Investigating the Effects of Primary Amine Linkers with Different Carbon Chain Lengths on the Acid Dissociation Constant (pKa) for Covalently Immobilized Anthraquinone at the Electrode Surface Using Linear and Non-Linear Fitting

By: Hamzah, HH [Hamzah, Hamid Hisham]¹ ¹, Chein, WC [Chein, Wei Chew]¹,², Rahiman, SSF [Rahiman, Siti Sarah Fazalul]²,³, Shafiee, SA [Shafiee, Siti Sarah Fazalul]¹,³

JOURNAL OF THE ELECTROCHEMICAL SOCIETY
Volume: 166 Issue: 16 Pages: H877-H887
DOI: 10.1149/2.0301916
Published: DEC 6 2018
Document Type: Article
View Journal Impact

Abstract
Electrografting of primary amine linkers is a widely used technique to covalently immobilize redox molecules or biomolecules at the electrode surface as it can produce a uniform and highly stable monolayer. Herein, we discussed the effects of having primary amine linkers with different carbon chain lengths as a medium to attach anthraquinone (AQ) at the electrode surface to study its acid dissociation constant (pKa). Anthraquinone was covalently attached to glassy carbon (GC) electrodes in aqueous buffer solutions at different pH values ranging from pH 1 to pH 13. In this study, ethylenediamine (EDA, C₂) and hexamethylenediamine (HMDA, C₆) were used as the primary amine linkers. The pKa values of the surface-bound AQ were determined from the linear and non-linear fittings performed on the graphs of the mid-potential (Eₘₐᵋₜₐ) of the redox peaks for AQ against the pH. The pKa values obtained from the linear fittings were using the values at the intersection point of two linear slopes between two pH gradients, whilst the pKa values for the non-linear fittings were determined according to the Nernst pH reduction theory. Overall, the non-linear fittings can provide us with a reliable and accurate approach in determining the pKa values of AQ. (Q) The Author(s) 2018. Published by ECS.

Keywords
Keywords Pisa: SOLID PHASE SYNTHESIS; MODIFIED GLASSY CARBON; ELECTROCATALYTIC REDUCTION; AQUEOUS ELECTROCHEMISTRY; OXYGEN REDUCTION; GOLD ELECTRODES; QUINONE DERIVATIVES; MONOLAYERS; OXIDATION

Author Information
Reprint Address: Hamzah, HH (reprint author)
USM, Sch Chem Sci, George Town 11800, Malaysia.

Addresses:
¹ USM, Sch Chem Sci, George Town 11800, Malaysia
² USM, Sch Pharmaceut Sci, George Town 11800, Malaysia
³ Univ Texas Austin, Sch Chem, Austin, TX 78712 USA
Email Addresses: hshamhamzah@usm.my

Funding

<table>
<thead>
<tr>
<th>Funding Agency</th>
<th>Show details</th>
<th>Grant Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Universiti Sains Malaysia</td>
<td></td>
<td>304/PKIMA/6315208</td>
</tr>
</tbody>
</table>

View funding text

Publisher
ELECTROCHEMICAL SOC INC, 65 SOUTH MAIN STREET, PENNINGTON, NJ 08534 USA

Journal Information
Impact Factor: Journal Citation Reports

Categories / Classification
Research Areas: Electrochemistry, Materials Science
Web of Science Categories: Electrochemistry, Materials Science, Coatings & Films

See more data fields

Cited References: 70
Showing 30 of 70 View All in Cited References page