

## Research Progress on Detection Methods of Reducing Sugar in Luzhou Flavor Fermented Grains

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### Abstract

According to the data, the traditional classical chemical methods used to determine the reducing sugar in fermented grains are Feilin reagent method and 3,5-Dinitrosalicylic acid (DNS) method. After the starch in fermented grains is hydrolyzed into glucose, it is quantitatively determined by chemical reaction with ferring's solution and indicator based on the reducibility of aldehyde groups contained in glucose molecules; The Astoria Analyzer System (Micro-CFA) developed by the US Astoria-Pacific International (API) can quickly and accurately determine the content of reducing sugar in fermented grains, which is more convenient and efficient than traditional measurement methods, and has better guiding significance for the production of liquor.

### Keywords

Fermented grains, Automatic chemical analysis instrument, Reducing sugar detection.

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## 1. Introduction

Fermented grains, as an important product of Bajjiu fermentation, will change continuously with the fermentation process[1,2,3]. Reducing sugar is an important nutrient in the fermentation process of fermented grains. It not only provides energy for yeast, but also directly affects the fermentation quality and liquor yield. It needs to be determined quickly and accurately. With the research of scholars on the detection methods of reducing sugar in fermented grains, it is roughly divided into traditional detection methods and rapid detection methods.

## 2. Traditional detection method

### 2.1 Principles and steps of traditional detection methods

The traditional determination of reducing sugar content is mainly based on Feilin's method. Ferring's solution consists of solution a (copper sulfate solution) and solution B (sodium hydroxide and potassium sodium tartrate solution)[4,5]. When mixed, copper sulfate reacts with sodium hydroxide to form copper hydroxide precipitation; Then react with potassium sodium tartrate to dissolve copper hydroxide. Divalent copper in potassium sodium copper tartrate complex can oxidize the carbonyl group in reducing sugar to sugar acid, which is reduced to red cuprous oxide precipitation with oxidation number of 1. Finally, methylene blue indicator is used for display. Because the oxidation capacity of methyl blue is weaker than that of divalent copper, when all divalent copper is reduced, the drop of excessive methylene blue will immediately reduce the methylene blue until the color of the solution disappears completely. The measurement steps are shown in the figure:

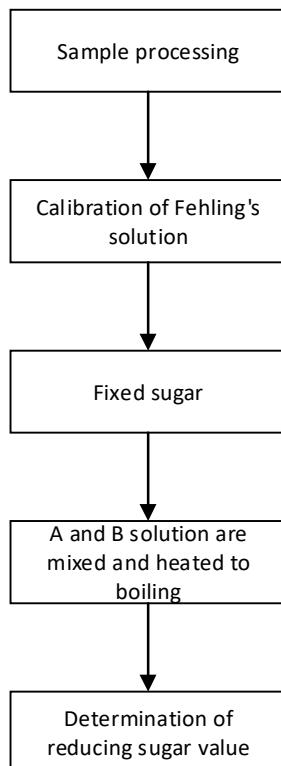


Figure1: Determination flow chart

## 2.2 Defects of traditional detection methods

When Fehling reagent is used to detect reducing sugar in fermented grains, it has many steps, complex operation and limitations. The standard deviation of reducing sugar determination is greatly affected by the concentration change of standard solution. When the concentration of standard solution is less than 0.35g/100ml, the determination result is relatively stable and the deviation is small. When the concentration of standard test solution is greater than 0.35g/100ml, the determination of reducing sugar is unstable and the deviation is large. The Feilin reagent detection method is time-consuming and labor-intensive, and the labor cost is large. It needs more energy and time to prepare the solution to be measured before titration. Due to the uncertainty of manual operation, it is easy to cause problems such as pollution or damage of the solution to be measured, resulting in error.

## 3. Rapid detection method

### 3.1 Principle and steps of rapid detection method

With the Baijiu Baiyun development, liquor production and the demand for physical and chemical properties of fermented grains, the traditional method of reducing sugar has been unable to meet the fermentation of Baijiu baijiu. Continuous flow analysis technology (CFA) is a rapid detection technology proposed in the 1950s and developed and popularized in the 1970s[6,7]. Its basic working principle is to design each chemical reaction step in the process of generating colored compounds in the detection into a chemical reaction instrument connected in series, so that the sample and reaction reagent enter this flow path to automatically complete the reaction, and the finally formed colored compounds enter the colorimeter for color comparison, and then automatically calculate the results through the data processor. The whole analysis process is completed by instrument. Compared with manual detection, it not only reduces the labor cost, but also reduces the method error to a certain extent. It has the advantages of high precision, good reproducibility and fast speed.

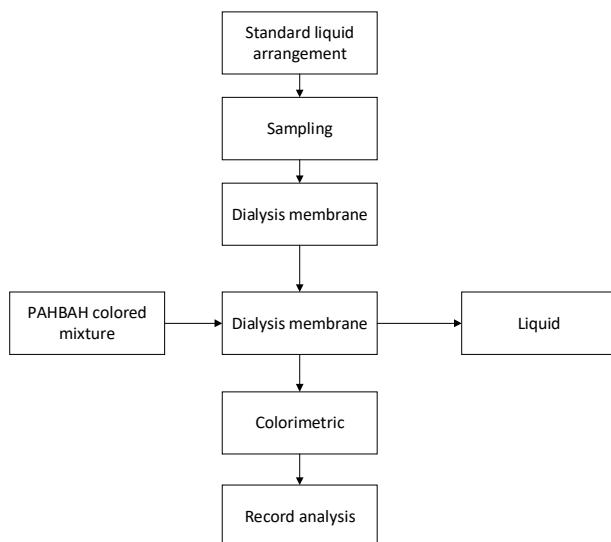


Figure2: Quick detection method diagram

### 3.2 Advantages of continuous flow analysis in detecting reducing sugar

At present, the main methods for detecting total sugar in food are chemical titration, colorimetric analysis and high performance liquid chromatography. However, the sample pretreatment and experimental operation process of these methods need manual operation, many steps and long detection cycle, and there are many factors affecting the experimental operation process. The workload of testing samples is large and the probability of error is large. The continuous flow analyzer is used for determination. It takes only a few minutes from sample injection to output results, which greatly shortens the detection time and is very suitable for the analysis and measurement of a large number of samples. Due to the small amount of reagent, the consumption and waste of reagent are reduced, human error is reduced, and the accuracy and accuracy of detection are improved. In recent years, researchers at home and abroad continue to improve and upgrade their continuous flow analysis technology, and their analytical instruments are becoming more and more advanced. With the continuous increase of relevant test standards, continuous flow analysis technology shows excellent application advantages in more application fields.

## 4. Conclusion

As Baijiu Baijiu is developing, people's demand for Baijiu quality is improved. The liquor production process is more and more strict in determining the physicochemical properties of fermented grains. The traditional method of reducing sugar has not been able to meet the accuracy and efficiency of the liquor. Therefore, the existing detection methods are improved and promoted on the basis of traditional detection methods. Even realizing the full automation of the determination of physical and chemical properties of fermented grains is the direction of our pursuit and development in the future. This paper summarizes the working principles and steps of traditional detection methods and rapid detection methods, expounds their advantages and disadvantages, and provides a reference for the detection method of reducing sugar in fermented grains.

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