ABSTRACT

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Title of thesis: Preparation of a Novel Method for Screening of Cobalt Chelators

Cobalt as a structural part of the vitamin B12 is an essential microelement for living organisms including humans. However, its excess is associated with pathological conditions. Cobalt poisoning can be caused for example by exposure to cobalt metal dust during the production of hard metals or follow the corrosion of metal hip prosthesis. Patients intoxicated by cobalt can develop different manifestations including neurological impairment, hypothyroidism or cardiomyopathy.

The aim of this work is to prepare a standardized, rapid, cheap but precise method for the screening of cobalt chelators. For this purpose, spectrophotometric detection using 1-nitroso-2-nafphhol-3,6-disulfonic acid disodium salt as the indicator was used. Firstly, it was found that the addition of cobalt ions led to a clear bathochromic shift of the maximum absorbance of the indicator. The relationship between the absorbance and cobalt concentration was highly linear from 470 to 560 nm at all 4 tested pH conditions (4.5, 5.5, 6.8 and 7.5). The sensitivity of the method was 500 nM at pH 4.5 and the method was even more sensitive at higher pH conditions. Long-term stability of the reagents was also documented. Finally, the methodology was tested on known chelators. EDTA chelated Co2+ ions with a probable stoichiometry of 3:2. 8-hydroxyquinoline and its derivative nitroxoline were also relatively strong chelators, while quercetin showed no chelation and baicalein was only a relatively weak chelator.

In conclusion, a competitive method for screening of cobalt chelation was developed. This approach, as far as I know, has not been available previously.