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Production of ethanoic acid by oxidation of ethanol

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Abstract
Ethanoic acid is also called acetic acid. It is colorless and if it is undiluted that called glacial acetic acid. In many countries like USA, United Kingdom and other Asian countries acetic acid used as a food additive, that is why this lab work is done to produce acetic acid with a better yield of 81%. It is used to for cooking, cleaning and laundry purposes, so one can prepare it at home easily. It is not only used as a food additive but also widely used in industrial processes. The basic purpose of manufacturing acetic acid is to produce household vinegar which is 3 to 9% of acetic acid by volume. Acetic acid is produced by oxidation. And oxidation used in preparing acetic acid is a unit process. Whereas, unit operations used in preparing acetic acid are mixing & distillation.

Keywords: Acetic acid, distillation, oxidation, yield, vinegar, unit operation, unit process.

1. Introduction
Acetic acid, which is costly ingredient of the road deicer calcium magnesium acetate. It is an organic compound. Acetic acid is also used a chemical reagent widely. Vinegar is also be produced which approx 3-9% by volume of acetic acid. It has no color, pungent smell and density of 1.04 g/cm³. It's melting & boiling point is -16 °C & 119 °C respectively. Acetic acid has acidity of 4.76 and basicity of 9.198.
Easters of acetic acids are used as solvents for inks, paints and coatings. Whereas diluted acetic acid can be used in physical therapy by iontophoresis.

2. Reagents Used in production
Solution 1:
Distilled water 5ml, conc. H2SO4 3.3ml and sodium dichromate=3.5g
Solution2:
Distilled Water = 6ml and Ethanol 5ml.

2.1 Ethanol
Ethanol is the basic component used for preparing acetic acid at laboratory. The alcohol is heated under reflux with an excess of oxidizing agent. Ethanol has no color with slight smell, melting point and boiling points are -144 °C & 173°F. Its molecular formula is C2H6O. Its oxidation gives acetaldehyde.

2.2 Sodium Dichromate
Sodium dichromate is an oxidizing agent used in preparation of acetic acid. It acts as a mixture of sodium dichromate and sulfuric acid. It has red color and odorless compound. It has density of 2.52 g/cm³. Sodium dichromate melting and boiling points are 256.7 °C & 400 °C. Its molecular formula is Na2Cr2O7.

2.3 Role of Water
In preparation of ethanoic acid, water is used to dilute the sodium dichromate and ethanol.

3. Chemical Reactions
C2H5OH + H2O -> CH3COOH + 2H2

4. Methodologies
First of all, apparatus was setup for distillation with round bottom flask, condenser and receiving flask.

Solution number 1 was poured into flask. This solution was heated and allowed to boil. Then flame was removed and few drops of solution 2 were introduced in flask. After that it was noticed that solution turned black. Flask was heated again, continuing the addition of solution 2 (drop wise) to the round bottom flask. After condensation, the main product was obtained in receiving flask as acetic acid.

5. Calculations

Theoretical yield:
Ethanol is limiting reactant here.
Weight of product = 0.0258 moles of ethanol*(1mole of acetic acid/1mole of ethanol)*(60g of acetic acid/1mole of acetic acid)
Weight of product= 1.548g
Weight of reactants= 1.185+11= 12.185g
Theoretical Yield = Weight of Product/Weight of reactant
Theoretical Yield = 1.548/12.185
Theoretical Yield = 0.1270
Theoretical Yield = 12.70%

Actual Yield:
Weight of Product = 1.258g
Actual Yield = Weight of product/weight of reactant
Actual yield = (1.258/12.158)*100 = 10.33%
% Yield = Actual Yield/Theoretical yield
= (0.1.33/0.1270)*100
% Yield = 81.3%

6. Conclusions

Percentage yield of product was calculated i-e- 81.33.
Sodium dichromate acts as a oxidizing agent, Whereas, water is used to dilute the mixture.

7. Acknowledgment

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