

# Determination of Alcohol with Ammonium Hexanitratocerate (IV) Reagent in Nitric Acid Medium

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## ARTICLE DETAILS

### Article History

Published Online: 02 April 2018

### Keywords

Ammonium Hexanitratocerate reagent, oxidation, qualitative and quantitative estimation.

## ABSTRACT

Alcohols are hydroxyl derivatives of hydrocarbons. They form an importance class of compounds used as antifreeze in car-radiators, Petrol constitute, solvents for paints, liquors and enamel, in making low freezing dynamite, as preservative and starting materials numerous valuable compound. Because of various importance of alcohols a large number of procedures have been developed for qualitative and quantitative estimation of these compounds, In this article I tries to determine these compounds on microscale. Unlike many oxidants discussed earlier, Ce (IV) oxidizes alcohols to CO<sub>2</sub> and H<sub>2</sub>O.

## 1. INTROUCTION

The survey of literature done by me reveals a fact that Ce (IV) has not been used for the determination of alcohols an microscale. So, in this article I tried to determine various alcohols with the help of Ammonium Hexanitratocerate reagent. This reagent is an one electron oxidising agent that is use for oxidative addition reactions for electrophilic radicals to alkenes, enabling intermolecular and intramolecular C-C and carbon heteroatom bond formation. It also oxidizes secondary alcohols into ketones and benzylic alcohols into aldehydes. It provides on alternative to the Nef reaction.

Depending on the structure of alcohol, different types of reaction products can be formed by the reaction between are alcohol & a cerium (IV) salt. The alcohols can undergo direct oxidation, fragmentation or combination of both processes.

## 2. APPROACH OF THE REACTION

For testing the quantitative validity of the reaction, erythritol was taken as the test sample. Different amount of the sample were allowed to react with varying amount of Ce (IV) reagent at 50C for different intervals of reaction time. The stoichimetry of the reaction was established for each sample and possible course of reaction was suggested. In case of abnormal results the reaction conditions were suitably modified and possible explanation was given.

## 3. EFFECT OF VARIABLES

Effects of temperature, reaction time & volume of Ce (IV) were neglected for limiting the area of experiment. The micro determination of erythritol, Pentaerythritol, adonitol, xylitol, arabitol, sorbitol and mannitol with respect to Ce (IV) reagent are given in Table 1, Table 2, Table 3, Table 4, Table 5, Table 6 & Table 7 respectively.

**Table 1**  
Microdetermination of Erythritol with Ce (IV) reagent.

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molarity	Error %
1	1.0000	10	0.9964	18	-0.36
			0.9972		-0.28
			1.0020		+0.20
2	2.0000	10	2.0040	18	+0.40
			2.0020		+0.20
			2.0056		+0.28
3	3.00000	10	2.9868	18	-0.44
			3.0106		+0.36
			2.9886		-0.38
4	4.0000	10	4.0000	18	+0.20
			4.0120		+0.30
			4.0180		+0.45
5	5.0000	10	5.0100	18	+0.20
			5.0140		+0.28
			5.0070		+0.14

**Table 2**  
**Microdetermination of Pantaerthritol with Ce (IV) reagent.**

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molecularity	Error %
1	1.0000	10	1.0022	24	+0.22
			0.9976		+0.24
			1.0021		+0.21
2	2.0000	10	2.0042	24	+0.21
			2.0044		+0.22
			2.0060		+0.30
3	3.00000	10	2.9958	24	-0.14
			2.9898		-0.34
			3.0033		+0.11
4	4.0000	10	4.0040	24	+0.10
			4.0080		+0.20
			4.0052		+0.13
5	5.0000	10	5.0110	24	+0.22
			5.0100		+0.16
			5.0050		+0.10

**Table 3**  
**Microdetermination of Adinitol with Ce (IV) reagent.**

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molecularity	Error %
1	1.0000	20	0.9985	22	-0.15
			0.9987		-0.13
			1.0018		+0.10
2	2.0000	20	2.0036	22	+0.10
			2.0024		+0.12
			2.0034		+0.17
3	3.00000	20	2.9937	22	-0.21
			3.0105		+0.25
			3.0096		+0.32
4	4.0000	20	4.0072	22	+0.18
			4.0100		+0.25
			4.0108		+0.27
5	5.0000	20	5.0120	22	+0.24
			5.0140		+0.28
			5.0150		+0.30

**Table 4**  
**Microdetermination of Xylitol with Ce (IV) reagent.**

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molecularity	Error %
1	1.0000	20	0.9985	22	-0.15
			1.0023		+0.23
			1.0027		+0.27
2	2.0000	20	2.0050	22	+0.25
			2.0062		+0.31
			2.0042		+0.21
3	3.00000	20	3.0105	22	+0.35
			3.0069		+0.23
			3.0066		+0.22
4	4.0000	20	4.0080	22	+0.20

			4.0170		+0.30
			4.0072		+0.18
5	5.0000	20	4.9890	22	-0.22
			5.0150		+0.30
			4.9885		-0.23

**Table 5**  
Microdetermination of Arabitol with Ce (IV) reagent.

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molarity	Error %
1	1.0000	20	1.0010	22	+0.10
			1.0024		+0.24
			1.0043		+0.43
2	2.0000	20	2.0030	22	+0.15
			2.0036		+0.18
			2.0050		+0.25
3	3.00000	20	3.0045	22	+0.15
			3.0081		+0.27
			3.0060		+0.20
4	4.0000	20	4.0040	22	+0.10
			4.0072		+0.18
			4.0075		+0.19
5	5.0000	20	4.9890	22	-0.22
			4.0160		+0.32
			5.0100		+0.20

**Table 6**  
Microdetermination of Sorbitol with Ce (IV) reagent.

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molarity	Error %
1	1.0000	30	0.9970	26	-0.30
			0.9970		-0.30
			0.9986		-0.14
2	2.0000	30	2.0020	26	+0.10
			2.0020		+0.14
			2.0062		+0.31
3	3.00000	30	2.9922	26	-0.25
			3.0000		+0.30
			3.0099		+0.33
4	4.0000	30	4.0120	26	+0.30
			4.0072		+0.18
			4.0080		+0.20
5	5.0000	30	5.0180	26	+0.36
			5.0150		+0.30
			4.9930		-0.14

**Table 7**  
Microdetermination of Mannitol with Ce (IV) reagent.

Aliquots Taken (ml)	Amount Present (mg)	Reaction Time (min)	Amount recovered (mg)	Molarity	Error %
1	1.0000	30	0.9978	26	-0.22
			1.0010		+0.10
			0.9980		-0.20
2	2.0000	30	2.0020	26	+0.10
			2.0028		+0.14
			2.0032		+0.16

3	3.00000	30	2.9874	26	-0.42
			2.9904		-0.12
			2.9965		-0.45
4	4.0000	30	4.0040	26	+0.20
			4.0056		+0.28
			4.0064		+0.32
5	5.0000	30	4.9695	26	-0.61
			4.9675		-0.65
			4.9740		-0.52

#### 4. RESULT AND DISCUSSION

After studying variables and establishing the reaction conditions, an effort was made to trace the mechanics of the reaction of Ce (IV) with polyhydric alcohols. For this purpose, stoichiometry of the reaction in case of polyhydric alcohol was established. Attempt were made to isolate or detect the intermediate reaction products. Oxidation of alcohols with other reagents from time was also reviewed.

Potassium dichromate and sulphuric acid and paramagnate etc. Oxidise primary and secondary alcohols to aldehydes and ketones respectively. In case of primary alcohols it is difficult to check the oxidation at carbonyl stage, secondary alcohols present less difficulty.

N- bromosuccinimide oxidises primary alcohols to corresponding carbonyl compounds. But in many cases the action is not highly detective, e.g. the conversion of benzoic acid into benzoquinone.

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