



TO STUDY THE SELECTIVITY OF NATURAL EXTRACT FOR COPPER IONS USING COMPLEXOMETRIC TITRATION: A GREEN CHEMISTRY APPROACH

Chemistry

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ABSTRACT

Development of natural complexing agents has been primarily driven by a desire to minimize the use of synthetic reagents. *Garcinia Indica* (Kokum) fruit extract is highly selective for Cu^{2+} ions forming coloured complex at pH 10. Interference studies also support the strong binding capacity of *Garcinia indica* with copper ions. Use of *Garcinia indica* extract as an indicator in complexometric titrations exhibits a sharp colour change. Further, the comparative study with standard synthetic indicator also led to the conclusion that *Garcinia indica* as a natural complexometric indicator for Cu^{2+} ions imparts the same degree of precision as obtained with synthetic indicators.

KEYWORDS

Garcinia indica, extract, complexometric.

INTRODUCTION :

Use of natural extract isolated from different parts of the plant as pH indicator has been studied extensively¹. Capacity of it to bind with certain metal ion at a specific pH imparting coloured complex is of equal interest². Number of synthetic derivatives are available as ligands for metal complex formation³. Since 'benign chemistry' is the prime aspect of Green technology, tapping the use of natural extract as complexing agents becomes point of concern⁴. *Garcinia Indica* is commonly known as Kokum in India, abundant in southern part of India has been in use as an essential ingredient of food delicacies and medicines. Its dark red colour is attributed to Anthocyanine family⁵⁻⁶ which is reviewed and established in literature survey⁷⁻⁸.

Pigment when isolated in methanol showed sharp coloured complex formation with transition metal ion Cu^{2+} at pH 10. The specific binding capacity of *Garcinia Indica* extract with copper ions at particular pH can be practically employed in complexometric titration.

Standard complexometric titrations make use of organic dyes as indicator that form complex with copper ions. Substitution of organic dyes with present natural extract also imparts sharp colour changes with same degree of accuracy and precision.

Experimental:

Material and Methodology: The peels of *Garcinia Indica* were procured from the Konkan region, Maharashtra. All AR grade chemicals (Thomas Baker) were obtained from Smt. CHM College , Ulhasnagar. Solutions of required Molarity were prepared as per standard procedures.

Calibrated glassware (Corning / Borosil) were used for all experimental procedures. Analytical Balance of 0.001gm sensitivity was used.

Preparation of the extract:

The dry peels of kokum were cleaned by distilled water and cut into small pieces and macerated for four hours and anthocyanins were extracted at 300cc, overnight using solvent system, ethanol:water (80:20) . The extract was preserved in tightly closed container and stored in dark. The pigments in the extract separated by Thin Layer Chromatography – a technique similar to paper chromatography. The buffer system in pH range 1-14 was prepared using potassium dihydrogen phthalate.

Procedure:

Complexometric titrations of 0.02 M solutions of CuSO_4 were conducted against 0.02M EDTA (Disodium salt) as per established procedures , using *Garcinia Indica* extracts as indicator. The results were compared with those obtained using synthetic Metallochromic indicators. Control experiments were conducted , varying the

concentration of salts and also of EDTA , to verify the accuracy and reproducibility of the results.

RESULTS AND DISCUSSION: The extract was studied for its selectivity towards transition metal ion copper in bivalent oxidation state. Two different concentrations of metal ions were prepared to study the efficacy of indicator even at low concentration. Estimation of Cu with EDTA by complexometric titrations:

- Titration of 0.02M EDTA with 0.02M CuSO_4 solution using Murexide indicator in presence of buffer of Ph6. (Table1)

Colour change : Yellow to blue violet

Sr. No.	Initial	Final	Difference	C.B.R.
1.	0.0ml	10.0ml	10.0ml	10.0ml
2.	0.0ml	10.1ml	10.1ml	
3.	0.0ml	10.0ml	10.0ml	

Titration of 0.02M EDTA with 0.02M CuSO_4 solution using *Garcinia Indica* extract as an indicator in presence of buffer of pH10. (Table2)

Colour change: red orange to violet pink

Sr. No.	Initial	Final	Difference	C.B.R.
1.	0.0ml	9.8ml	9.8ml	9.9ml
2.	0.0ml	9.9ml	9.9ml	
3.	0.0ml	9.9ml	9.9ml	

- Titration of 0.1M EDTA with 0.1M CuSO_4 solution using Murexide indicator in presence of buffer of pH6 (Table3)

Colour change : Green to blue violet

Sr. No.	Initial	Final	Difference	C.B.R.
1.	0.0ml	10.0ml	10.0ml	10.0ml
2.	0.0ml	10.1ml	10.1ml	
3.	0.0ml	10.0ml	10.0ml	

- Titration of 0.1M EDTA with 0.1M CuSO_4 solution using *Garcinia Indica* extract as an indicator in presence of buffer of pH 10. (Table4)

Colour change : Blue to green

Sr. No.	Initial	Final	Difference	C.B.R.
1.	0.0ml	10.2ml	10.2ml	10.2ml
2.	0.0ml	10.2ml	10.2ml	
3.	0.0ml	10.1ml	10.1ml	

CONCLUSION; The results indicate that the ethanol extract of *Garcinia Indica* peel can replace synthetic metallochromic indicators for the Complexometric estimation of Copper. High degree of accuracy and sharp, intense colour change at the end-point was observed.

It is particularly beneficial as it can be locally extracted with no energy input, is easily available and being a natural pigment, is Environment

friendly . It has colour stay Capacity of upto 4 weeks when stored in a glass container.

Future scope for study:

As the present fruit extract proves its efficiency in complexometric titrations and its selectivity for copper ions. Thus, interference study with other metal ions can be studied in future.

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