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RESEARCH ARTICLE

BETA VULAGRIES EXTRACT AS SELECTIVE METALLOCHROMIC INDICATOR IN COMPLEXOMETRIC TITRATIONS

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Abstract:
The application of beetroot peel extract as selective metalion indicators was studied in complex metric titration. The pigment imparting red colouris betalain that can be extracted from red beet root peels. It is used as a food coloring agent, and the color is sensitive to pH. Its extensively studied application is in food colours. Present study attempts to explore its use as metallochromic indicator that can substitute the synthetic indicators generally organic dyes. This Green approach is not only eco friendly but economically viable too. Betanin exhibits high affinity for transition metal ions copper and Nickel at specific pH and brings sharp colour change at the end point when titrated with EDTA. The simple extraction with water -ethanol system readily extracts the pigment from waste peels .Comparative study with standard methods using synthetic indicators gives high degree of accuracy which is a success indicator of the study.

Keywords: betalain, complex metric, EDTA

1. Introduction:

It was established that beetroot pulp extract has a high content of bioactive compounds, namely phenolics and betalains, and possesses Important antioxidant and anti-proliferative activities [1,2].

Beetroot (Beta Vulgaris) is the chief source of natural red dye. The pigment whichcauses the red colour is called betalain, which is glucoside and hydrolyses into sugar glucose and betanidin. [3]. Betalains are alkaloid pigments that are found in some families of plants belonging to the order Caryophyllales,Variation of pH also affects the colour of the pigment and it is reddish violet in acidic conditions. The extraction of the pigments is to be carried out carefully as it is readily affected by heat. [3.4]

The most preferred method to produce colour concentrates is Microwave assisted extraction. Heating the plant tissues with solvents by exposing them to microwaves that increases the kinetic of

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extraction, is called microwave-assisted extraction (MAE). A number of advantages is attributed to MAE over traditional method of extraction for e.g., higher extraction rate associated with shorter extraction time, less solvent to express more compounds from complex matrices of vacuoles, especially natural products.[5]Due to rapid technological developments, MAE has become one of the cost-effective extraction methods available today. Various parameters such as pH, microwave power and microwave time were used for the extraction process.

In order to reduce wastage and value addition the peels are subjected to different extraction conditions and red pigments are extracted. The study focused on: 1) drying the peels before it can be used, 2) selecting solvents for pigment extraction from the dried sample, 3) optimizing temperature, Ph and solvent system parameters to get concentrated extract.

Application of concentrated extract was employed as a ph indicator in acid base titrations [5,6]but its use as a metallochromic indicator in complex metric titration remain unexplored . Its color pigment property can be studied as an affinity towards transition metal ions. At specific PH , selectivity of beetroot extract is very high for certain transition metal ions. Taking advantage of this, two transition metal ions were studied for their binding property with beetroot extract and quantifying the amount of those ions in EDTA titrations.

2.1Materials and Methodology:

Beetroot peels collected from local vegetable market and oven dried at 60˚C for 6-8hrs and ground to make a powder of 80 mesh size. Solvent system used for extraction was ethanol and water (ethanol 80%). For preparing metal ion solutions AR grade copper sulphate and nickel sulphate compounds were used.

All glassware used of borosil and calibrated before the course of titration.

2.2 concentration of betalain pigment

The ground dry beetroot peel powder (1gm) was soaked in water (50ml) and allowed to stand in dark for 12 hours. The filtered pigment extract was allowed to mix with solvent system at interface in solvent extraction separating funnels. Equilibration time was maintained as 3 minutes. Extracted pigment was treated as indicator for further complex metric titrations.

2.3 Preparation of metal ion and buffer solutions100 cm3 of 100ppm Copper solution and 100 ppm nickel solution were prepared as stock solutions for titrating with 0.02 M sodium salt of EDTA. Buffer solutions in the range 3-12 were prepared using Indian pharmacopeia.

2.4 Experimental method

Set 1: 10 cm3 of $CuSO_4$ solution + .5 cm3 of buffer solution + 0;5 cm3 of extract indicator

Set II: 10 cm3 of $NiSO_4$ solution + .5 cm3 of buffer soluton + 0;5 cm3 of extract indicator

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Change in colour after addition of indicator were noted and further sharp change in colour during the course of titration near equivalence point were recorded as end point of titration.

Result and Discussion:

1. For set I, Buffer of pH 12 exhibits sharp color change with metal ion-extract solution, from dark blue to faint green
2. For set II. Buffer of pH 10 exhibits sharp color change with metal ion-extract solution, from golden yellow to red

Table 1. 100 ppm Cu solution titrated with 0.02 M EDTA Colour change Colour change at end point Volume of EDTA recorded Addition of buffer pH 10and indicator Fast sulphon Black F Blue Green 5.2 cm3(Reproducibility 3 times)

Addition of buffer pH 10 and indicator beetroot peel extract Blue Faint green 5.4 cm3(Reproducibility 3 times) Table 2:100 ppm Ni solution titrated with 0.02 M EDTA Color change Colour change at end point Volume of EDTA recorded Addition of buffer pH 10and indicator murexide red Bluish violet 5.8 cm3(Reproducibility 3 times)
Addition of buffer pH 10 and indicator beetroot peel extract yellow red 5.6 cm3(Reproducibility 3 times) It is quite evident from above observations that distinct colour change occurs at two stages. When metal ion -indicator complex is formed and near the equivalence point when EDTA -metal ion complex is formed.

Conclusion: Beetroot peel extract can act as a selective metallochromic indicator for copper and nickel metal ions titration with EDTA. It is replaceable by EDTA near end point. The volumes of EDTA recorded for standard synthetic indicators and that of beetroot peel extract at end point coincide with each other indicating good degree of accuracy. Thus beetroot peel extract can be used as a economically viable substitute for synthetic organic dyes widely used as indicators in complex metric titrations.

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