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METHODS TO REDUCE WASTE IN THE PROCESSING OF ACETIC ACID

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Abstract
Acetic acid (Acidum aceticum) CH3–COOH has been known as "vinegar" since ancient times, its composition was discovered by the Swedish chemist Berselius in 1814. From Wikipedia, the free CH3COOH encyclopediaThe manufacturing process of producing acetic acid consists of the following stages:

- preparation of catalyst solution;
- oxidation of acetaldehyde;
- rectification of crude acetic acid (distillation, reprocessing);
- Processing of distillation residues;
- dosing acetic acid.

Keywords: Acetic acid, synthesis, processing, contamination, acetylation, catalyst, enzymatic method.

Introduction

Acetic acid is mostly produced via a chemical route which involves a variety of identical and non-identical catalytic methods. The carbonylation of methanol via Monsanto's process is the most appropriate path advanced as Cavita process with catalyst selection and process intensification. The enzymatic approach has also gained attention in the last decade; But a commercial approach has not yet been established. Current trends in sustainable production require an urgent paradigm shift to develop and sustain sustainable routes to reduce environmental damage. An approach will also be taken in the development of membrane-based technology, which offers a very simple design with eco-friendly production.

Acetylation of various food categories using acetic acid bacteria led to the production of more than one food product. Acetic acid bacteria occur naturally in fruits, flowers and plants, they react naturally and convert carbohydrate sugars into organic acids in the presence of oxygen. The same concept is used to prepare biotechnologically diverse food and drinks.

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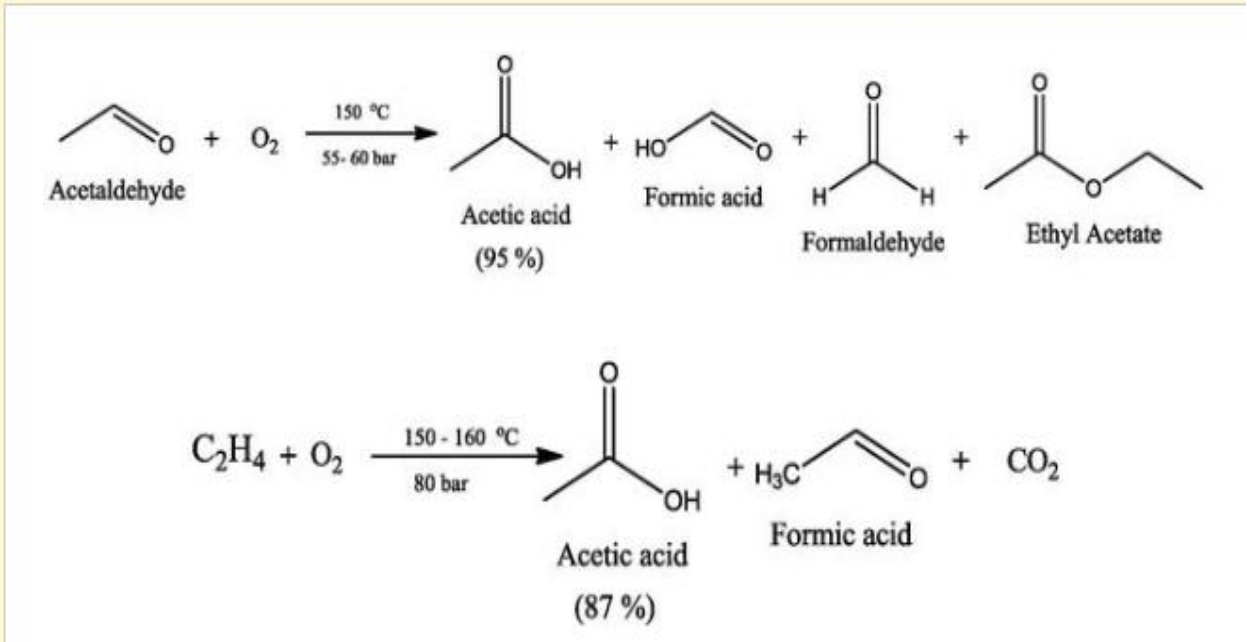
1. **The oxidation process of acetaldehyde.** Oxidation of acetaldehyde is the key process for the synthesis of acetic acid, in which acetaldehyde is first prepared by oxidizing ethylene using palladium and copper chloride and it oxidizes again to form acetic acid (Figure 1). The same process is prepared using cobalt and chromium-based catalyst at 55 bar pressure and 150°C. The one-step process of conversion of ethylene to acetic acid is also used using a high-pressure lead- and lead-platinum-based catalyst compared to acetaldehyde oxidation process with low yields of acetic acid [1].



2. The enzymatic method. The enzymatic pathway is adapted for the formation of acetic acid in foods, which are mostly vinegar. This process mainly involves the use of renewable carbon resources, such as apples, grapes, pears, honey, cane, coconut, palm, syrupy grains, hydrolyzed starch, beer, and wine [10]. The fermentation process is basically divided into two stages: boiling with yeast, special microorganisms called "acetic fungi" in the formation of acetic acid, oxidize ethyl alcohol to acetic acid.

Vinegar production is carried out by oxidative fermentation. Acetobacterium and Gluconacetobacteria are the most commonly used species among many classified generations. Acetobacter pasteurianus is conventionally used for the commercial production of vinegar with no more than 6% concentration whilst Gluconacetobacter europaeus is used for the production of 10% of vinegar with a high concentration. The price of vinegar varies depending on the source used and the region in which it is generated.

3. Acetylation method. Acetylation is simply the bacterial oxidation of ethanol to form acetic acid and water. The process is also known as oxidative fermentation. During acetylation, the rate of reaction depends mainly on the type of microorganism used for catalysis and on the available oxygen concentration in the medium.

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Ethanol Acetic Acid

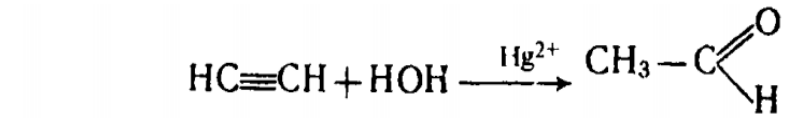
There are various types of micro-organisms that occur naturally in foods and are responsible for a variety of natural processes such as acetation, alcoholism, proteolysis, and enzymatic reactions that change the natural condition of food. This bioprocess technology is studied and applied regularly in order to improve quality in order to improve texture, taste, mouthfeeling, colour, and longevity of foods. The overall concept has evolved into the production of all kinds of food and beverages that are produced in an affordable and sustainable way.

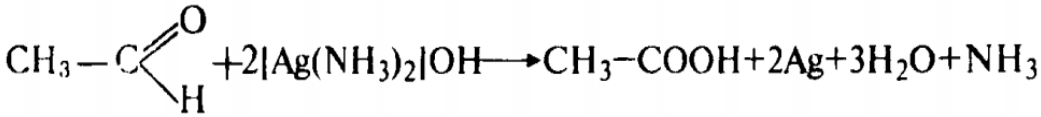
4. When the wood is dry-plowed, acetic acid accumulates in a layer of water, and as a by-product, methyl alcohol and acetone are formed. In order to separate acetic acid, the mixture is neutralized with lime, whereby calcium acetate formed at the same time decomposes when heated with sulfuric acid, and the acetic acid decomposes in its pure state:

$$2CH_3COOH + Ca(OH)_2 \rightarrow (CH_3COO)_2Ca + H_2O$$

$$Ca(CH_3COO)_2 + H_2SO_4 \rightarrow \downarrow CaSO_4 + 2CH_3COOH$$

5. The main technical method for obtaining acetic acid is the Kucherov reaction, which produces acetylene acetylene to acetic aldehyde, in which the resulting aldehyde is converted into acetic acid by oxidation in the presence of catalysts:





6. At present, acetic acid is being efficiently extracted from oil by oxidation in the liquid phase at the catalyst of manganese salts. By oxidizing hydrocarbons, e.g. butane, pentane, etc., under the action of air oxygen at high temperatures, industrial methods for obtaining acetic acid were developed

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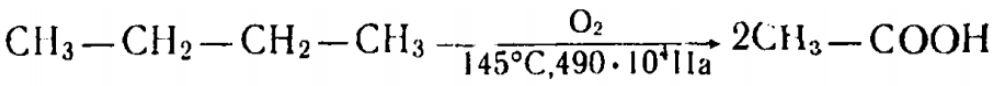

7. Acetic acid is also synthesized by the oxosynthesis method. For example, unsaturated hydrocarbons are obtained by exposure to acids (H_2SO_4 and H3PO4**)** or $Ni(CO)_4$— carbon(II)- oxide and water vapor at the catalyst of tetracarbonyl nickel:

$$CH_2=CH_2+CO+H_2O \xrightarrow[t,P]{Ni(CO)_4} CH_3-CH_2-COOH$$

$$CH_3OH + CO \xrightarrow[200\ atm.\ (2*10^7 Pa)]{Ni(CO)_4} CH_3COOH$$

Production of synthetic acetic acid in Navoi Nitrogen with a design capacity of 25,000 tons per year in January 1970 was put into use in Navoi Nitrogen with participation of liquid-phase oxidation of acetaldehyde to acetic acid technical oxygen with participation of the catalyst - manganese acetate.

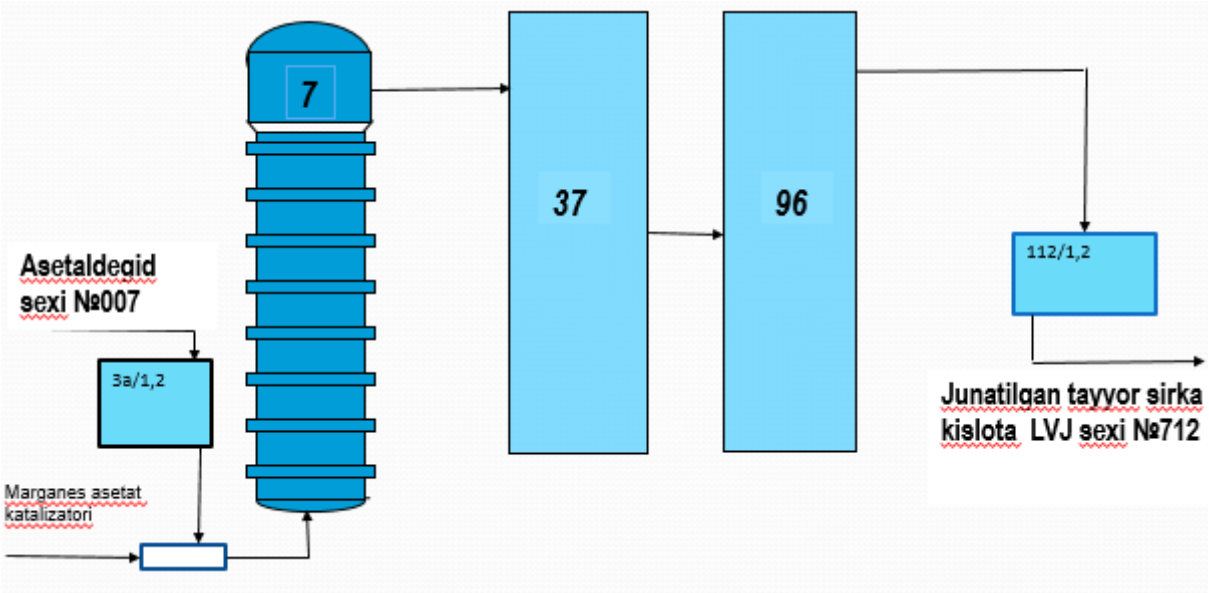

Figure 1. Schematic scheme of acetic acid production

Acetic acid generates wastes such as catalysts and other by-products spent in plants. Proper waste management is very important to prevent environmental pollution. Where possible, recycling and reusing or ensuring safe disposal of waste is an important step towards minimizing the environmental impact of the waste generated by these plants. Acetic acid plants are subject to a number of environmental permits and regulations, depending on the location and scope of activity. Compliance with these rules is important to minimize the impact on the environment. Factory operators are responsible for ensuring that their facility complies with these standards.

Conclusion

Currently, acetylic acid and its properties are used in various industries such as acetylcellulose (from which acetate fibers, plastics, varnishes, noncombustible film plates and others are obtained), as an acetylating agent, in the food and textile industries, etc.Therefore, it is of great importance to obtain acetic acid and to study it on industrial technology. The production of acetic acid is a complex process. At the same time, various waste products are released during the extraction and processing of acetic acid. To reduce emissions and prevent pollution, it is necessary to pay attention to: - the use of advanced emission control systems to reduce air pollutants;
-optimization of waste management processes, recycling and reuse of materials whenever possible;

-the introduction of efficient water treatment and treatment systems to reduce water use and prevent pollution;

-Ensuring strict adherence to environmental regulations and regularly monitoring waste management. Solving such problems is a priority.

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