

Review In Spectrophotometric Methods for Estimation the Catechol amines Drugs

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Abstract:

Catechol amines are one of the most common pharmaceutical compounds, that used for treatment of bronchial asthma, hypertension and Parkinson's disease. Determination of active catechol amines agents in pharmaceutical samples is an important step for pharmaceuticals industries and quality control. Most of available determination methods are based on using very expensive instruments beside the sophisticated conditions such as time consuming, expensive solvents. This article review focused on simple and quick spectrophotometric methods. These methods might be based on redox reaction of the catechol amines using an oxidizing agents, use of polyvalent cations for chelation and complexometric reactions, oxidative coupling reactions or aziotization coupling organic reactions.

Keywords: Catechol amines, Spectrophotometric, Complexometric, Redox reaction.

مراجعة في الطرق الطيفية لتقدير ادوية الكاتيكول امين

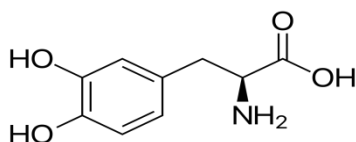
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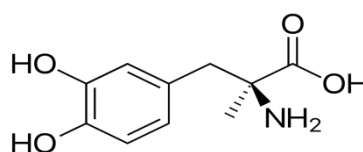
تعتبر ادوية الكاتيكول امين احدى المركبات الصيدلانية التي تستعمل لعلاج حالات الربو , ارتفاع ضغط الدم وامراض باركنسون. تقدير مركبات الكاتيكول امين الفعالة في النماذج الصيدلانية تعتبر خطوة مهمة في الصناعات الدوائية والسيطرة النوعية. معظم هذه الطرائق تعتمد على استخدام طرائق الية مكلفة ومعقدة الظروف مثلاً استهلاك الوقت ومذيبات مكلفة. في هذه المقالة البحثية تم التركيز على الطرائق الطيفية البسيطة والسريعة. هذه الطرائق تعتمد على تفاعلات الاكسدة والاختزال لادوية الكاتيكول امين مع عوامل مؤكسدة واستعمال ايونات متعددة حالات الاكسدة لتكوين معقدات , وكذلك تفاعلات الاكسدة والازدواج والازوتة والازدواج العضوية.

1. Introduction:

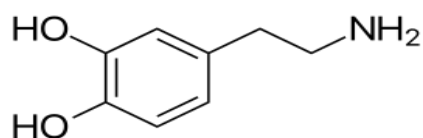
Catecholamines are dihydroxy compounds where 3 or 4 positions are unoccupied, catecholamines are drugs including L-dopa , Methyl Dopa , Dopamine and Adrenaline. The structures of these compounds are showing in figure 1 [1].



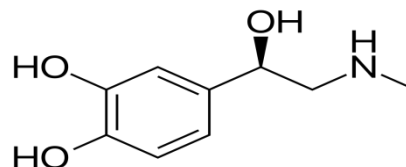
L-Dopa



Methyl-Dopa



Dopamine



Adrenaline

Fig 1: Chemical Structures of Catechol amines.

Several methods are currently available for the analysis of pharmaceutical products and effluents such as HPLC[2], the most common ones being spectrophotometric methods involve oxidation – reduction reactions, oxidative coupling reactions, azotization coupling reaction and complexation reactions. Although they are accurate, they suffer from various disadvantages like time consuming, costly and require a good operators. This article review deals with reviewing the recent spectrophotometric assays for the estimation of catechol amines drugs as pure and dosage forms.

2. Analytical Methods Used for assay of Catechol amines Drugs:

Since the pharmaceutical industry is operated in a continuous manner, the routine analysis using these technologies is quite an obstacle for the drug manufacturing companies. Hence,. Spectrophotometric assay include the evolution the concentration of active ingredients with the absorbed intensity of light (visible/UV range) and compare with standard amounts, measured at the optimum parameters. Often, agents that react with the compound to form the color product (chelating agents, oxidizing agents, dyes, etc.) are used.

Different analysis methods were adopted for estimation of active catechol amines such as high performance liquid chromatographic methods [3], electro-analytical methods [4]. HPLC and Electro-analytical methods are so sophisticated techniques. While, spectrophotometric assays were simpler in routine analyses of pharmaceutical compounds in different.

2.1 Spectrophotometric Methods:

Because of the presence of hydroxyl group on benzene ring of catechol amine, in addition to presence amino acid group, the catechol amines drugs tends to be active toward different reagents forming color products that can measured in the visible regions of spectrum in spectrophotometric methods. Most of spectrophotometric methods reported involve reaction of catechol amines using different organic reactions such as oxidative coupling , Diazotization reactions , charge transfer reactions and oxidation – reduction reactions, However. The present article tries to cover most of these methods in the following table.

Table (1:1): Analytical spectrophotometric methods for assay of Catechol amines.

Ref No	Catechol Amines Drug	Reagents and Reaction	Wave length λ_{\max} (nm)	Linear range	Applications
5	Methyl dopa	Coupling with 2,6-dichloroquinone-4-chlorimide (DCQ)	400	4-20 ppm	Tablets Formulations
6	L-dopa and methyl dopa	interactions with vanadium (V) that transform to vanadium (IV) and produce a complex with eriochrome cyanine R	565	0.028-0.84 0.099-0.996 ppm	Tablets Formulations
7	levodopa, methyl dopa and dopamine	reaction of catecholamine with bromanil	741 and 738	0.2 – 3.5 ppm 0.1 – 4.0 ppm 0.2 – 2.5 ppm	Tablets and injections Formulations
8	methyl dopa	interaction with MTD and sodium nitrite in an acid medium	430	6.37 -82.81 ppm	Tablets Formulations
9	methyl dopa adrenaline dopamine	Interaction with 3-amino pyridine and sodium periodate to produce orange color	476 488 490	1-40 ppm 1-40 ppm 1-20 ppm	Tablets and Injections Formulations
Ref No	Catechol Amines Drugs	Reagents and Reaction	Wave length λ_{\max} (nm)	Linear Range	Applications
10	methyl dopa	Formation of ternary complex among MTD, 2-aminopyridine and different metal cations such as [Fe(III), Mn(II), and Co(II)]	572 473 465	4–40 ppm 4–32 ppm 4–40 ppm	Tablets Formulations

11	Dopamine	Depend on the oxidation of thionine with bromate	601	0.2–103.3 ppm	Injections Formulations
12	Dopamine Levodopa Adrenaline	convert Ag ⁺ ions to nanoparticles (Ag-NPs) using polyvinylpyrrolidone (PVP produced very intense plasmon resonance spectrum of Ag-NPs.	440	3.2×10 ⁻⁶ - 2.0×10 ⁻⁵ M, 1.6×10 ⁻⁷ - 1.0×10 ⁻⁵ M, 1.5×10 ⁻⁶ - 4.0×10 ⁻⁵ M	Ringer's injection solution
13	Adrenaline	Using Mannish reaction between adrenaline using 5-benzimino-1,3,4-thiodiazole-2-thione and formaldehyde .	312	2-20 ppm	Injections Formulations
Ref No	Catechol Amines Drugs	Reagents and Reaction	Wave length λ_{\max} (nm)	Linear Range	Applications
14	Dopamine	Oxidation – Reduction using Potassium Ferricyanide – Fe(III) to form Prussian blue complex	735	0.05-6 ppm	Injection Formulations and Banana
15	Dopamine	Oxidation with Chloramine-T and	490	2-20 ppm	Injections Formulations

16	Adrenaline and isoprenaline	Copper Reaction with Metaperiodate	491	2×10^{-5} - 2×10^{-4} M	Tablets and Injections Formulations
17	Dopamine, levodopa and methyldopa	Reaction of these drugs Bromanil form charge-transfer complexes	350 366 368	1-25 ppm 0.8-30 ppm 1-30 ppm	Tablets and Injections Formulations
18	methyldopa, dopamine and adrenaline	Depend on oxidation with iron(III) in acidic medium and the Fe^{+3} formed Fe^{+2} forming 1,10-phenanthroline complex	510	0.1-2.8 ppm 0.1-2.0 ppm 0.2-6.0 ppm	Tablets and Injections Formulations
19	Noradrenaline	reaction with alizarin red sulphate (ARS) to produce violet product	530	0.5-10 ppm	Injections Formulations
20	Methyldopa	Interaction of Methyldopa and phenylenediamine using periodate ions	494	0.1-10 ppm	Tablets Formulations
Ref No	Catechol Amines Drugs	Reagents and Reaction	Wave length λ_{max} (nm)	Linear Range	Applications
21	Adrenaline noradrenaline	Reaction with known of Cr^{+6} in the presence of sulfuric acid. The residue of Cr^{+6} ions is then reacted with 1,5-phenylcarbaid to form red-violet product	542	0.2-3.2 ppm 0.3-3.2 ppm	Injections Formulations

22	Levodopa, methyldopa, dopamine hydrochloride, Pyrocatechol	Formation of (phenanthroline)iron(II) and tris(bipyridyl)iron(II) obtained by the catecholamines oxidation	510 522	0.04-0.6 0.06-0.75 0.06-0.65 0.05-0.70 (A) 0.02-1 0.04-1.3 0.05-1 0.06-1.1 (B)	Tablets Injections Formulations
23	Dopamine Derivatives	Interaction with 4- aminoantipyrine form a new ligand reacts with copper ions to give colored products. formation of ion-pair iodinated complexes between at pH 5.	525 520 500	19.7–69.0 ppm 18.1–54.3 ppm 39.44– 78.88 ppm	Tablets and Urine Samples

Ref No	Catechol Amines Drugs	Reagents and Reaction	Wave length λ_{\max} (nm)	Linear Range	Applications
24	Adrenaline NorAdrenaline Methyldopa	Oxidation with Bromosuccinimide , N-Bromophthamide ,Bromoamine –T	485	4-65 ppm	Injections and Tablets Formulations
25	Adrenaline NorAdrenaline Methyldopa	Oxidation with NH_4VO_3	485	9-90 ppm 7-75 ppm 10-95 ppm	Injections and Tablets Formulations

26	Methyldopa NorAdrenaline	Reaction with P-Benzaldehyde, P-toludehed , P-anisaldehyde	450	24-192 ppm 16-135 ppm	Tablets and Injection Formulations
27	Methyldopa NorAdrenaline	Reaction with Vaniline in basic medium	420	0.12- 1.44mg/ml 0.085- 1.85mg/ml	Tablets and Injections Formulations
28	L-dopa Methyl dopa	Reaction with Benzidine and sodium periodate	480 485	0.4-64 ppm 0.8-72 ppm	Tablets Formulations
29	Methyldopa Isoprenaline Noradrenaline Adrenaline	Reaction with Resazurin	485	3-25 ppm	Tablets Formulations
30	Methyldopa Dopamine L-dopa	Oxidation with Sodium Bismothate	429	80-130 ppm	Tablets and Injections Formulations
31	Methyldopa L-dopa	Reaction with Mo(VI) and H ₂ O ₂	350	0.4-17.4 ppm	Tablets Formulations
32	L-dopa Methyldopa Dopamine Catechol	Oxidative Coupling with Sulfanilic acid and K ₂ CrO ₄	490 495 490 560	1-23 ppm 1.5-40 ppm 2-11 ppm 1-16 ppm	Tablets and Injections Formulations
Ref No	Catechol Amines Drugs	Reagents and Reaction	Wave length λ_{\max} (nm)	Linear Range	Applications
33	Dopamine L-dopa Methyl dopa Adrenaline Catechol	Reaction with sodium bisulphate and Semicarbazide	460- 470	1-24 ppm	Injections and Tablets Formulations
34	L-dopa Methyl dopa	Reaction with N- Bromosuccinimide	480- 490	2.9-12 ppm 5-16 ppm	Tablets and Injections

	Dopamine	and Isonazide		2.8-14.5 ppm	Formulations
35	L-dopa Methyl dopa Dopamine	Reaction with sodium periodate and barbituric acid	380-420	04-32 ppm 1-32 ppm 2-50 ppm	Tablets and Injections Formulations
36	Dopamine L-dopa Methyl dopa Adrenaline	diazotised p-nitro aniline (DPNA) with catechol amines using molybdate ions	500-510	-	Tablets and Injections Formulations

3. Conclusions

The methods reported in this manuscript for spectrophotometric determination of catechol amines drugs shows accepted analytical results. The results indicated accepted values in compare with the standard methods used for the assay of catechol amines. these methods are useful for determination and for these drugs in research and pharmaceutical industry.

Conflict of interest

None conflict of interest.

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