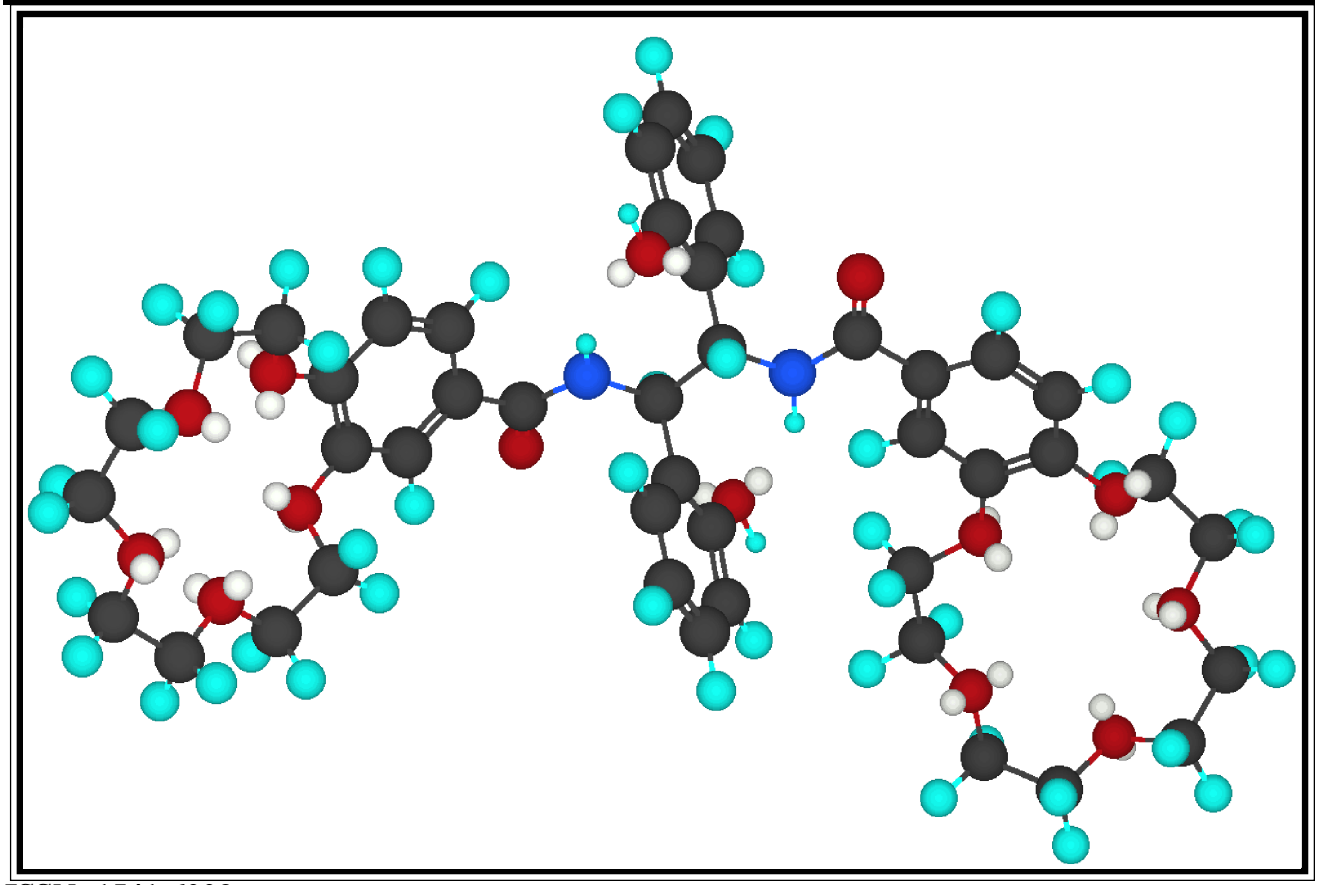
Winter 2013 Volume 12, Number 1

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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Volume 12, Number 1 **Winter 2013**

Journal of Undergraduate Chemistry Research

ISSN: 1541-6003

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SYNTHESIS AND CHARACTERIZATION OF TWO NEW N,N'-BIS(PHENYLIMINO)ETHANES

Described in this report is the synthesis of *N,N*'-bis(4-methoxy-2-methyl-phenylimino)ethane and *N,N*'-bis(4-methoxy-3-methyl-phenylimino)ethane via imine condensation performed under mild conditions in methanol. The new diimines were fully characterized using spectroscopic and crystallographic methods.

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QUANTIFICATION OF 4-ETHYLPHENOL IN BELGIAN STYLE BEERS BY GAS CHROMATOGRAPHY-MASS SPECTROMETRY

The fermentation of grain to produce alcoholic beverages has occurred for several millennia. In order to impart distinct flavor and aroma characteristics in beer, microorganisms with differing metabolic pathways have been utilized. Certain styles of Belgian beers, such as Lambic and sour ales are brewed with *Brettanomyces spp.* instead of the typical *Saccharomyces spp. Brettanomyces* yeast produces 4-ethylphenol, which has a characteristic aroma of leather, varnish, or a barnyard animal. Here, the 4-ethylphenol content of imported and homebrew Belgian style beers was quantified. The analyte was isolated through a liquid-liquid extraction and analyzed using gas chromatography-mass spectrometry. An internal standard curve was used to determine analyte concentrations, and the values were compared to the sensory perception threshold value of 0.440 ppm. It was determined that the homebrew beer contained the most 4-ethylphenol. Analytical figures of merit were also calculated based on the internal standard curve to validate the results.

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ANALYSIS OF THE THERMAL LOSS OF CO FROM CIS DICARBONYLBIS(DIORGANODITHIOCARBAMATO)IRON(II) COMPLEXES

Thermogravimetric analysis was used to investigate the thermal loss of CO ligands from *cis*-dicarbonylbis-(methylphenyldithiocarbamato)iron(II) and *cis*-dicarbonylbis(dibenzyldithiocarbamato)iron(II). Mass loss equivalent to removal of one CO ligand produced compounds that were stable under nitrogen, and in the case of the methylphenyl derivative, stable in air. Empirically, these new compounds are monocarbonylbis(methylphenyldithiodicarbamato)iron(II) complexes and have not previously been reported in the literature. These monocarbonyl complexes may exist as a five-coordinate complex or a bridged dimer. Attempts to identify the structure of these compounds using FTIR were inconclusive.

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DETAILED SPECTROSCOPIC AND THERMODYNAMIC CHARACTERIZATION OF NICKEL(II) COMPLEXES WITH METHYL/PYRIDINE ATTAINED VIA FACTOR ANALYSIS

The molar absorptivity curves for $[NiL_n(MeOH)_{6-n}]^{2+}$ L = pyridine, 3-methylpyridine, 4-methylpyridine, n = 1- 4, have been simultaneously deduced by modeling composite absorbance data of a series of equilibrium solutions in dry methanol using equilibrium-restricted factor analysis, a technique for obtaining spectral and thermodynamic information for component species involved in solution equilibria. Furthermore, the stepwise formation constants at 296 K have been determined with a high degree of accuracy. For pyridine, $\log K_{1-4}$ = 1.272(6), 0.669(9), 0.14(2), -0.32(2), respectively. For 3-methylpyridine, $\log K_{1-4}$ = 1.802(9), 1.16 (1), 0.32(1), -0.46(1), respectively. For 4-methylpyridine, $\log K_{1-4}$ = 2.808(9), 1.114(4), 0.411(4), -0.421(9), respectively. Unrestricted factor analysis was used to confirm the precise number of unique complexes in each case. The only additional complex for which some evidence was found was the *pentakis* version of the pyridine complex.

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THERMOREVERSIBLE GELATION OF POLYCAPROLACTONE IN DIMETHYLFORMAMIDE

The thermoreversible gelation of polycaprolactone homopolymer has been observed for the first time. Samples of polycaprolactone in dimethylformamide form gels at low temperatures and upon heating reversibly transition to solutions. The transition temperature from gel to solution was measured by differential scanning calorimetry and was found to increase with both the concentration and molecular weight of the polycaprolactone samples. The transition temperature from gel to solution appears to be independent of if the polycaprolactone was polymerized with or without the use of 1,4-butanediol as an initiator; however, the use of an initiator might affect the percent crystallinity of the gels.

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REGARDING CLAIMS OF IMPROVED EFFICIENCY IN INTERNAL COMBUSTION GASOLINE ENGINES BY THE ADDITION OF HYDROGEN AND OXYGEN GAS MIXTURES

A study of fuel consumption difference in a small, direct spark engine modified to run on gasoline with a hydrogen and oxygen gas additive was performed. The energy to produce the hydrogen and oxygen through electrolysis was provided indirectly by the engine. No effect on fuel consumption was observed at low levels of additive; however, a small increase in efficiency was observed at a gas addition of 1.0 LPM.

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FORMATION OF THE MIXED EXCIMER OF 1- AND 2-METHYLNAPHTHALENE ON ALUMINA DURING TEMPERATURE PROGRAMMED DESORPTION

Bilayers of 1-methylnaphthalene-d_{10} (1-MN-d_{10}) and 2-methylnaphthalene (2-MN) were formed by vapor deposition onto a single crystal of α-alumina. The rate constants of the laser induced fluorescence (LIF) decay were monitored as the surface temperature of the α-alumina was linearly ramped in a temperature programmed desorption (TPD) experiment. Just prior to the desorption of the bilayer, the intensity of fluorescence increased dramatically. This change has been tentatively attributed to the formation of the mixed excimer. For the mixed excimer, both the fluorescence spectra and rate constants differ slightly from those for the multilayers of 1-MN-d_{10} and 2-MN.

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SYNTHESIS AND UTILIZATION OF TWO-CENTER PHASE TRANSFER CATALYSTS ON ADJACENT CARBONS OF A CHIRAL BACKBONE

Asymmetric two-center phase transfer catalysts using 2-[(1R,2R)-1,2-diamino-2-(2-hydroxyphenyl)ethyl]phenol as the chiral backbone were prepared. For this study, both quaternary ammonium salts and crown ethers were attached to this backbone and employed under S-L and L-L conditions to reduce prochiral ketones. The findings from these reactions indicated the overall activities and asymmetric inductions were dependent on the reaction conditions. The highest asymmetric inductions occurred under S-L conditions were little or no water could be transferred to the organic layer. The activities for these reactions were considerably lower than those found for the ones conducted under L-L conditions. Additionally, activities of the reactions were essentially the same for both the crown ethers and quaternary ammonium salts under all conditions. However, the crown ethers were more effective in yielding asymmetric products than the quaternary ammonium salts.

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Journal of Undergraduate Chemistry Research

ISSN: 1541-6003 JUCR@vmi.edu
http://www.vmi.edu/show.aspx?tid=36955&id=2156&ekmensel=8f9c37c3_156_160_2156_2

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ACKNOWLEDGMENT

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

The *Journal of Undergraduate Chemistry Research* is issued quarterly and indexed once per year. Claims for missing issues will not be honored after four months of issue date. Duplicate copies may not be sent due to the change of address when the publisher was not notified in a timely manner. The *Journal of Undergraduate Chemistry Research* can be contacted via phone (540-464-7244), fax (540-464-7261) or e-mail (PharrDY@vmi.edu) through Dr. Daniel Y. Pharr Editor. Manuscripts will be accepted through e-mail or fax but a hard copy of figures and tables should be sent to the editor. No responsibility is assumed by this journal, editor, reviewers or sponsors for any injury and/or damage from products, negligence, experiments, instructions or ideas contained in this journal that result in damage to persons or property.

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