



# A comparative study of the effect of organic dopant ions on the electrochemical and chemical synthesis of the conducting polymers polyaniline, poly(*o*-toluidine) and poly(*o*-methoxyaniline)

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Received: 12 October 2020 / Accepted: 16 December 2020  
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## Abstract

Electroactive polymers such as polyaniline and its derivatives have many potential applications, but the nature of the dopants can have an adverse effect on their properties. Polyaniline (PANI), poly(*o*-methoxyaniline) (POMA) and poly(*o*-toluidine) (POT) have been synthesised using appropriate organic acid dopants (2-naphthalenesulfonic acid and 1,5-naphthalenedisulfonic acid) via electrochemical and chemical polymerisation methods, where the later was achieved at pH (1–2) in the presence of ammonium persulfate as an oxidant. The effects of the monomers and organic dopants on the physiochemical properties and morphological surface of the polymers were studied by means of Fourier transform infrared spectroscopy, electrical conductivity measurements, thermogravimetric analysis and scanning electron microscopy (SEM). The above films were also synthesised electrochemically whilst varying conditions such as scan rate, scan number and in aqueous solution of organic acids using cyclic voltammetry techniques. Cyclic voltammetry experiments have been employed to analyse the growth behaviour and electrochemical stability of films in the background electrolytes (monomer-free). It was found that PANI salts displayed higher doping levels and conductivity while POMA and POT salts were found to show lower conductivity and doping levels, respectively. Furthermore the electrochemical response of films was different in the stability and this may be because of the methoxy ( $-\text{OCH}_3$ ) and methyl ( $-\text{CH}_3$ ) groups located at the ortho position of the aromatic ring structure of the monomers (*o*-methoxyaniline and *o*-toluidine). The  $-\text{OCH}_3$  and  $-\text{CH}_3$  groups have significant steric effects and can reduce to form long chains of polymers and also decrease conductivity. The SEM showed that the morphologies of the prepared conducting polymers were different, which was associated with the nature and size of the dopant and monomer present in the bath solution.

**Keywords** Conducting polymers · Polyaniline · Poly(*o*-toluidine) · Poly(*o*-methoxyaniline) · Dopant ions · Chemical and electrochemical polymerisation

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