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An Electrochemical Study of L-3,4-dihydroxyphenylalanine (L-DOPA)
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Objective: Understand electrochemistry of L-DOPA to have insight into electrochemistry of proteins isolated from blue mussel (Mytilus edulis L)

Introduction
Blue Mussels
• Secrete adhesive structures composed of proteins containing L-DOPA
• Adhesive structures contain metal ions
• Ability to complex metal ions allows for attachment to substrates
• L-DOPA is a novel amino acid having a catecholic functional group

Catechols
• Catechol is 1,2-dihydroxybenzene
• Metal-ligand coordination plays a critical role in adhesive structure formation and adhesion
• Coordination between iron (Fe) and catechol ligands is correlated to high extensibility of mussel byssal threads
• When a catechol coordinates with iron, it forms a metal-catechol complex
• The stoichiometry of Fe³⁺-catechol complexes (mono-, bis-, or tris-) is controlled by pH
• A mono- complex is formed at an acidic pH, a bis- complex at a neutral pH, and a tris- complex at an alkaline pH

Methodology
CV Scans
• 10mL cell with platinum working electrode
• Silver silver chloride reference electrode

Spectroscopy
• Measured absorbances
  - pH=4.5, λmax 650 nm
  - pH=7.2, λmax 545 nm
  - pH=10.2, λmax 503 nm

Results
Cyclic Voltammetry
pH= 4.5
999ppm L-DOPA / 30ppm Fe = 3.3
3.3/197.2 g/mol L-DOPA * 55.85 g/mol Fe = 0.9:1
0.9:1 is ~ 1 L-DOPA to 1 Iron

pH= 7.2
198ppm L-DOPA/ 30ppm Fe = 6.6
6.6/197.2 g/mol L-DOPA * 55.85 g/mol Fe = 1.9:1
1.9:1 is ~ 2 L-DOPA to 1 Iron

Spectroscopy
pH=4.5
137.9 ppm L-DOPA / 30 ppm Fe= 4.6
4.6/197.2 g/mol L-DOPA * 55.85 g/mol Fe=1.3:1
1.3 L-DOPA to 1 Iron

pH=7.2
238.59 ppm L-DOPA / 30ppm Fe= 8.0
8.0/197.2 g/mol L-DOPA * 55.85 g/mol Fe= 2.3:1
2.3 L-DOPA to 1 Iron

Conclusions
• Fe³⁺/L-DOPA complex stoichiometric at pH= 4.5 and 7.2
• Fe³⁺ is more strongly complexed in L-DOPA at pH=7.2
• Absorbance plot shape implies a larger Kₐ at pH=7.2

References: