Winter 2012 Volume 11, Number 1

Journal of Undergraduate Chemistry Research

ISSN: 1541-6003

Journal of Undergraduate Chemistry Research JUCR@vmi.edu

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ACKNOWLEDGMENT
The *Journal of Undergraduate Chemistry Research* wishes to acknowledge the generous support of the VMI Chemistry Department and the Virginia Military Institute for their support of this journal.

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CHEMICAL CONTROL OF PAPERWHITE (*NARCISSUS TAZETTA* CV. ZIVA) GROWTH AND FLOWERING

Paperwhites, *Narcissus tazetta*, are plants that are commonly grown indoors from bulbs for blooming in winter. They are known for their stunning white flowers that are perched on top of a much too-tall stem appearing out of proportion to the flowers. In a previous report, paperwhite bulbs were grown in alcoholic solutions (optimal 5 vol% ethanol) instead of water, claiming to result in shorter stems to remedy the plant's "floppiness" without sacrificing floral quality. This study expanded the prior work by testing a wider variety of alcohols as well as other common laboratory and household chemicals for growth solutions. Growing paperwhites in a 5 vol% solution of ethanol in water indeed stunted the stems of the plants, but also lessened the number of flowers, in contradiction to this previous report. Aqueous 5 vol% solutions of ethanol, methanol, isopropanol, ethylene glycol, glycerol, and acetone were all effective at stunting the stem growth by 33-50%, but the number of flowers also tended to be about 33% less than the control (water). Nevertheless, the size of the blooms and the bloom period remained relatively unaffected by the chemical additives. These chemicals appeared to stunt but not kill the paperwhites, probably acting as mild toxins. Thus, although alcoholic solutions are effective in producing paperwhites with shorter stems, the previous conclusion that floral quality remains unaffected is misleading.

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THERMOGRAVIMETRIC ANALYSIS OF SALICYLHYDROXAMIC ACID-BASED METALLACROWNS: A NEW TECHNIQUE FOR METALLACROWN CHARACTERIZATION

Metallacrowns are a family of metallamacrocycles with metal-rich ring structures at the molecular core. Characterization of metallacrowns typically relies upon methods that require sample solubility, e.g. X-ray crystallography or electrospray ionization mass spectrometry. However, many metallacrowns exhibit severely limited solubility. Thermogravimetric analysis shows promise as a technique for metallacrown analysis, especially less soluble compounds. Herein a family of copper 12-MC-4 metallacrowns derived from salicylhydroxamic acid, H_3shi, and derivatives, e.g. 2-methoxy-benzohydroxamic acid, H_2mbha, 5-chloro-2-methoxybenzohydroxamic acid, $H_2$5Clmbha, and 5-methyl-2-methoxybenzohydroxamic acid, H_2membha, is analyzed by thermogravimetric analysis. Similar decompositions, with large mass loss events consistent with loss of the ring supporting, ligands are observed. The data are consistent with a 5:4 ratio of copper:ligand, which supports a 12-MC-4 structure for the new metallacrowns, and is consistent with the structures known for salicylhydroxamic acid copper metallacrowns.

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THERMOGRAVIMETRIC ANALYSIS OF *CIS*-DICARBONYLBIS (DITHIOCARBAMATO)IRON(II) COMPLEXES

The thermogravimetric analysis (TGA) of nine *cis*-dicarbonyl-bis(diorganodithiocarbamato)iron(II) complexes has been carried out. The complexes first lose, either singly or in combination, the carbon monoxide ligands (131-223°C) and then lose a dithiocarbamate ligand and portions of the second, generally yielding FeS_2. Subsequent heating usually yields FeS and then Fe. These TGA results are compared to corresponding tris(diorganodithiocarbamato)iron(III) complexes.

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BASE STACKING IN DEOXYOLIGONUCLEOTIDE DUPLEXES

In this study, the melting temperature of deoxyoligonucleotide double helices containing either eight- or fourteen-base pairs of identical composition but different sequence was measured. From the dependence of the melting temperature on concentration and using a van't Hoff analysis, the thermodynamic parameters (ΔG^o, ΔH^o, ΔS^o) were calculated and compared with the nearest-neighbor model. When the guanine and cytosine content was increased, an increased stability was not observed, thereby illustrating the fact that excess hydrogen bonding alone does not increase the stability of the duplex. The effect of a series of organic solvents on the stability of the double helix was investigated as well. The reduced stability of the duplexes with increased hydrophobicity of the solvent reinforces the stabilizing effect of the hydrophobic component of base stacking.

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A COMPUTATIONAL APPROACH TO UNDERSTANDING CROP DISEASE RESISTANCE AND SUSCEPTIBILITY

Polygalacturonases (PGs) are a form of pectinase produced by fungi and bacteria during the early stages of attack on plant cell walls. Many plants have polygalacturonase inhibitor proteins (PGIPs) that show varying degrees of inhibition against some PGs. The PGIP inhibition mechanism was investigated by studying the PG from *Xylella fastidiosa* and PGIPs from grape, known to be susceptible, and from pear, known to be resistant. Molecular modeling and molecular dynamics simulations were performed to observe the activity of the XfPG in the presence and absence of PGIPs. The results suggest that molecular dynamics simulations are capable of monitoring the activity of PGs and can consequently observe the effects of inhibition or non-inhibition when PGIPs are added. The computational methods employed in this study will be valuable in the continued assessment of known inhibiting and non-inhibiting PG/PGIP pairings in an effort to identify predictors for crop disease resistance or susceptibility.

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METHOD DEVELOPMENT FOR ELEMENTAL ANALYSIS OF FOLIAR BLUEBERRY (*VACCINIUM CORYBOSUM* L.) SAMPLES

Interest in organic vegetables and fruits has grown among both consumers and farmers. Key to the development of organic farming systems is monitoring crop health. This can be accomplished by analysis of leaf nutrients with atomic absorption spectrometry (AAS). However, AAS can require significant sample preparation before analysis. This study developed a sample preparation protocol for optimal foliar elemental analysis of Fe, Zn, Mn, Cu, Ca, and Mg from two blueberry cultivars, Blueray and Jersey. Two acid digests and two concentrating treatments, with and without dry-ashing, were compared. Elemental concentrations were the same for non-ashed samples than for samples ashed at 450°C, as well as for samples digested with 6 M HCl or concentrated HNO_3. Elemental concentrations are different between blueberry cultivars and cannot be grouped together for nutrient evaluation. Using oven-dried leaf samples digested with 6 M HCl was established as the preferred method due to ease of preparation.

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REMOVAL EFFICIENCY OF SULFAMETHOXAZOLE IN WATER SAMPLES USING NANOMATERIALS

The presence of pharmaceuticals and personal care products (PPCPs) in natural water resources and drinking water supplies has raised public concern because of their potential adverse ecological effects on aquatic organisms or even on human health. The study of pharmaceutical elimination is crucial in providing information for the disinfection strategy in water treatment facilities. This research project was conducted to investigate the feasibility of using nanomaterials to remove sulfamethoxazole from natural and drinking water. Three different nano-materials (iron oxide, silicon oxide, and activated carbon) at four different contact time increments (30 minutes, 2 hours, 3 hours, and 24 hours) have been studied to investigate the removal efficiency of sulfamethoxazole. A high performance liquid chromatography (HPLC) system was used for quantitative analysis of sulfamethoxazole in natural and drinking water. Duplicate data for each condition was obtained for data accuracy and statistical data analysis. The research results show that iron oxide nanoparticles at 3 hour contact time provide the best removal for sulfamethoxazole in water. This study provides valuable information for water treatment facilities.

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STORAGE STABILITY AND LUBRICITY OF SOY, CORN AND CANOLA-DERIVED BIODIESEL BLENDED WITH PETROLEUM-DERIVED DIESEL

As the price of petroleum fuels continues to escalate, the use of bio-derived materials both as fuels and/or as blending stocks becomes more attractive. Historically, many biomass and agricultural derived materials have been suggested. Middle distillate transportation fuels for military applications have more severe restrictions than for the regular commercial consumer. One of the most difficult requirements to meet is that of fuel storage stability. In the present research, SoyGold®, along with synthesized corn and canola methyl esters were added in concentrations of up to 20% to both stable and unstable petroleum middle distillate fuels. The agricultural liquids mixed with petroleum diesel fuel proved stable. Furthermore, the addition of the agricultural fuel liquids enhanced the combustion properties, greatly improved the stability of unstable petroleum fuels, and dramatically improved fuel lubricity.

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THE INFLUENCE OF PROLINE ON THE FOLDING OF CONOTOXINS

Understanding the role of disulfide bridges is essential in the study of protein folding. We are exploring how slight changes in the sequences of small peptides can influence their folding properties. The peptides in our study are multiple disulfide bridge-containing peptides, α-conotoxins SI, SIA, GI, and GII. These are thirteen amino acid-containing peptide amides having four cysteine residues. The four cysteines can form two disulfide bridges, leading to three possible regioisomers. The amino acid in position 9 of the sequence of these peptides has a significant role in the biological characteristics of these compounds. We have investigated the effects of proline in this position on the folding of the peptides. Proline's cyclic nature may impose steric constraints for the folding of the peptides.

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Journal of Undergraduate Chemistry Research

ISSN: 1541-6003 JUCR@vmi.edu
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