Promise of Citric Acid for BioFuel

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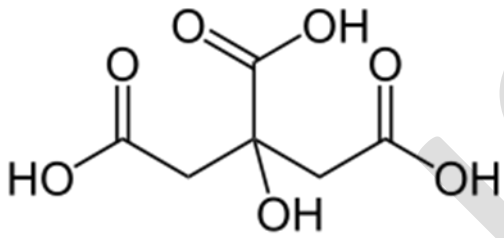
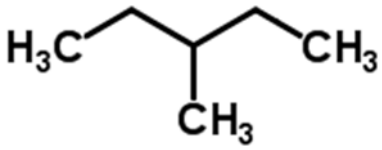
Abstract: **This paper deals about the synthesis of 3-methylpentane from citric acid.The reaction includes two steps. Initially, $LiAlH_4$ reacts with citric acid forming a polyol product and in second step, the hydriodic acid reacts with polyol to form 3-methylpentane. The purpose of this research paper is to provide high octane fuel for transportation.The octane number for 3-methylpentane is found to be 80 – 86.**

I. INTRODUCTION

Rising of oil prices and depletion of oil wells has given rise to Green Chemistry. One of the principles of Green Chemistry is that the source must be from the renewables i.e., Biomass. Based on this principle, synthesis of 3-methylpentane from citric acid could be done.



Structure of Citric Acid



Structure of 3-methyl pentane

Citric Acid is a 2-hydroxypropane-1,2,3-tricarboxylic acid. It is one of the naturally occurring organic acids found in major proportion with other organic compounds in Citrus Fruits. Industrially, Citric acid production is mainly based on the action of Aspergillusniger over sucrose and molasses. In recent years, the production of citric acid has reached about 14, 00,000 tonnes. It's demand and consumption increases annually at 3.5-4.0%.

II. MATERIALS AND METHODS

Lithium aluminium hydride, diethylether, Hydriodic acid and red phosphorus are the reagents used in the experiment.

Step 1: Preparation of Poly-ol

10 grams of citric acid is dissolved in 500g of diethyl ether. Lithium Aluminum Hydride is added to the solution. When the system is kept open to atmosphere diethyl ether vaporizes leaving the residue, polyol of 7.655 grams.

Step 2: Preparation of 3-methylpentane

Thispolyol residue under treatment with Hydriodic acid of 6.527 grams in the presence of red phosphorus yields 3-methylpentane of 4.257 grams.

III. REACTIONS

Citric acid forms Polyol by reacting with Lithium Aluminum Hydride. This Polyol compound has to get treated with Hydriodic Acid in the presence of red Phosphorus. This reaction produces 3-methylpentane, a Straight chain hydrocarbon with one methyl group attached to its third carbon atom

$$C_6H_8O_7 \xrightarrow{LiAlH4} C_6H_{14}O_4$$

$$C_6H_{14}O_4 \xrightarrow[P]{HI} C_6H_{14}$$

Table 1:

Amount of Citric Acid (g)	Amount of LiAlH4 (g)	Amount of Polyol (g)	Conversion %
10	1.976	7.655	98

Table 2:

Amount of Polyol(g)	Amount of HI (g)	Amount of 3-methylpentane (g)	Conversion %
7.655	6.527	4.275	97

IV. CONCLUSION

3-methylpentane could be synthesized from citric acid the research octane number (RON) for 3-methylpentane is 80-86. About 98 percent conversion could be achieved in the first step and about 97 percent conversion could be achieved in the second step reaction.

REFERENCE

[1]. D Sokic-Lazic, SD Minteer "Citric acid cycle biomimic on a carbon electrode" Biosensors and Bioelectronics, 2008 - Elsevier
[2]. B Safer, JR Williamson "Mitochondrial-cytosolic interactions in perfused rat heart Role of coupled transamination in repletion of citric acid cycle intermediates" Journal of Biological Chemistry, 1973
[3]. JW Guo, TS Zhao, J Prabhuram, "CW Wong Preparation and the physical/electrochemical properties of a Pt/C nanocatalyst stabilized by citric acid for polymer electrolyte fuel cells"ElectrochimicaActa, 2005 - Elsevier