**CHM 314**

**Lebanese American University**

**Experiment 4:**

 **Reactions of Aldehydes and Ketones**

**Date: Wednesday, March 12th, 2013**

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1. **Objective:**
2. Perform common reactions for carbonyl group
3. Test for the presence of a carbonyl group
4. Detect the presence of aldehyde of ketone
5. **Procedure:**

Refer to the manual pgs 231-243

1. **Reactions Involved:**

  

Aldehyde Carbonyl Ketone

1. **Tests to prove the presence of**
2. Oxime Test:



 + NH2OH🡺

 Hydroxyl Amine Oxime

Result: This test gives was not performed in the lab.

1. Phenyl Hydrazone Test



1. In 2 test tubes, add 1ml of benzaldehyde in one, and 1ml Cyclopentanone
2. Add 3ml phenyl hydrazine in each
3. Shake well and observe

Result: Both test tubes gave us orange red precipitate

1. 2,4-dinitrophenylhydrazone Test:



Result: Both benzylaldehyde and the cyclopentanone gave us orange yellow precipitates.

1. Semicarbazones:



 Semicarbazide Semicarbazone

This test was not performed in the lab.

1-Aldol Condensation



2-Crossed Aldol Condensation



-2.5 ml Benz aldehyde + 1 ml acetone + 15 ml ethanol

- we add 5 ml NaOH 5%

-Swirl till solid appears

-Cool, Filter

1. Special Tests for Aldehydes:

These tests show negative results for ketones.

1. Tollen’s Test:



Tollen’s reagent (Silver diamine complex) is very explosive; it cannot be stored and must therefore be prepared in Situ.

Tollen’s Reagent Preparation:

To 2ml AgNO3, add 1ml NaOH. Add NH3 drop wise just to dissolve ppt.

Reactions:

2AgNO3 + 2NaOH 🡪 Ag2O + 2NaNO3 + H2O

Ag2O + 4NH3 + 3H2O 🡪 2Ag(NH3)2 + HO-

We did Tollen’s test for benzaldehyde and 3-pentanone each time adding a few drops of Tollen’s reagent to 3ml of the carbonyl compound and then heated in a warm water bath.

Benzaldehyde gave us a silver mirror (positive result) whereas 3-pentanone maintained the yellow (light brown) coloration (no change; negative result)

1. Fehling’s Test:



Do Fehling Test for acetaldehyde and 3-pentanone and then heat in a warm water bath.

Results:

Fehling test showed unusual results in the lab session probably because of inappropriate contaminations. In theory, it remains blue with 3-pentanone (ketone) and gives a brick red precipitate with acetaldehyde (aldehyde).

1. Haloform Reaction (Iodoform test)

This is a test for α-methyl ketones.\



Iodoform (CHI3) is a yellow precipitate.

P.S: It should be noted that I2 is not soluble in water and therefore, we use IKI instead.

We add IKI to 5 drops of acetone (α-methyl ketone; (CH3)2CO) mixed with 2ml of 5% NaOH and shake. We observe a nice yellow precipitate at the end end.

1. **Table of Reagents**

**Reaction of benzaldehyde and acetone**

|  |  |  |  |
| --- | --- | --- | --- |
| Compound | Molecular Formula | Molecular Weight (g.mol-1) | M.p (°C) |
| Benzaldehyde | C6H5CHO | 106.121 | -26°C°C |
| Acetone | C3H6O | 58.08  | -95°C |
| Dibenzalacetone | C17H14O | 234.29 | 60 °C |

1. **Results:**

Reagent Molecular Weight Grams Moles

Benzaldehyde 106.121 g.mol-1 2.5ml(d=1.04g/ml) 0.0245 mol

Acetone 58.08 g.mol-1 1ml (d=0.791g/ml) 0.0136 mol

The yield-limiting reagent is benzaldehyde (0.0245/2= 0.01225 < 0.0136 mol)

Theoretical yield of dibenzal acetone = 0.01225 mol = 0.01225 mol × 234.29 g.mol-1 = 2.87 g

Actual yield = 2.51 g

Percentage yield = $\frac{2.51}{2.87}×100=87.5 \%$

1. **Discussion of Results:**

We obtained a percentage yield of 87.5% which is relatively good and is less than 100% due to several experimental errors discussed below.

1. **Sources of Error:**
2. The greatest source of error during the procedure arises from the fact that the reactants and products are transferred between containers multiple times.
3. The presence of any contaminants in the glassware used.
4. During the dryin grocess, some of the reactants remained stuck to the filter paper.
5. Answers to questions