



EFFICIENT, ECONOMICALLY VIABLE, AND CONVENIENT METHOD FOR QUANTITATIVE ESTIMATION OF ETHANOL

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Abstract: In continuation of our work on Patent¹ for the detection of alcoholic functional groups, we herein report an efficient, economically viable, and convenient method for the quantitative estimation of ethanol.

IndexTerms : Quantitative estimation of ethanol

I. INTRODUCTION

A review of the literature reveals that numerous attempts have been made by various investigators to quantify alcohol. Some of their reviews are illustrated. Jessica Ferguson² reported the estimation of alcohol content in wine by dichromate oxidation followed by redox titration and discovered that the oxidation reaction may be seen as a color change from orange to green. Rosalind and Theodore³ described A simple colorimetric approach for ethanol quantification at 1-6% v/v with good accuracy and precision. Alka Kumari Neeraj Kumar Manoj K. Verma⁴ used a densitometer, an analyzer, and consultation to estimate the amount of alcohol in alcoholic beverages. Nagarajan, A. Gupta, R. Mehrotra, and M. M. Bajaj⁵ investigated attenuated total reflectance spectroscopy for quantitative analysis of alcohol, sugar, and tartaric acid in alcoholic beverages as an alternative to chemical analysis.

Meden F. Isaac-Lam⁶, reported an assessment of the alcohol content in alcoholic beverages using a 45 MHz benchtop NMR spectrometer, it was discovered that benchtop NMR technology offers more affordable and low-maintenance equipment than high-field NMR instrumentation. Mei-ling wang et al⁷ proposed a rapid method for determining ethanol in alcoholic beverages using capillary gas chromatography.

Y. Yap and D. Trau⁸ investigated the determination of ethanol in alcoholic beverages using the photopette cell method and discovered that this enzymatic approach is useful for beverages, food, and a variety of biological materials. The ethanol test for measuring unknown alcohol contents in wine was demonstrated using a Photopette cell at 340 nm. Sandip Sumbhate, Satish Nayak, Damodar Goupale, Ajay Tiwari, and Rajesh S. Jadon⁹ discovered a simple and sensitive colorimetric method for determining total ethanol in marketed alcoholic drink brands using a 4% solution of sodium dichromate, sulfuric acid, and an acetate buffer at pH 4.3.

Massimo Gallignani, Salvador Garrigues, and Miguel de la Guardia¹⁰ used the derivative Fourier to determine ethanol in alcoholic beverages using infrared spectrometry. and found that the developed procedure is the only method available for the FT-IR determination of ethanol in all types of alcoholic beverages, from beer samples to spirits.

Camilla Brus¹¹ studied the GC-based methods for determining alcohol levels in wine and mulled wine. Vonage, B. Lendl, and R. Kellner¹² reported the high-performance liquid chromatography with real-time Fourier transform infrared detection for the determination of carbohydrates, alcohols, and organic acids in wines and found that the coupling of high-performance liquid chromatography (HPLC) with Fourier-transform infrared spectroscopy (FTIR) is presented as a new and versatile tool for the direct determination of the main components of wine.

Miah, R., Siddiqua, A., Tuli, J., Barman, N., Dey, S., Adnan, N., Yamada, M., and Talukder,¹³. published an article titled Inexpensive Procedure for Ethanol Measurement: Application to the Bioethanol Production Process.

Marc Maudoux, Shou He Yan, and Sonia Collin¹⁴ conducted a quantitative analysis of alcohol, real extract, original gravity, nitrogen, and polyphenols in beers using NIR spectroscopy and discovered that the goal of this study was to develop a rapid and accurate NIR analysis method for determining alcohol, real extract, original gravity, total nitrogen, and total polyphenols. A sensitive and precise spectrophotometric approach was created and evaluated for the quantitative determination of ethanol in fermentation products by Malinee Sriariyanun, Kittipong Rattanaporn, Parita Mutrakulcharoen, Surapon Tapaamorndech, and KraiPat Cheinkachoren¹⁵.

Yasushi Numata and Yoshiyuki Iida Hiroyuki Tanaka¹⁶ reported the quantitative analysis of alcohol-water binary solutions using Raman spectroscopy and discovered that Raman spectroscopy could be used for rapid and in-situ alcohol measurements in alcohol-water binary systems.

G. Cavinato, D. M. Mayes, Z. Ge, and J. B. Callis¹⁷ studied a noninvasive method for monitoring ethanol in fermentation processes using fiber-optic near-infrared spectroscopy and found that short-wavelength near-infrared (SW-near-IR) spectroscopy (700–1100 nm) is used for the determination of ethanol during the time course of fermentation.

The review of literature on various methods for quantification of alcohol reveals that researchers are working on finding a simpler and suitable method for quantitative estimation of alcohol. In the current study, we herein report an efficient, affordable, and convenient approach for the quantitative estimation of ethanol.

In this method, we used our patented¹ reagent as the titrant, and quantitative estimation was achieved using a simple conductometric titration.

MATERIAL AND METHOD: Sample absolute ethanol (99%) was obtained from Manas Agro Industries and infrastructure ltd. Unit 1 Bela , Khursapar (Bela) Tahsil Umred, Dist Nagpur.

Reagent Preparation Method: Patented Reagent was prepared by dissolving 10g of ceric ammonium nitrate in 85 ml of distilled water and 5 ml of concentrated H₂SO₄ was added slowly with constant stirring. The clear, orange-colored solution was obtained. This reagent was diluted by adding 50 ml of distilled water. 5 ml of this solution was taken in a beaker and 25ml of distilled water was added, the solution so obtained was used as a reagent for quantitative estimation.

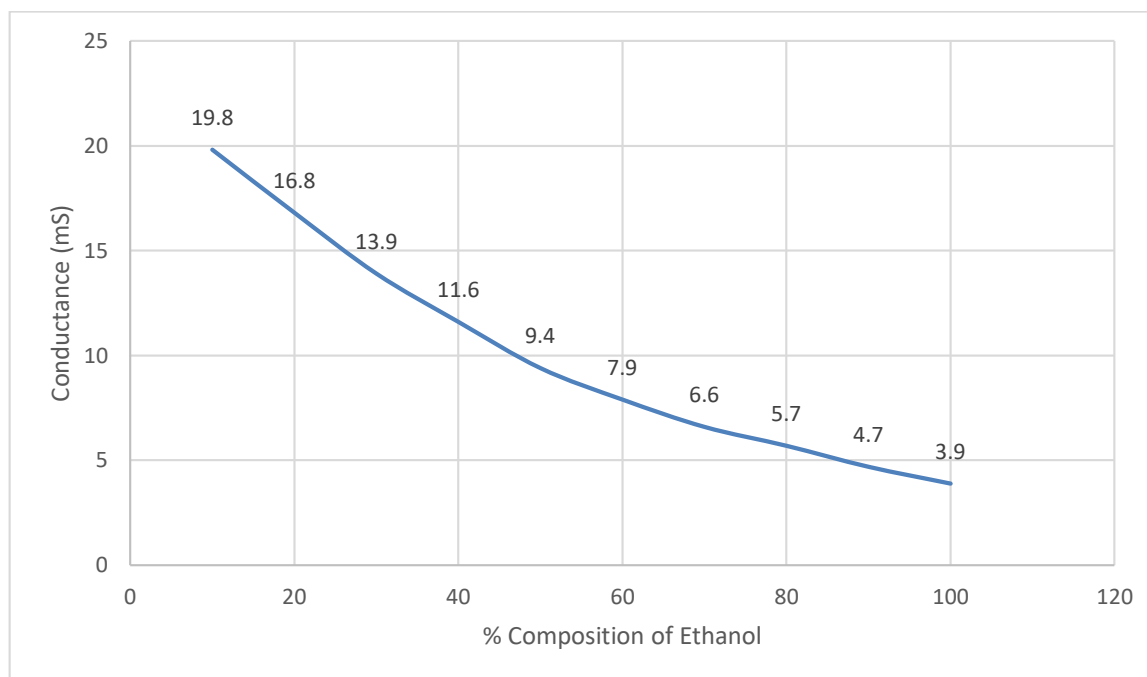
Experimental: 10 different solutions of varying ethanol concentrations (10% to 100%) were made for the calibration curve, and 10 ml of each was taken in a 100ml beaker. 3ml of reagent was added in each beaker. The solution so formed was allowed to stand at room temperature for 30 minutes. The conductance of each solution was measured and the results obtained are listed in table 1

Table 1

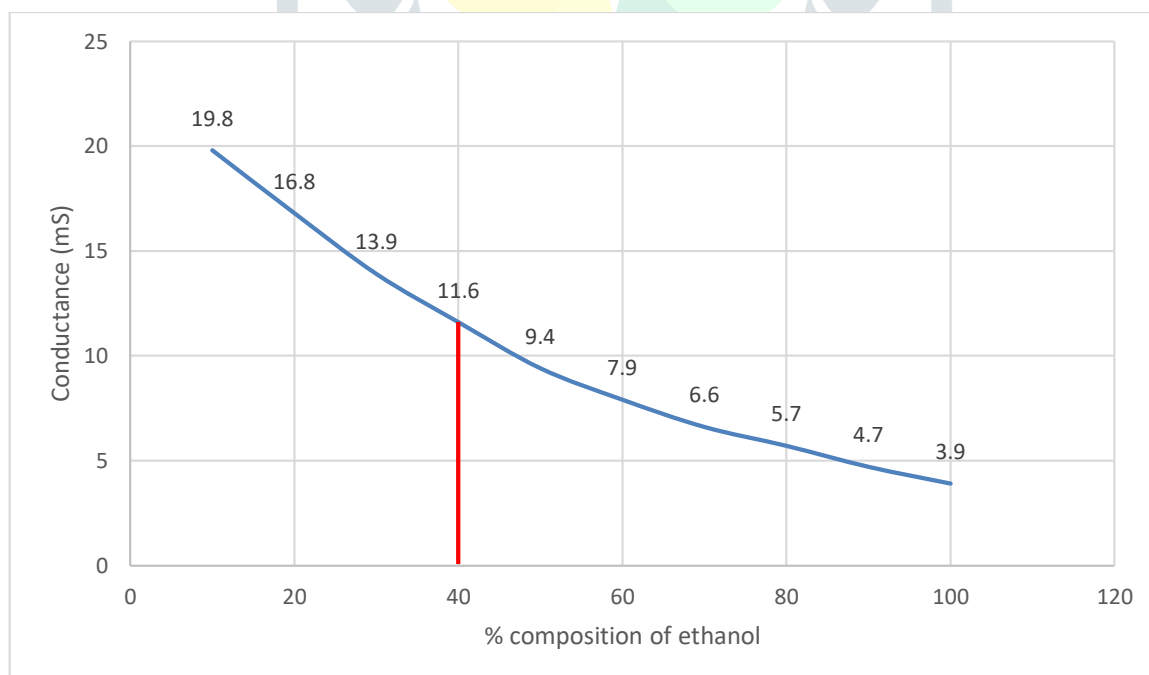
Composition of ethanol	The amount of Reagent Added	Conductance of resulting mixture(mS)
10%	3 ml	19.8
20%	3 ml	16.8
30%	3 ml	13.9
40%	3 ml	11.6
50%	3 ml	9.4
60%	3 ml	7.9
70%	3 ml	6.6
80%	3 ml	5.7
90%	3 ml	4.7
100%	3 ml	3.9

Result and Discussion

The graph is plotted between % composition of ethanol and conductance. This graph is used as the calibration curve for the determination of composition of unknown mixture.



For validation of the results, a solution of 40% composition of ethanol was prepared and its conductance is measured. The conductance of the solution was found to be 11.6 mS and from the calibration curve the % composition was validated as 40% of ethanol.



Conclusion

In the present study an efficient, economically viable, and convenient method for quantitative estimation of ethanol is reported. The method uses a very convenient procedure to find out the % composition of ethanol.

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