and their derivatives. Detailed experimental procedure and spectroscopic data are explained in chapter three. Chapter four is further divided into two parts whereby the first part explains the synthetic approaches and the second part explains the conductivity of PPVs. Finally all findings together with recommendation and future works are summarized in chapter five. PPV derivatives were basically synthesized using modified Gilch's route. In this study, the synthesis involved chemical modifications of PPV unit at one and four positions of the aromatic ring with different alkyl chain length. The synthesis started with *O*-alkylation reaction of 4-alkoxyphenol followed by hydrohalogenation reaction. The monomers were then polymerized by controlling the rate of monomer addition to the base in order to avoid aggregation and incomplete dehydrobromination of monomers. Ten new PPVs and a commercially available MEH-PPV, were successfully synthesized using this method. Six of which were further subjected to conductivity measurement against MEH-PPV as the standard, to observe the effect of the modification of the ring system. The results showed that one of the PPV derivative has higher conductivity in comparison to MEH-PPV, $1.02 \times 10^{-7}$ $Scm^{-1}$. The highest conductivity value was recorded for compound **38** (MPR-PPV) which is $1.11 \times 10^{-6}$ $Scm^{-1}$. The effect of chemical modification made also was observed in terms of solubility and colors. Compounds **36** and **37** were insoluble, and the color of PPVs was in the range of red-orange to violet color after the insertion of benzyl substituent on phenylene units. Besides, exploration on PPV oligomers had resulted in one PPV oligomer in a stereoisomer form (compound **52**). In conclusion, ten new PPV derivatives were successfully synthesized in three main steps and one PPV oligomer was managed to isolate in a stereoisomer form. Some of these polymeric materials showed good solubility and conductivity in their free standing condition. These PPV derivatives which posses interesting red-orange to violet colors is believe can provide an option and good candidates for several applications including polymer light emitting diodes (PLEDs), photovoltaic cells, photodiodes, solar cells and optically pump-lasers.

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