

Out of the Blue: The Synthesis and Characterisation of *cis*-Bis(glycinato)copper(II)-1-water

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School of Chemistry, [REDACTED]

Background

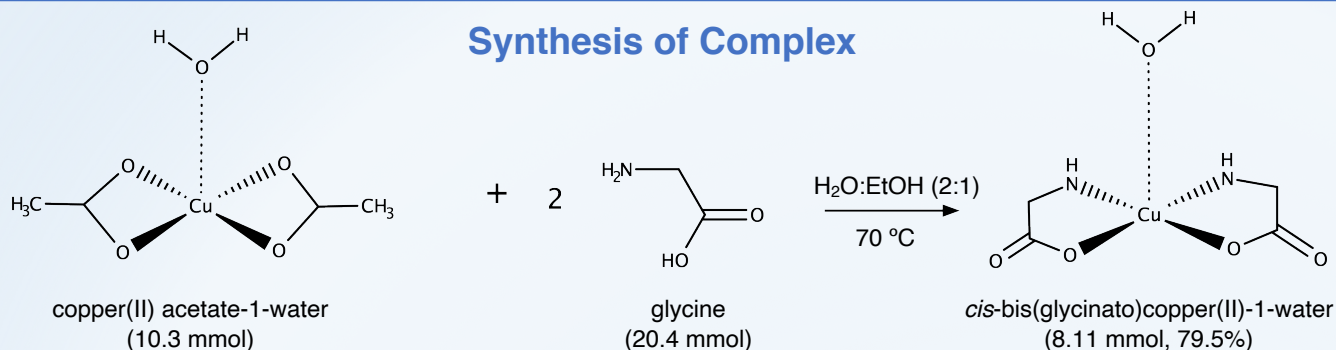
Bis(glycinato)copper(II)-1-water ($[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$) has been shown to be useful in increasing public health: it can be used to increase dental hygiene¹ and, more recently, has been used in the synthesis of nanoparticles which reduce the superoxide radicals produced by smoking.² UV-visible spectroscopy is an important method in determining electron transitions in metal complexes—determining rise to their colour.³

Aims

The aims of this experiment were to:

- synthesise the complex *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$;
- characterise *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$ using UV-visible spectroscopy—determining λ_{max} , ϵ_{max} , and Δ_0 ; and
- determine the solubility of *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$ in different solvent systems.

Synthesis of Complex



Results

The peak at 630 nm in the UV-visible spectrum (see **Figure 1**) shows that the solution of *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$ in water (0.01 M) absorbs light within the red range of frequencies. Therefore, the solution will appear as the complementary colour of red—i.e. blue, as observed.

Hydrochloric acid (3 M) dissolved the synthesised complex to produce a colourless solution (see **Table 1**):

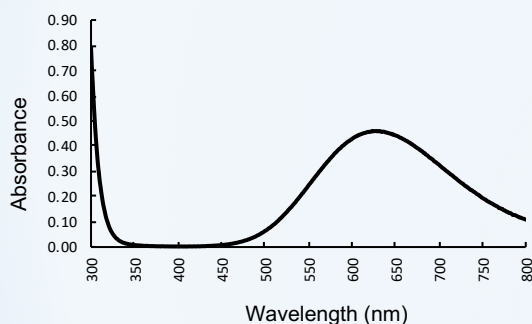
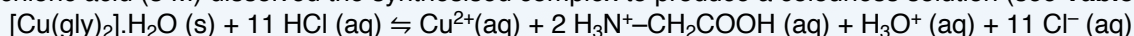


FIGURE 1. UV-visible spectrum of aqueous solution of *cis*-bis(glycinato)copper(II)-1-water (0.01 M) at 25 °C. $\lambda_{\text{max}} = 630 \text{ nm}$, $\epsilon_{\text{max}} = 45.3 \text{ M}^{-1} \text{ cm}^{-1}$, $\Delta_0 = 15900 \text{ cm}^{-1}$.

TABLE 1. Solubility results of *cis*-bis(glycinato)copper(II)-1-water in different solvent systems. Polar aprotic includes chloroform, acetone, 2-propanol, ethanol, and ethyl acetate. Acids/bases include acetic acid, ammonia, NaOH, and HCl. Non-polar includes hexane only.

Solvent system	Soluble
Polar aprotic	×†
Acids/bases	✓
Non-polar	×

† the solute was dissolved in ethanol upon heating

× indicates insoluble

✓ indicates soluble

Conclusions and Outlook

- The complex *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$ was successfully synthesised as light-blue pin-needle crystals with a high yield (79.5%).
- λ_{max} , ϵ_{max} , and Δ_0 were determined and the UV-visible spectrum explained the colour of the solution.
- In future studies, the solubility results could be used to describe the delivery of copper in *cis*- $[\text{Cu}(\text{gly})_2]\cdot\text{H}_2\text{O}$ to different compartments.

References

1. Hunter, B. A.; Moussa, S. M.; Fenton, R. R.; Kennedy, B. J., Polymorphism and Phase Transitions in Bis(glycinato)copper(II). A Powder Diffraction Study. *Aust. J. Chem.* **2002**, *55* (5), 331-341.
2. Korschelt, K.; Ragg, R.; Metzger, C. S.; Klueker, M.; Oster, M.; Barton, B.; Panthofer, M.; Strand, D.; Kolb, U.; Mondeshki, M.; Strand, S.; Brieger, J.; Nawaz Tahir, M.; Tremel, W., Glycine-functionalized copper(II) hydroxide nanoparticles with high intrinsic superoxide dismutase activity. *Nanoscale* **2017**, *9* (11), 3952-3960.
3. Koleżyński, A., Computational Methods in Spectroscopy. In *Molecular Spectroscopy—Experiment and Theory: From Molecules to Functional Materials*, Koleżyński, A.; Król, M., Eds. Springer International Publishing: Cham, 2019; pp 1-48.