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Electropolymerization of partially purified natural terthiophenes extracted from roots of *Tagetes erecta*

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To fulfill the growing global energy demand, harvesting energy directly from the sunlight, using solar cells, is considered as one of the best methods available. Conjugated polymers have significant influence in changing the perception of solar cell materials due to low cost and manufacturing simplicity compared to conventional Si-based solar cells. It has been shown that the inorganic polymers can be replaced by organic conjugated polymers to construct the organic solar cells.

Polythiophene with both doped and undoped states, are one of the major categories of conjugated polymers used in organic solar cell applications. Starting materials of polythiophenes are commonly obtained from nonrenewable sources such as petroleum byproducts and their price may vary with the crude oil price. Green thiophene derivatives are reported in roots of *Tagetes sp.* The current study discusses electropolymerization of polythiophenes from hexane soluble fraction (HSF) of partially purified roots extract of thiophene derivatives from the *Tagetes erecta*.

In literature, several thiophene derivatives were identified in the root extracts of *Tagetes erecta* including 5-(3-buten-1-ynyl)-2,2-bithienyl, 5-(4-hydroxy-1-butynyl)-2,2-bithienyl, 5-(4-acetoxy-1-butynyl)-2,2-bithienyl and 2,2:5,2-terthienyl (terthiophene). In this work, crude extract of *Tagetes erecta* was partially purified and partitioned into hexane. Partitioning of thiophene derivatives into hexane was confirmed by GCMS studies.

According to GCMS data, terthiophene is the only possible compound in HSF that can undergo electropolymerization. Cyclic voltammetric study was carried out to characterize the redox potential of terthiophenes in HSF and oxidation of terthiophenes was observed at 1.05 V. Electropolymerization of terthiophenes was carried out in acetonitrile medium under inert environment and $LiClO_4$ was used as the electrolyte. During the electropolymerization, a thin layer was formed on the anode surface.

Electropolymerized products from HSF were characterized using FTIR, UV-Visible Spectroscopy and powder X-ray diffraction techniques and those were compared with the results of the electropolymerized product of pure thiophene monomers. These results further confirmed the possibility of electropolymerization of terthiophenes from the HSF of *Tagetes erecta*, to obtain highly crystalline polythiophenes.