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#### Synthesis and Characterization of the Binuclear Mn (II) Complex with 1,10-Phenanthroline and Adipic Acid

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The variety of chemical structures of coordination complexes offers a range of possibilities in spectroscopic, photophysical, and photochemical applications, especially complexes containing phenanthroline-type ligands. The 1,10-Phenanthroline, being a bidentate ligand, favors the complexation of transition metals, obtaining good structural and thermal stability. Adipic acid is one of the dicarboxylic acids, which through the carbonyl group easily binds to metals and has shown promising results in the photoelectric field. The present work seeks to explore the structural, vibrational, and thermal properties of the binuclear manganese (II) complex, 1,10-Phenanthroline and adipic acid, through characterizations of X-ray diffraction (XRD), thermogravimetric analysis (TG), differential thermal analysis (DTA), FT-IR and Raman spectroscopies. The complex was synthesized by the slow solvent evaporation method, with equimolar ratios of 1:1:1. The complex after 20 days and its structure was confirmed by XRD and Rietveld refinement. The parameters that measure the quality of the refinement are good,  $R_p = 9.1\%$ ,  $R_{wp} = 9.9\%$  and  $S = 1.09$  (Goodness of fit); while the lattice parameters are in accordance with the reference cif data,  $a = 8.27(4) \text{ \AA}$ ,  $b = 9.83(6) \text{ \AA}$ ,  $c = 11.99(2) \text{ \AA}$ ,  $\beta = 70.52(8)^\circ$ ,  $\gamma = 75.38(4)^\circ$ ,  $\delta = 72.05(2)^\circ$  and  $V = 863.22(5) \text{ \AA}^3$ . The TG and DTA analyses demonstrated that the material has thermal stability up to 400 K. The FT-IR and Raman analyses evidenced the complexation of the manganese (II) ion with the molecules of 1,10-Phenanthroline and adipic acid, since the observed vibrations are associated with stretches and deformations of Mn (II) with nitrogen and oxygen atoms of these molecules. The results confirm the obtaining of the binuclear Mn (II) complex and it will be subjected to further physical characterizations to verify its potential use in energy storage and/or optical material.