

Riboflavin (vitamin B2) may be used as a potential chelate in Wilson disease: Magnetic resonance relaxation study

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Purpose/Introduction: Generally, absolute values of relaxation times have not been proven to be helpful for defining pathologies, but in some cases, relaxation time measurements can be used to confirm preliminary diagnosis. Illnesses, such as Wilson's disease or anemia, caused by significant increase of free paramagnetic ions circulating in the blood stream. Routine diagnostic tests detect the total content of Fe, Cu or Zn, but these aren't sensitive to distinguish free ions. It is well known that the presence of free paramagnetic ions shortens the NMR relaxation times of blood serum. Addition of the selective chelating agent (i.e.: D-penicillamine (D-pen) to serum causes the formation of stable and water soluble complexes of free ions and this nulls the effect of shortening of relaxation times of solution. After chelation one can easily measure the prolongation of relaxation times and this fact can be used as evidence of presence of free ions in blood serum.

Methods: In our previous investigations we have proposed that the measurements of water protons T_1 before and after chelation with d-PEN may be used as an alternative approach for monitoring the presence of free copper ions in blood serum in the case of Wilson disease [1]. In this communication we show that also riboflavin can be used as a chelation agent. NMR relaxation studies were performed using two Bruker systems: Minispec NMR spectrometer working at a proton resonance frequency of 60 MHz, and Bruker BioSpin working at a proton resonance frequency of 400 MHz. Measurements of T_1 values were performed with use of Inversion recovery method for Minispec relaxometer and Flash sequence for Bruker BioSpin 9.4T.

Results: Fig.1 shows the relaxation rate constants ($R_1 = 1/T_1$) as function of Cu^{2+} concentration in aqueous solutions of $CuSO_4$ with and without riboflavin. Additionally we made MRI scans of animal samples tissue with injected paramagnetic ions solution for illustrating paramagnetic relaxation enhancement before and after chelation.

Conclusions: Obtained results confirm that the chelate action of Riboflavin (Vit.B₂) is very similar to action of D-pen, but riboflavin as a natural product, have much smaller side effects and will be better tolerable for patients as D-pen.

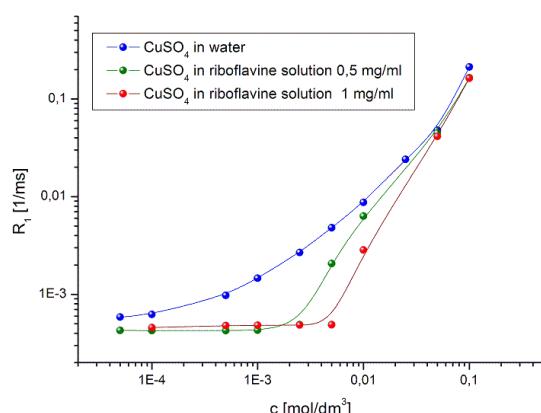


Fig.1. The rate of T_1 relaxation time in water in the function of $CuSO_4$ concentration in addition of Riboflavin as a chelation agent in different concentrations.

[1].Blicharska B., Witek M., Fornal M., MacKay A.L, J. Magn. Reson. 2008, 194, 41-45.