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RESEARCH ARTICLE

MEASUREMENT OF ABSORBANCE THROUGH MIXTURE OF SOLUTION FILTERS

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ABSTRACT

The present research paper discusses the absorbance measurement by using different mixtures of solutions filter. The expected and observed transmittance spectra were recorded and the results have been compared with the wavelength of maximum absorbance, maximum percentage of transmittance values. Mixture of copper nitrate, Copper chloride, Sodium dichromate, Potassium permanganate and Rhodomine- B were used in the present study. $Cucl_2$+$Na_2Cr_2O_7$ mixture solutions desirable results among other mixtures of solution filters. It is commonly know that every compound absorbs or transmits light over a firm range of wavelength. Colorimetry is one of the most useful devices of quantitative investigation in several areas such as chemical science, physical science, life science, and Medical science applications.

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INTRODUCTION

Colorimetry is used to quantify how much a chemical material absorbs light by measuring the intensity of light as a ray of light passes through sample solution and this mechanism is based on Lamberts –Beers low. The study of the filters is very much important in colorimetry. In colorimetric investigation the light of definite wavelength is vital and it provides a simple means for determining minute quantities of the substances using proper filters. In the present research work, the absorbance measurement by using different mixtures of solutions filter. The expected and observed transmittance spectra were recorded and the results have been compared with the wavelength of maximum absorbance, maximum percentage of transmittance values. Mixture of copper nitrate, Copper chloride, Sodium dichromate, Potassium permanganate and Rhodomine- B were used in the present study. Mavrodineanu and Boiteux (1965) define three selection systems for sodium, potassium and calcium consisting of gelatin filters and cuvettes of copper sulphate solution for the selection of sodium, copper chloride solution for the selection of the calcium band. Sill (1961) and Mortimer (2003) status that absorption filters are typically made from dyed glass, lacquered gelatin, or synthetic polymers to offer a wide range of applications. Certain metal complexes or salts liquefied or suspended in glass yield colour equivalent to the predominant wavelength transmitted (Rogers 1986, Burtis and Ashwood, 1994). According Scientific Reports (1966) and Rand (1969) the efficiency of a COJ-500-D Griffin Colorimeter with the created filter was defining by equating the slope of calibration curve of aqueous KMnO4 solution with that obtained with the manufacturer filter of the colorimeter. In this research work, mixture of an absorption of filter above mentioned solution and its performance on expected and observed value are defined.

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MATERIAL AND METHODS

Preparation of solutions

The solutions of selected metal ions are prepared in the concentration of 0.1 M. All the chemicals used were of analytical grade and double distilled water.

- **Copper nitrate ($Cu(NO_3)_2, 3H_2O$) :** 2.4152 g of solid copper nitrate was dissolved in double distilled water and finally diluted to 100 ml to get 0.1 M solution.
- **Copper chloride ($CuCl_2, 2H_2O$):** Preparation of 0.1 M solution of copper chloride was obtain by liquefying 1.7045 g of salt of it in 100 ml distilled water.
- **Potassium permanganate ($KMNO_4$):** 0.0158 g of solid potassium permanganate was dissolved in double distilled water and finally diluted to 100 ml.
- **Sodium dichromate ($Na_2Cr_2O_7, 2H_2O$):** 2.9790 g of sodium dichromate was dissolved in little distilled

water and diluted to 100 ml. The resulting solution is of 0.1 M concentration.

- **Rhodamine-B ($C_{28}H_{31}ClN_2O_3$):** 04790 g of Rhodamine - B was dissolved in little distilled water and finally diluted to 100 ml to get 0.1 M solution.

In present work rectangular cell was used, which possess some particular characteristics. The rectangular cells are used for used for the liquids or solutions. The dimensions of cell was perpendicular to the path of the radiation so that the radiation will not strike the walls and reflect from them. Instrument was 'on' before an hour to stabilize electronic configuration for transmittance or absorption spectra. 100% transmittance is in step by REF front Panel taking reference solution in both rectangular cells and zero percent transmittance is adjusted using an opaque block in the reference position wavelength control. The percentage transmittance and absorbance are noted in the visible region from 400 to 890 mμ and percentage transmittance versus wavelength in mg of each solution were plotted. Results are a affected by uncertainty sources arising from the nature of the compounds and/or solutions that are measured when UV/VIS spectrophotometer is used in quantitative chemical analysis included spectral interferences caused by absorption band overlap, fading of the color of the absorbing species and possible composition mismatch between the sample and the calibration solution (Skoog *et al*., 2007) and Sooväli *et al.* (2006).

RESULT AND DISCUSSION

The findings of present research work are given in tabular format. The absorbance of solution mixture displayed considerable variations in expected and observed values. Highest % of transmittance could be observed in $CuCl_2$+$Na_2Cr_2O_7$ mixture of solution filter followed by Cu(NO3)2 + Na2Cr2O7. Highest Δλ max half band was observable in $CuCl_2$+$Na_2Cr_2O_7$ and$CuCl_2$ + $KMnO_4$ mixture of solution. While the least Δλ max half band could be found $CuCl_2$ + Rhodamine-B. $CuCl_2$ + Rhodamine-B, $Cu(NO_3)2$ + Rhodamine-B and$CuCl_2$ + $KMnO_4$ shows similar values for λ max and % T for observed value except $CuCl_2$ + $KMnO_4$ which shoes least% T. Adeeyinwo Adedeji (2007) concluded that an absorption filter was so constructed using 40% $CuSO_4.5H_2O$ solution in 8M HCl (w/v) in glass support of 2mm internal diameter.

Observation tables

Table 1. Percentage transmittance of 0.1M of different solutions at various wavelength

Sr. No.	Wavelength in (mμ)	Transmittance percentage									
		Copper nitrate		Copper chloride			Potassium permanganate	Sodium dichromate		Rhodamine-B	
1	300	-	-	25	-	-	05	-	-	-	-
2	320	20	20	35	35	35	05	-	-	-	-
3	340	85	80	66	65	66	05	-	-	-	-
4	360	95	92	78	78	78	08	-	-	20	-
5	380	97	93	83	83	83	25	-	-	25	-
6	400	98	94	87	85	86	61	-	-	20	-
7	420	99	95	88	87	87	78	-	-	23	-
8	440	99	96	90	88	88	70	-	-	40	-
9	460	99	96	90	89	89	46	-	-	30	-
10	480	99	97	90	89	89	17	-	-	05	-
11	500	99	97	90	89	89	04	-	-	02	-
12	520	99	97	90	89	90	02	10	-	02	-
13	540	99	96	90	89	90	02	10	15	02	-
14	560	95	95	90	88	90	02	65	65	02	12
15	580	90	91	84	83	85	16	84	85	02	20
16	600	83	83	76	76	76	51	85	86	42	35
17	620	72	72	66	66	66	58	86	86	80	75
18	640	58	58	55	55	56	62	86	86	88	88
19	660	45	45	44	45	44	68	86	86	90	90
20	680	32	32	32	32	33	74	86	86	90	90
21	700	23	23	23	23	23	80	85	85	90	90
22	720	17	17	17	16	22	83	84	84	89	89
23	740	13	13	13	14	13	84	-	83	89	89
24	760	12	13	-	13	11	85	-	82	89	88
25	780	12	-	-	13	-	-	-	-	89	88

Table 2. Expected and Observed percentage transmittance of mixture at various wavelength

Sr. No.	Wave length in (mμ)	mixture of Copper chloride and Rhodamine-B		Wave length in (mμ)	mixture of Copper nitrate and Rhodamine-B	
		Expected	Observed		Expected	Observed
1.	580	02	02	560	-	12
2.	600	12	47	580	-	20
3.	620	47	60	600	30	35
4.	640	40	50	620	51	60
5.	660	33	40	640	52	55
6.	680	20	28	660	33	43
7.	700	13	20	680	22	32
8.	720	05	15	700	15	23
9.	740	-	11	720	-	17
10.	760	-	-	740	-	13

Table 3. Expected and Observed percentage transmittance of mixture at various wavelength

Sr. No.	Wave Length in (mμ)	mixture of Copper nitrate and Sodium dichromate		Wave length in (mμ)	mixture of Copper chloride and potassium permanganate		Wave length in (mμ)	mixture of Copper chloride and Sodium dichromate	
		Expected	Observed		Expected	Observed		Expected	Observed
1.	520	10	10	580	03	10	540	06	15
2.	540	10	10	600	26	35	560	54	60
3.	560	65	55	620	24	36	580	68	75
4.	580	76	68	640	18	33	600	62	70
5.	600	69	63	660	12	28	620	52	62
6.	620	58	55	680	06	22	640	41	53
7.	640	43	44	700	02	17	660	30	40
8.	660	30	33	720	-	13	680	18	30
9.	680	18	22	740	-	10	700	08	20
10.	700	12	15	-	-	-	720	02	14

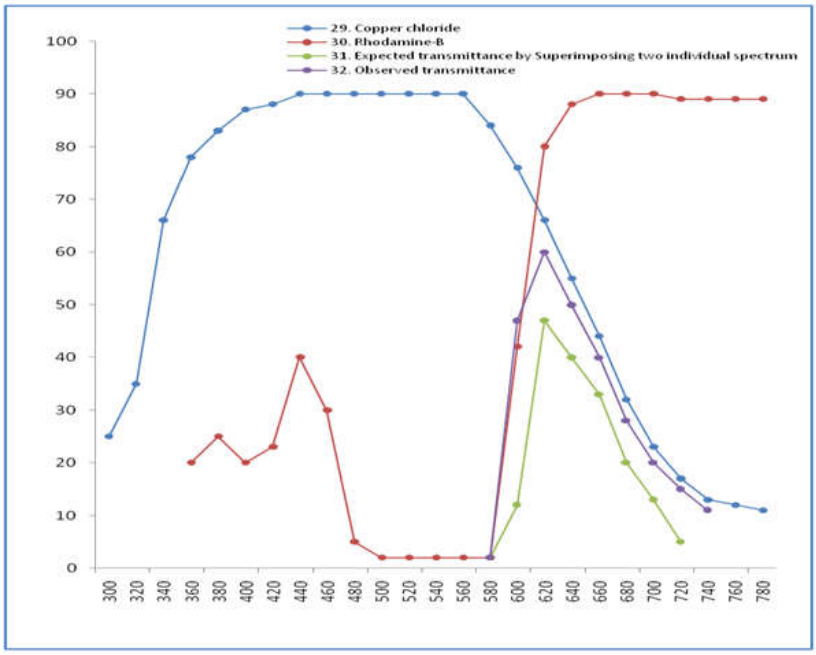

Fig. 1. Individual, expected and observed percentage transmittance of Copper chloride and Rhodamine-B at various wavelength

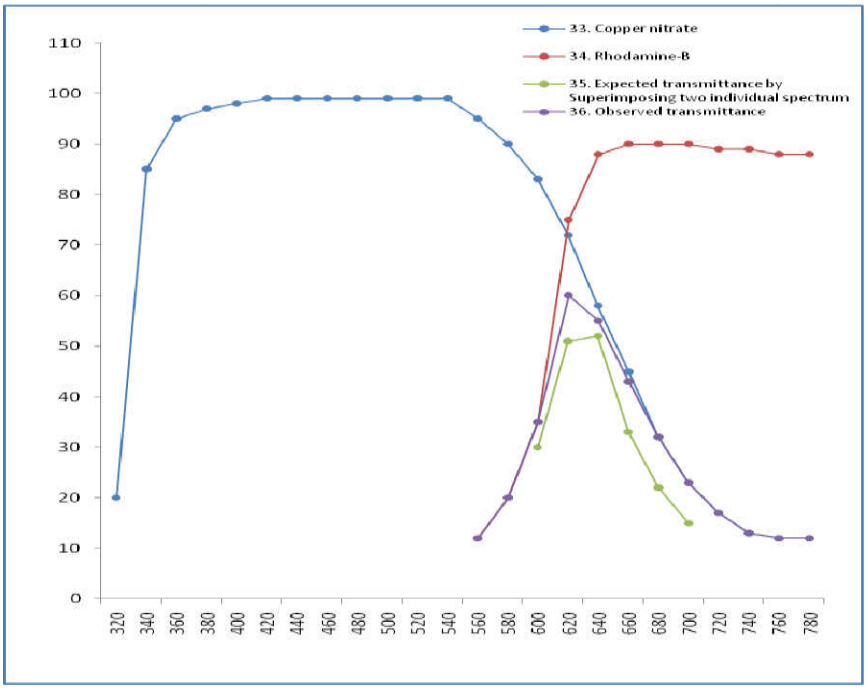

Fig. 2. Individual, expected and observed percentage transmittance of Copper nitrate and Rhodamine-B at various wavelength

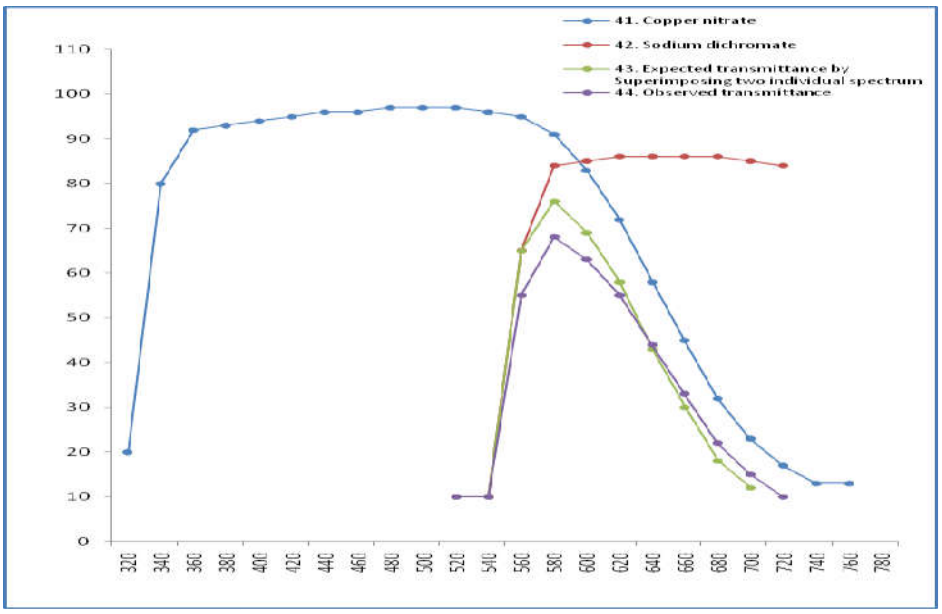

Fig. 3. Individual, expected and observed percentage transmittance of Copper nitrate and Sodium dichromate at various wavelength

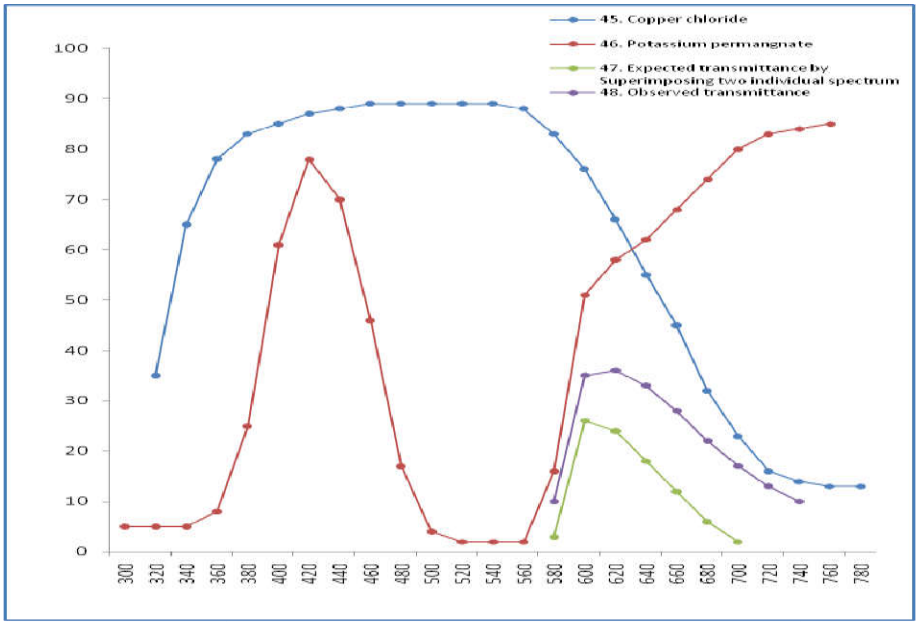

Fig. 4. Individual, expected and observed percentage transmittance of Copper chloride and Potassium permanganate at various wavelength

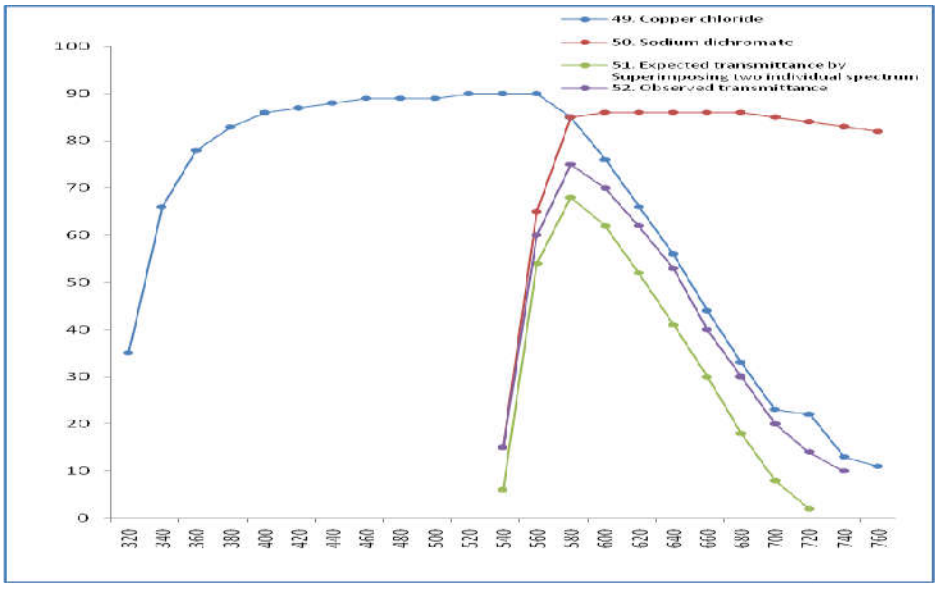

Fig. 5. Individual, expected and observed percentage transmittance of Copper chloride and Sodium dichromate at various wavelength

Table 4. Comparison of transmittance spectra, expected transmittance spectra superimposed spectra and observed spectra

Sr. No	Solution Mixture	λmax expected	λmax observed	%T expected	%T observed	$\Delta\lambda_{max}$ half band width (expected) mμ	$\Delta\lambda_{max}$ half band width (observed) mμ
1.	$CuCl_2$ + Rhodamine-B	620	620	47	60	52	80
2.	$Cu(NO_3)_2$ + Rhodamine-B	640	620	52	60	60	88
3.	$Cu(NO_3)_2$ + $Na_2Cr_2O_7$	580	580	76	68	100	108
4.	$CuCl_2$ + $KMnO_4$	600	620	26	36	72	108
5	$CuCl_2$ + $Na_2Cr_2O_7$	580	580	68	75	96	112

The results obtained decisively demonstrated the usefulness and the effective potential of mixture of solution filters in the field of colorimetric analysis. Accordingto Rogers (1986), Burtis and Ashwood (1994) the colour of the $CuSO_4.5H_2O$ solution in 8M HCl (w/v) was green when observed against white light having wavelength ranged from540 to 550nm. This is concluded that a solution will appear green against white light if it transmits light maximally between 500-580nm. Regarding the individual transmittance spectra, expected transmittance spectra superimposed spectra and observed spectra of listed solution filters are mentioned in Table 01 to Table 04 and Fig. 01 to Fig. 05.

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