FORM 2

THE PATENTS ACT 1970

39 OF 1970

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THE PATENT RULES 2003

COMPLETE SPECIFICATION

(SEE SECTIONS 10 & RULE 13)

1. **TITLE OF THE INVENTION**

VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION

2. **APPLICANTS (S)**

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2. **PREAMBLE TO THE DESCRIPTION**

COMPLETE SPECIFICATION

The following specification particularly describes the invention and the manner in which it is to be performed

VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION

Abstract:

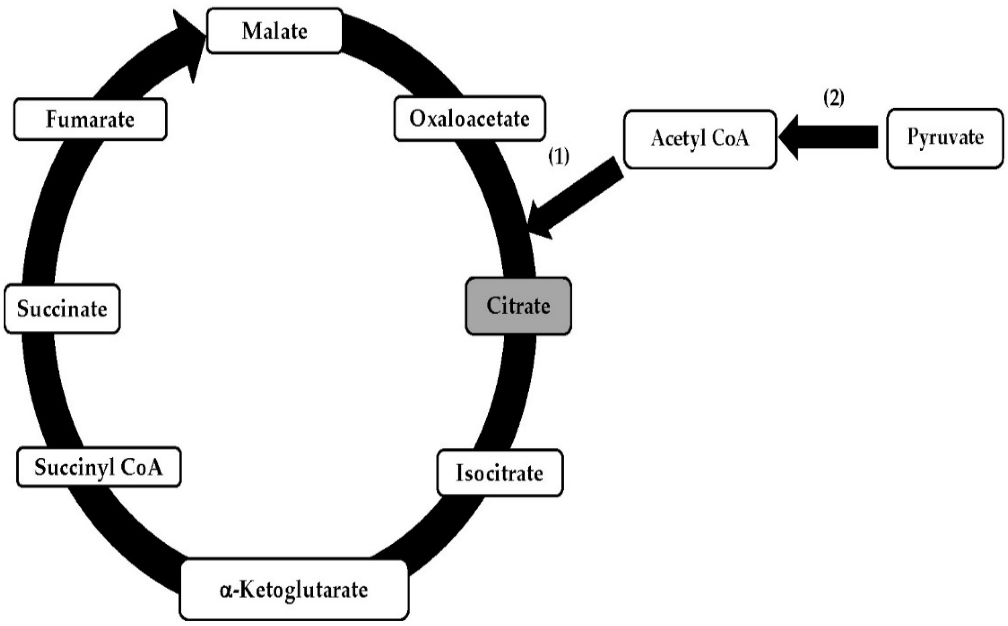
This study investigated how various strains of Aspergillus niger could aid in the solid-state fermentation-based production of citric acid from crop processing. The culinary and beverage industries have identified a variety of applications for citric acid. Strains of A. niger that are capable of producing a great deal of citric acid have genetic modifications that increase their propensity to produce a great deal of the organic acid. These modifications have the potential to affect citric acid cycle processes. Scientists have previously investigated whether A. niger could use agricultural wastes, such as fruit processing wastes, sugarcane bagasse, starch vegetable processing wastes, and cereal grain processing coproducts, to aid in the solid-state fermentation production of citric acid. Multiple genotypes of A. niger are capable of producing citric acid via solid-state fermentation. During the investigation, it was determined that only specific agricultural processing outputs were suitable for retaining a high level of acid production. Apple pomace, banana peels, grape pomace, and orange peels are examples of fruit refuse that aided in the production of citric acid by fungi following solid-state fermentation. However, A. niger strains that utilized solid-state fermentation were induced to produce minute quantities of citric acid by using bran and other residues of cereal grain ethanol production. It appears that the byproducts of grain processing contained less readily accessible sucrose. This made it more challenging for fungi to produce citric

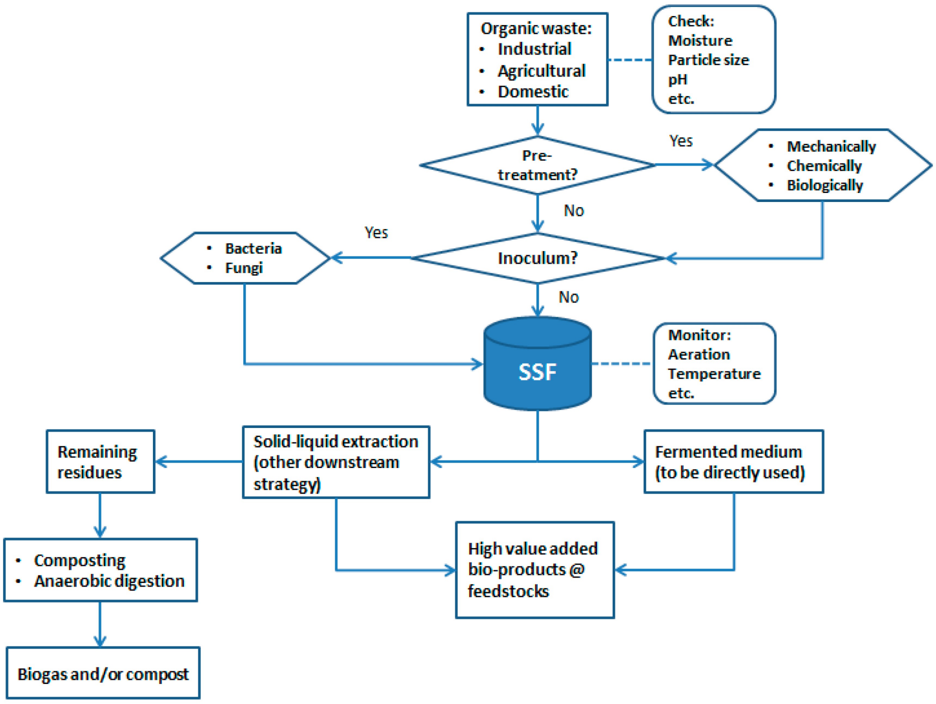
acid. A. niger strains' production of citric acid was found to be influenced by the quantity of sugar in the agricultural processing wastes utilized during solid-state fermentation. This was the ultimate decision.

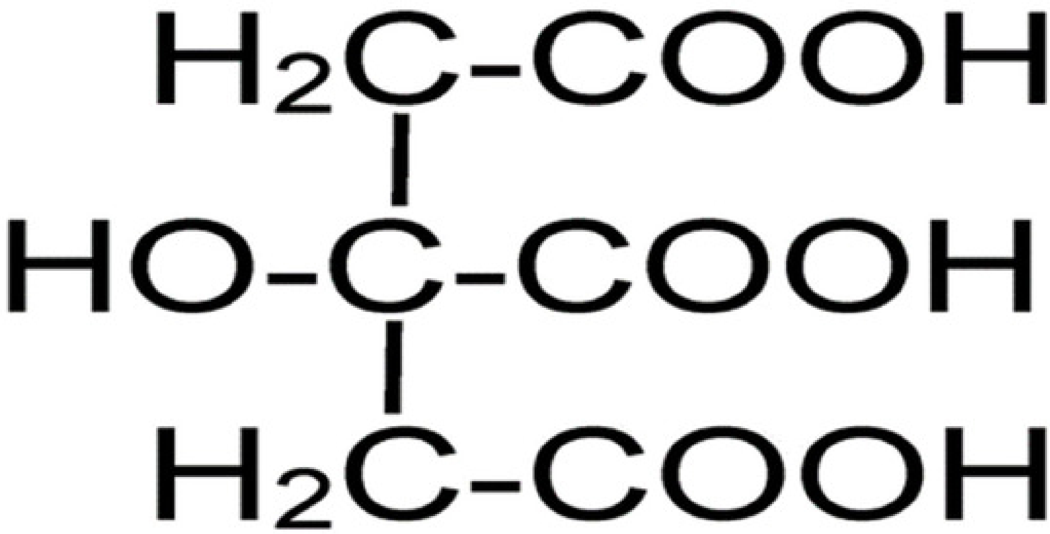
Descriptions:

Citric acid is a type of organic acid that has a solid structure, a white granular appearance, and dissolves in water. When combined with water, it has a powerful capacity to function as a cushion. In 2023, the global citric acid market is projected to be worth $3.2 billion. An estimated one million metric tons of citric acid are produced annually on a global scale. The World Health Organization states that citric acid is suitable for use in food. Citric acid can be used as a flavor enhancer, pH regulator, preservative, stabilizer, antioxidant, chelating agent, and chelating agent, among other applications. In the food and beverage industries, citric acid is utilized in a variety of profitable methods. Not only does it increase the acidity of the final product, it also contributes very little flavor. Citric acid, which has an acidic taste, is frequently added to beverages to achieve the ideal level of sweetness. It is well-known that citric acid benefits digestion and the kidneys. In the pharmaceutical industry, citric acid is utilized as an antioxidant and pH modulator to prevent the deterioration of vitamins. In the textile industry, citrate is used to produce foam, which softens materials. Environmentally, citrate-based detergents perform better than phosphate-based detergents. Citric acid, an organic acid, could be used as a component in the production of an industrial chemical. This is essential to recall. Using agro-residues as a substrate in a bioprocess to create novel items with commercial value is viewed as an important step in the development of environmentally friendly technology. Several varieties of rice husks were utilized in the solid-state fermentation procedure with Aspergillus niger to produce citric acid. Utilizing the pyridine-acetic acid anhydride method, a quantitative analysis of the produced citric acid was conducted. Placket Burman Design (PBD) was utilized to investigate the ten different media components required by Aspergillus niger (A. niger) to produce citric acid ((NH4)2SO4, MgSO4.7H2O, NH4NO3, KH2PO8, FeCl3.6H2O, CuSO4, FeSO4, ZnSO4, MnSO4, and Molasses). Face-Centered Central Composite Design (FCCCD) was used to determine which nutrients had the greatest effect on the final product. Thin-layer chromatography, Fourier transform infrared (FTIR), and melting point experiments were conducted on both commercial citric acid and citric acid produced in the laboratory. According to PBD statistics, hydrogen peroxide treatment was the most effective method for preparing rice fiber for use. The citric acid yield of 3.65 0.26g/kg RH was significantly greater than the acid, alkaline, and untreated rice husk yields of 2.94 0.83g/kg RH, 1.97 1.24g/kg RH, and 2.34 0.13 g/kg RH (p 0.05). When rice straw was used as a substrate to produce citric acid, it was necessary to add NH4NO3, KH2PO4, and jaggery to the medium. When the optimal concentrations of the three constituents were 2.5g/L, 3.25g/L, and 0.2275g/L, respectively, 4,765,001 mg/L of citric acid was produced. We obtained a "R2" coefficient of determination of 0.9790 at the p 0.05 level of significance, which is quite close to a "Adjusted R2" value of 0.9601. The melting point of A. niger citric acid was identical to the standard, which was 153 0.00 degrees Celsius. Standard and citric acid had O-H and C=O wavenumbers of 3338.7 cm-1 and 1565.5 cm-1 and 3324.8 cm-1 and 1625.1 cm-1, respectively. The results of this study indicate that citric acid can be extracted from rice chaff in a manner comparable to laboratory production. It also demonstrated the significance of employing a statistical design, such as Face Centred Composite Design (FCCCD) of the Response surface method, to improve A. niger's capacity to produce citric acid from rice fiber. This method has demonstrated its efficacy in determining the optimal conditions for producing citric acid. This article examined how solid-state fermentation can be used to produce citric acid from agricultural refuse. By solid-state fermenting a variety of agricultural byproducts, citric acid has been manufactured with variable degrees of success. The objective of these investigations was to identify a technique for producing citric acid. The variety of agricultural byproduct utilized for solid-state fermentation altered the A. niger strain's capacity to produce citric acid. Different A. niger strains were discovered to generate distinct byproducts when producing citric acid. This led to the discovery in question. A. niger strains produced the most citric acid during solid-state fermentation of fruit detritus, including apple and grape pomace, according to an analysis. A. niger strains produced the lowest quantity of citric acid following solid-state fermentation with potato processing waste or cereal grain processing waste as substrates. This generated the smallest possible quantity of citric acid. According to the data, the quantity of sugar in the substrate utilized by the A. niger strain for solid-state fermentation influenced the amount of citric acid produced. Industrial citric acid production has relied on either submerged or surface fermentation despite numerous experiments on A. niger solid-state fermentation to determine how to produce citric acid from agricultural byproducts. Despite the fact that this study focused on A. niger's solid-state fermentation of low-value biomass, more recent research has resolved any questions regarding how to compare the efficacy of producing citric acid through solid-state, submerged, and surface fermentation.

DRAWINGS:







CLAIMS

1. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION a cutting-edge science technology.

2. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said that it can be used for a variety of purposes.

3. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said the proposed system is more accurate and faster.

4. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said that in this paper, we analyzed and discussed various aspects.

5. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said that in recent years, aspergillus niger become a hot topic in all sectors.

6. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said that it is a reliable and efficient system for monitoring variables.

7. VALORIZATION OF RICE HUSK FOR CITRIC ACID PRODUCTION USING ASPERGILLUS NIGER BY SOLID STATE FERMENTATION of claim 1, wherein said that this research looks at all of the important and recent work that has been done so far, as well as its limitations and challenges.