An Apparatus for a Laboratory Demonstration of Anodic and Cathodic Reactions

Presenter(s):
Kruitk Patel

Abstract:
This demonstration illustrates the oxidation-reduction reactions at anode and cathode, respectively. Flowing electrolyte containing a pH indicator was fed to a Y-shaped electrochemical cell. The outlets of electrochemical cell were connected to two vertically positioned Pasteur pipet fountains. Direct current was applied to generate H₃O⁺ (aq) and OH⁻(aq) ions at anode and cathode respectively. Electrochemically generated ions at respective electrodes changed the pH and color of the electrolyte flowing through the fountain. Different indicators were used to produce fountains of a variety of colors. Colors of two fountains were exchanged by reversing the electrode polarities. This demonstration can be performed in an undergraduate or high school chemistry laboratory or a classroom.

Faculty Mentor(s):
Dr. Rajeev B. Dabke, Department of Chemistry

* Coulmetric Analysis of Antacid Tablets: An Experiment in Undergraduate Laboratory

Presenter(s):
Napoleon Johnson

Abstract:
As a part of my senior seminar research work, I aim at developing a new coulometry cell for analysis of household products. In view of using low sample volumes as well as miniature electrodes, I am developing a coulometry cell made of a silicon-based polymer. This environmentally friendly polymer is easy to process and has favorable mechanical properties. I propose to fabricate a cell consisting of two wells as anodic and cathodic compartments. Silicon-based polymer kit consists of an elastomer and a curing agent. Platinum wire electrodes will be housed in these compartments. A constant electric current will be passed through the cell. Analyte with an electrolyte will be placed in suitable compartment. Passage of electric current will generate H⁺ or OH⁻ species. Neutralization process will be monitored with a suitable indicator. Current required to reach the end point will be monitored. Faraday’s laws will be applied
to evaluate the quantity of household product. Proposed cell has following features that make my research relevant to the real world analysis: 1. Small volumes of sample required (microliters to milliliters) 2. Miniature electrodes reduce fabrication cost 3. No glass parts make the cell robust and suitable for routine use. Proposed cell will be used for analysis of vinegar, household ammonia, soft drinks containing phosphoric, antacid tablets, and iron supplement tablets. Preliminary results of antacid tablet analysis will be presented.

**Faculty Mentor(s):**  
Dr. Rajeev B. Dabke, Department of Chemistry

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*Determination of Toxic Heavy Metals in Ambient Air Samples in Columbus, GA*

**Presenter(s):**  
Brittany Aho

**Abstract:**

Ambient air samples were collected from the rooftop of the Lumpkin Center, Columbus State University, Columbus, GA, since August 2009 and analyzed for toxic heavy metals content. The concentrations of four heavy metals (Arsenic, Cadmium, Chromium and Lead) were determined by graphite furnace atomic absorption spectrometry (GF-AAS). The entire analytical procedure was validated using standard reference materials of Urban Particulate Matter (SRM 1648a), Buffalo River Sediment (SRM 8704), and Trace Elements in Soil Containing Lead from Paint (SRM 2586). Results of standard reference material were in agreement with certified values with a precision better than 5% for more than 96% of the measurements and reproducible results were obtained for ambient air samples.

Keywords: Toxic heavy metal; Ambient air; Columbus, GA

**Faculty Mentor(s):**  
Dr. Samuel Abegaz, Department of Chemistry
Effect of Preparatory Methods on Total and Active Surface Area of Silica Supported Palladium Catalysts

Presenter(s):
Yer Yang

Abstract:
Effect of preparatory methods on total and active surface area of silica supported palladium catalysts.

The catalyst was prepared by adsorption of tetraaminepalladium (II) nitrate on silica slurry in water. The slurry was dried in open air at room temperature for 72 hr, followed by further drying in He at 50C/min at 1000C for 3hr. The dried catalyst was calcined in air at 3000C for 3hr, and reduced at 3000C for 1hr in hydrogen atmosphere. Previous studies indicated that this catalyst was active in removing almost 100% CO at 130ºC and almost 100% CO at 500ºC when the reacting gas composition was 10% CO and 20% O2. The total surface area and active surface area were measured by BET and TPD methods. The crystallite size was calculated from active surface area. The correlation between catalytic activity and surface area will be discussed and presented in this poster.

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Faculty Mentor(s):
Dr. Anil C. Banerjee, Department of Chemistry
Improvement of Conductivity in Polypyrrole Homopolymers

Presenter(s):
Wendell Grainger

Abstract:
Conductive polymers are organic polymers that conduct electricity as a true metallic conductors or semiconductors. Processibility, flexibility, toughness, malleability and elasticity are the major advantages of conductive polymers. Conductive polymers are also plastics (which are organic polymers) and therefore can combine the mechanical properties (processibility, flexibility, toughness, malleability, elasticity, etc.) of plastics with high electrical conductivities. Their properties can be fine-tuned using the exquisite methods of organic synthesis. Since most conductive polymers require oxidative doping, the properties of the resulting state are crucial. Such materials are often salt-like, which diminishes their solubility in organic solvents and hence their processibility. Furthermore, the charged organic backbone is often unstable towards atmospheric moisture. Compared to metals, organic conductors can be expensive requiring multi-step synthesis. The poor processibility for many polymers requires the introduction of solubilizing substituents, which can further complicate the synthesis. In this research several polypyrrole conductive polymers were synthesized using optimized condition to improve the physiochemical properties of polymer and the conductivity as well. In conclusion, these improved polymers may have potential applications in the electronic and semi conductivity technology.

Faculty Mentor(s):
Dr. Yousef Ahmadiben, Department of Chemistry

Investigation of Toxic Heavy Metals in the Soils of Children's Environments in Columbus, GA and Phenix City, AL

Presenter(s):
Heather Boyette

Abstract:
This study provided a comprehensive assessment of four toxic heavy metals (As, Pb, Cr, and Cd) in the soil of children’s environment. Urban soils have accumulated large amounts of pollutants over the years. Since children show a typical hand-to-mouth-behavior, they may ingest such polluted soils. Soil samples were collected from eight day-care centers and playgrounds in Columbus, Georgia, and Phenix City, Alabama. Concentrations of As, Cd, Cr and Pb were determined by Graphite Furnace Atomic Absorption Spectroscopy (GF-AAS) following acid digestion of the soil sample. The instrument was optimized
for ashing and atomization temperatures and tested for standard reference materials of soil origin. Results of this study were in good agreement with the certified values. Reproducible results were obtained for all soil samples collected from Columbus, GA, and Phenix City, AL, with a precision better than 7%.

Faculty Mentor(s):
Dr. Samuel Abegaz, Department of Chemistry

Synthesis, Characterization and Luminescence Studies of Mono- and Dinuclear Europium (III) Complexes based on Carboxylate and Dithiomido Ligands

Presenter(s):
Lee Whitworth

Abstract:
Aromatic carboxylic acids and dithioimidodiphosphine ligands that possess large conjugated systems were used to synthesize europium (III) complexes. The complexes were synthesized by the reaction of EuCl3 · 6H2O with 2,2'-biquinoline-4-4'-dicarboxylic acid dipotassium salt (K2[C20H12 N2 O4]) and dithioimidodiphosphine (K[N(PPh2S)2]) in methanol as a solvent. The reactions resulted in the formation of yellowish and white powders in high yields respectively. The products were characterized by IR, UV-Vis and NMR spectroscopic methods. All the preliminary results suggested the formation of the expected complexes, Eu2[C20H12 N2 O4]3 and Eu[N(PPh2S)2]3.

Faculty Mentor(s):
Dr. Zewdu Gebeyehu, Department of Chemistry