

# Analysis of oxygen bearing compounds

[Health & Medicine](#), [Drug Abuse](#)



Analysis of Oxygen bearing Organic compounds Abstract The Unknown sample in the experiment can be tested to yield results such as 1° (primary), 2° (secondary), 3° (tertiary) alcohols. Tests such as the dichromate test, Tollen's test, Lucas test, DNPH test and iodoform test would be very useful in determining the type of alcohol that the unknown sample belongs to. In the experiment, the unknown sample underwent series of testing to identify what property of alcohol it belonged to and the result was that it was a primary alcohol.

It went through the Dichromate reaction, Tollen's reaction and finally the Lucas reaction. Introduction " The analysis of oxygen bearing organic compounds" is an experiment in which a variety of tests are available to identify a compound's property whether it is a primary, secondary or tertiary alcohol. The tests that are included to come up with such results are interconnected with one another like that of the Dichromate test, followed by the Tollen's test to yield an aldehyde if positive for mirror coating.

The second set of procedure would again start with The Dichromate test, followed by the Tollen's test and finally the Lucas test to yield either primary alcohol if it became turbid or secondary alcohols as it's result if it did not turn turbid. The last set of interconnected tests were that of again, the Dichromate test, Followed by the DNPH that would determine if the unknown sample is a Ketone (positive for red-orange precipitate) or a tertiary alcohol (if negative for red-orange precipitate).

But before going deeper on what these tests are, what first are the difference between their results which are the primary, secondary and the

tertiary alcohols, aldehydes and ketones? Alcohols are compounds in which one or more hydrogen atoms in an alkane have been replaced by an -OH group. Note however that there are different kinds of alcohols and Alcohols are categorized into different classes depending on how the -OH group is positioned and arranged on the chain of the carbon atoms. Chemical differences between the various types are possible.

First to be discussed would be the Primary ( $1^\circ$ ) alcohol, in which the carbon carrying the -OH group is only attached to one alkyl group. Meanwhile, In a secondary ( $2^\circ$ ) alcohol, the carbon with the -OH group attached is joined precisely to two alkyl groups, these alkyl groups that are attached to the carbon chain may be the same or different. In a tertiary ( $3^\circ$ ) alcohol, the carbon atom holding the -OH group is attached directly to three alkyl groups, which may be any combination of same or different [1].

On the other hand, another result that can occur would be the presence of ketones and Aldehydes. But again, to understand the experiment further, what are Ketones and aldehydes? A ketone can be characterized as either the functional group categorized by a carbonyl group ( $O=C$ ) attached to two other carbon atoms or it can be identified as a chemical compound that contains a carbonyl group. A carbonyl carbon bonded to two carbon atoms makes ketones different from carboxylic acids, aldehydes, esters, amides, and other oxygen-containing compounds.

The double-bond of the carbonyl group distinguishes ketones from alcohols and ethers. The simplest ketone known is acetone [2]. Lastly among the results is the aldehyde. The term aldehyde seems to have arisen from the

wordds alcohol dehydrogenated. Way back in earlier times, aldehydes were at times named after the corresponding alcohols, for example, vinous aldehyde for acetaldehyde. (Vinous is from Latin vinum = wine, the traditional source of ethanol; compare vinyl. ).

An aldehyde is an example of an organic compound which has a terminal carbonyl group. This functional group, which consists of a carbon atom bonded to a hydrogen atom and double-bonded to an oxygen atom (chemical formula  $O=CH-$ ), is commonly called the aldehyde group. The other names for aldehyde group are formyl and methanoyl group. The aldehyde group is considered polar. Oxygen, which is more electronegative than carbon, pulls the electrons in the carbon-oxygen bond in the direction of itself, creating an electron deficiency at the carbon atom.

Owing to resonance stabilization of the conjugate base, an  $\alpha$ -hydrogen in an aldehyde is more acidic than a hydrogen atom in an alkane, with a typical  $pK_a$  of 17 [3]. Results and discussions The experiment included parallel testing of 3 liquids that would be used for comparison. the first sample would be the unknown sample, the second would be the positive standard in which formaldehyde was used and the last would be the negative sample in which the simplest ketone, Acetone was used.

Only three tests were used to determine whether the group's unknown sample was under the category of primary, secondary, tertiary alcohol, aldehydes or ketones. The three tests were done one after the other in this order: Dichromate test, Tollen's test, and Lucas test respectively. In the Dichromate test, the unknown sample and the formaldehyde turned green

meaning that dichromate oxidized the primary alcohol, secondary alcohol, and aldehydes to ketones or carboxylic acids.

Samples turning green would be an indicator that the samples are positive for oxidation and therefore are oxidizable. On the other hand, the acetone remained orange which means that it is not oxidizable and can be further continued to another test, the DPNH test which would prove that it is categorized as a ketone because of the presence of a red-orange precipitate that indicates that the DPNH reagent condenses with the carbonyl containing molecules. The second test that followed the Dichromate test was the Tollen's test.

In this test, the unknown sample turned clear gray and the formaldehyde turned into a dark grey liquid with silver streaks. The silver streaks are similar with the silver mirror coat that means that the Tollen's reagent oxidized the ammonium salts of the carboxylic acids with this, the formaldehyde was categorized as an aldehyde. Alternatively, The clear grey liquid of the unknown sample would indicate that it was not positive for the Tollen's test and therefore it would need to continue to be tested so as to decipher if it is a primary or secondary alcohol.

The last test would be the Lucas test in which the unknown sample did not turn turbid and therefore it was concluded to be a primary alcohol. Together with the unknown sample that did not turn turbid was isopropyl and MeOH which just remained as clear liquids. then again, the sample liquid that turned turbid was the tertbutyl. By this reaction, it is said that alcohols are converted to alkyl chlorides with  $ZnCl_2$  taking into consideration too that

different alcohol types respond at different rates with  $ZnCl_2$ . Table 1.

Chemical Test | Unknown sample | Standard (+) | Standard(-) | | Dichromate |

\*unknown sample turned green | \*formaldehyde turned green meaning |

\*Acetone remained orange meaning it | | meaning it it oxidizable | it is

oxidizable | is not oxidizable | | Tollen's | \*unknown sample turned clear gray |

\*formaldehyde turned dark gray with | \*acetone turned very light grey | | |

silver streaks. then turned clear. | | Lucas | \*unknown sample did not turn

turbid | \*Tertbutyl- turned turbid fast | \*Acetone- Clear; already not | | |

\*Isopropyl- clear | applicable since it is a ketone. | | | \*MeOH- clear | |

Experimentation A. An unknown sample was given and it should be parallel tested with two other standards- one would be positive and one would be negative.

B. The Dichromate test started the experiment. 8 drops of the unknown sample as well as the the two other standard- formaldehyde and Acetone was placed in separate test tubes addind 2 drops of of 10%  $K_2Cr_2O_7$  and 5 drops of 6M  $H_2SO_4$ . C. The Tollen's test followed. 2 ml of freshly made Tollen's reagent and 5 droops of the unknown sample were mixed. After 5 minutes and the silver precipitate did not form yet, it was placed in a 70 degree water bath for another 5 minutes. Then the results were observed. D.

The last test was the Lucas test in which the iunknown sample, tertbutyl, isopropyl and MeOH was tested all at the same time. 5 drops of the sample was and 15 drops of concentrated HCl was mixed together with a " corn grain" amount of  $ZnCl_2$  solid and the appearance of turbidity was observed or not. Conclusion: It can be concluded that the unknown sample that was

given to be tested was an oxidizable, primary alcohol based on the tests that were conducted. Since it was positive for the dichromate test, it was deemed to be oxidizable.

In the Tolle's test, as it did not produce a mirror coat, it was directed to the choice of being a primary or a secondary alcohol. And for the last test, the Lucas test, it was finally concluded that it was a primary alcohol since it did not turn turbid. References: Books: • Timberlake, Karen C. , " General, Organic, and Biological Chemistry Structures of Life, Platinum Edition", Pearson Education, Inc. , 2004 • Bettelheim, F. A. , [et al. ], " Introduction to organic and biochemistry. 6th ed. " ? Belmont, CA : Brooks/Cole, c2007 • Wade, L.

G. , . " Organic chemistry 6th ed. ". Upper Saddle River, N. J. : Pearson Prentice Hall, c2006. Additional On-line sources: • [1] Clarks, j. (2003). Alcohol oxidation. Retrieved September 8 2008 from <http://www.chemguide.co.uk/organicprops/alcohols/oxidation.html> • [2] N. A, (24 August 2008). Ketones. Wikipedia®. Retrieved September 8 2008 from <http://en.wikipedia.org/wiki/Ketones> • • [3] N. A, (31 August 2008). Aldehydes. Wikipedia®. Retrieved September 8 2008 from <http://en.wikipedia.org/wiki/Aldehydes>