Discussion on the national food safety standards for sugar products

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Abstract: This paper focuses on the main content of the national food safety standards for sugar products, discusses the changes in the standards, and proposes suggestions. It is beneficial for production enterprises to implement the new standards, regulate industry production management, and promote the healthy development of the industry.

Keywords: Sugar, National Standards, Indicators, Discussion

1. Introduction

China is a major producer and consumer of sugar, and the quality and safety of sugar products are not only related to people's health and life but also to the country's image and reputation. Safety requires quality to be guaranteed, and quality issues are first and foremost standard issues. Standards are an important sign to judge and measure the quality of products.

To implement the "Food Safety Law" and its implementation regulations, the National Health and Family Planning Commission (formerly the Ministry of Health, hereinafter referred to as the NHFPC) commissioned relevant units to revise the sugar hygiene standard GB13104-2005[1]. The new national food safety standard for sugar, GB13104-2014[2], was implemented on May 24, 2015, replacing and invalidating GB13104-2005. This article interprets the main content of the revision of the national food safety standard for sugar and analyzes and discusses the differences between the new and old standards and the similarities and differences between the standards and international standards.

2. Main changes in the standard

2.1. GB13104-2014 revised the name of the standard

The name of the standard was changed from the 2005 version's "Sugar Hygiene Standard" to the 2014 version's "National Food Safety Standard for Sugar," signifying that the standard has been elevated from a hygiene standard to a national food safety standard.

In accordance with Article 3 of the Implementation Regulations of the Food Safety Law of the People's Republic of China, food producers and operators shall engage in production and business activities in accordance with laws, regulations, and food safety standards. They must establish and improve food safety management systems, take effective management measures, and ensure food safety. Food producers and operators are responsible for the safety of the food they produce and operate, are responsible to society and the public, and bear social responsibility.

Therefore, food safety standards are mandatory standards. National food safety standards are formulated and reviewed by the Food Safety National Standard Review Committee.

2.2. The GB13104-2014 standard expands the scope of application

The scope of the standard has been modified. The 2005 version applied to raw sugar, white sugar, cotton sugar, and brown sugar produced from sugarcane and beets. In the 2014 version, the scope has been expanded to include red sugar, cube sugar, and rock sugar, among others.

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2.3. The GB13104-2014 standard adds terminology and definitions

The standard has added terms and definitions, explicitly listing the definitions of raw sugar, white sugar, cotton sugar, brown sugar, red sugar, cube sugar, and rock sugar. These terms and definitions are essentially consistent with the national standard for sugar industry terminology GB/T9289-2010.

2.4. GB13104-2014 has revised the sensory requirements

The sensory requirements specify color: the product should have its characteristic color; taste and odor: it should taste sweet, without any foreign tastes or smells; and state: it should have the characteristic state of the product, without clumping, and be free from visible foreign matter to the naked eye.

2.5. GB13104-2014 has added references to contaminant limits and deleted microbial indicators

The standard no longer lists the requirements for contaminant limits repeatedly but directly refers to GB2762-2012. Currently, the "Food Safety National Standard for Contaminants in Food" GB2762-2012 has a total arsenic limit of ≤0.5mg/kg and a lead limit of ≤0.5mg/kg, which is consistent with the GB13104-2005 version.

The standard has removed the limits for total bacterial count, coliform groups, molds, yeasts, and pathogenic bacteria, retaining the biological indicator for mites, with the requirement that mites should not be detected. A comparison of the limits in the new and old standards can be seen in Table 1.

2.6. GB13104-2014 has added regulations on the use of food additives

The standard stipulates that the use of food additives should comply with the provisions of GB2760-2014.

2.7. Other

GB13104-2014, in accordance with the format requirements of national food safety standards, has removed the regulations on "hygienic requirements for production and processing," "packaging," "labeling," "storage," and "transportation."

Table 1 Comparison of Limit Indicators between Old and New Standards

Indicator	GB13104-2005	GB13104-2014
Insoluble impurities (mg/kg)	≤350	≤350
Total arsenic (mg/kg)	≤0.5	Must comply with GB2762: ≤0.5
Lead (mg/kg)	≤0.5	Must comply with GB2762: ≤0.5
Sulfur dioxide (mg/kg)	Raw sugar ≤20 mg/kg	Must comply with GB2760 provisions
Total plate count (c f u/g)	Granulated sugar, fine sugar ≤100; brown sugar ≤ 500	
Coliforms (MPN/100g)	≤30	
Molds (c f u/g)	≤25	
Yeasts (c f u/g)	≤10	
Salmonella	Not detectable	
Shigella	Not detectable	
Staphylococcus aureus	Not detectable	
Hemolytic streptococcus	Not detectable	

3. Comparison with international standards

The International Sugar Codex Standard (CAC) Codex Stan 212-13 is established by the Sugars and Sweeteners Committee of the Codex Alimentarius Commission and is recognized by ISO as an international

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standard. It mainly determines the method standards, terminology standards, and safety standards for sugar products, which are universally applicable on an international scale. The main scope of application is sugar that does not require further processing and is intended for human consumption, including direct consumption and use in food processing. It includes white sugar, brown sugar, sugar powder (rock sugar), fine sugar, soft brown sugar, anhydrous glucose, hydrated glucose, glucose powder, glucose syrup, lactose, fructose, and raw cane sugar. The comparison between China's current national standards and international standards is as follows.

3.1. In terms of quality indicators

The quality indicators of the (CAC) Codex Stan 212-13 include optical rotation, invert sugar content, conductive ash, loss on drying, and color value. In contrast, the national food safety standard GB13104-2014 is directly transformed from a hygiene standard, hence the standard only specifies sensory requirements and the limit requirement for insoluble impurities (only for raw sugar). However, since this standard is a mandatory one, it applies to raw sugar, white sugar, soft white sugar, red brown sugar, brown sugar, cube sugar, and rock sugar, etc. Therefore, when white sugar, soft white sugar, red brown sugar, brown sugar, etc., comply with this standard, their product characteristics such as sucrose content, total sugar content, color value, etc., are not controlled.

3.2. In terms of hygiene indicators

The (CAC) Codex Stan 212-13 requires production in accordance with good manufacturing practices, specifies that no foreign matter should be present, and mandates that upon inspection, the product should not contain harmful microorganisms, parasites, or metabolites of microorganisms in quantities that could pose a risk to human health. In contrast, the national food safety standard GB13104-2014, which is a mandatory standard applicable to raw sugar, white sugar, soft white sugar, red brown sugar, brown sugar, cube sugar, and rock sugar, among others, only stipulates a biological indicator for mites: not detectable, without setting limits for other microorganisms.

The International Sugar Codex Standard, recognized by ISO, has been in place since 1999 and has not been revised for nearly more than a decade, indicating that it is overdue for an update. Analyzing the current situation, it is evident that China's current food sugar safety standards are lagging behind the International Sugar Codex Standard.

4. Issues to be explored

4.1. The issue of sulfur dioxide residue limits in sugar standards

The sugar industry is a traditional industry in China, and most domestic sugar factories use the sulfur dioxide method, which primarily employs sulfur dioxide as a clarifying and bleaching agent. This results in a widespread issue of sulfur dioxide residue in sugar. The sulfur dioxide in sugar exists in the form of sulfites, mainly as calcium sulfite, and also includes colorless sulfates formed by the addition reaction of sulfites with organic compounds containing double bonds (mainly phenolic substances and melanin). During the sugar boiling and crystallization process, a small amount of mother liquor is encapsulated within the growing sugar crystals, and calcium sulfite precipitate particles are mixed on the surface of the crystals, which is the fundamental source of sulfur dioxide residue in sugar.

4.1.1. Sulfur dioxide in China's sugar: Standards and global trends

Abroad, refined sugar is mainly produced, and developed countries have discontinued the use of the sulfur dioxide method. Renowned international sugar-using food companies, such as beverage giants Coca-Cola and Pepsi, have very strict requirements for sulfur dioxide residue in white sugar, effectively treating it as a quality indicator. This poses a significant challenge and impetus for the production of white sugar in China. Since the 1990s, when China's white sugar standards aligned with international trends by introducing sulfur dioxide residue as a quality indicator, it has indeed played a significant role in promoting the continuous improvement of production technology, equipment, and sugar quality levels in China's sugar manufacturing enterprises. Based on the current state of production technology and equipment in China, the

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sugar hygiene standard GB13104-2005 stipulates sulfur dioxide residue limits as follows: white sugar ≤30mg/kg; red brown sugar ≤70mg/kg; soft white sugar ≤15mg/kg. The setting of these indicators is quite reasonable, as it has promoted an increase in domestic production levels, enhanced the market competitiveness of China's sugar, improved the quality level of China's sugar, brought it closer to international standards and practices, and ensured the level of food safety in China. Moreover, the sugar hygiene standard GB13104-2005 is stricter than the GB2760-2014, which stipulates ≤0.1g/kg, reflecting the efforts of the Ministry of Industry and Information Technology, the Light Industry Department, the Standardization Committee, the sugar industry, including scientists, producers, downstream enterprises, distribution links, consumers, and the media over 20-30 years. It has been a process of resistance, acceptance, and re-resistance until it has finally been accepted and deeply ingrained.

4.1.2. Sugar standards conflict: Sulfur dioxide issue

The food safety national standard for sugar GB13104-2014 replaces GB13104-2005 "Sugar Hygiene Standard" and applies to raw sugar, white sugar, soft white sugar, red brown sugar, brown sugar, cube sugar, and rock sugar, etc., stipulating that the use of food additives should comply with the provisions of GB2760-2014. GB2760-2014 states, "A.4: Table A.3 specifies the exceptions to the food categories listed in Table A.2, which should comply with the provisions of Table A.1 when using additives. At the same time, these food categories shall not use food additives allowed in the higher-level food categories specified in Table A.1." Since Table A.3 lists the exceptions for food categories that can use food additives as needed for production, including "11.01.01 white sugar and white sugar products (such as white sugar, soft white sugar, rock sugar, cube sugar, etc.), 11.01.02 other sugars and syrups (such as brown sugar, red brown sugar, ice sugar, raw sugar, fruit sugar (from sugarcane), molasses, partially inverted sugar, maple syrup, etc.)", this means that the main varieties of sugar currently cannot have detectable sulfur dioxide! This is clearly an error in the standards, indicating a contradiction between the provisions for sugar in A1 and A3! The contradictions between the standards and the errors in GB2760 have caused confusion for many sugar manufacturing enterprises and testing institutions!

4.2. Microbiological limits for sugar products

Microbiological testing of food is an important means of evaluating the sanitary quality of food, ensuring food safety, and preventing and controlling foodborne diseases. Sugar is not only a product that can be consumed directly but also an important raw material for medicine, candies, pastries, and many beverages. If sugar is contaminated with pathogenic bacteria, it can pollute many foods through various routes and, in severe cases, cause food poisoning. Therefore, the microbiological testing of sugar is of great significance. The International Sugar Codex Standard (CAC) Codex Stan 212 stipulates that sugar should not contain microorganisms in quantities that pose a risk to human health. Renowned companies such as PepsiCo, Coca-Cola, and Wrigley's have established their own sugar standards. The sugar standards of PepsiCo and Coca-Cola, in addition to having limited requirements for bacteria (≤200cfu/10g), also have limited requirements for molds and yeasts (both ≤10cfu/10g).

The total plate count is an important indicator of the sanitary quality of sugar, primarily serving as a sign to determine the degree of contamination of sugar products. This method is used to observe the dynamics of bacterial reproduction in sugar products to provide a basis for the sanitary evaluation of the inspected samples. From a bacteriological perspective, the sugar production process should aim to remove bacteria brought by sugarcane as much as possible and effectively prevent the growth and reproduction of bacteria in semi-finished products to reduce losses and ensure the sanitary quality of sugar. Molds and yeasts are also indicator organisms for evaluating the sanitary quality of sugar, and the count of molds and yeasts is used to determine the degree of contamination of sugar products. Many types of yeasts have highly active enzyme systems and can produce a large amount of invertase under certain conditions, leading to significant losses of sucrose. In China's sugar manufacturing enterprises and distribution markets, there have been cases of white sugar being contaminated by molds and turning red, and brown sugar being contaminated by yeasts and turning white. The new standard does not have limited regulations for microorganisms, which is confusing and hard to understand for us. According to common practice, if it is cooked before consumption, this requirement may not be necessary, but is our sugar like that? Obviously not, rock sugar, soft white sugar

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consumed in the north, small packaged white sugar, refined white sugar, or its extended products in every corner of the market, catering shops, and dessert shops, are not all these directly consumed! This formulation is very inconsistent with food requirements (now the safety standards for condiments retain these requirements, do people consume less sugar directly than condiments?), which undoubtedly poses a serious hidden danger to food safety risks in sugar product consumption.

5. Suggestions for enterprises to implement new standards

The current situation is indeed quite entangled. It is suggested that the interpretation of the Standards Law in the past should be followed. The safety standard is a general standard with guiding significance. All departments, localities, and enterprises should develop their own standards that are stricter than the general standard according to their own characteristics, needs, and demands. This is reasonable, compliant, allowed, and encouraged. It is the exclusive product that should be implemented. It is suggested that the corresponding supervisory management departments should implement the product declared quality standard in their regulatory work (unless the declared quality standard is lower than the safety standard baseline).

Since the national safety standard for sugar GB13104-2014, like the vast majority of product standards, is directly transformed from the product's hygiene standard, its product characteristic indicators such as color value, sucrose content, total sugar content, reducing sugar content, and insoluble impurities in water are not reflected in the standard, which also brings difficulties to the daily supervision of production enterprises and food safety. At present, China's sugar market has attracted the attention of the country, and in the past three years, the sugar market is being severely impacted by foreign sugar. In order to protect the national ethnic industry, to build a safe and efficient sugar processing industry, to ensure the food safety of all links in the sugar chain, and to maintain the credibility of the government and industry, it is suggested that enterprises should implement the food safety national standard in combination with product standards when the sugar product standard is inconsistent with the food safety standard.

6. Conclusion

China's sugar product standard system has been in operation for decades, constantly improving and perfecting. There is a reason why China's sugar industry has become the world's third and stands among the world's major sugar-producing countries. By comparing the CAC standards with China's current national sugar safety standards, the overall quality level is still a long way off from the advanced countries in the world. In terms of the formulation of sugar product standards, the current system basically maintains the pattern of a planned economy, which is still quite far from a market-oriented mechanism and has a certain gap compared with foreign advanced standards. Faced with the severe impact of foreign sugar, we should have a strong sense of crisis and urgency. We must continuously improve technological progress and strengthen quality management to catch up with or surpass the world's advanced level in product quality as soon as possible, to obtain the pass to participate in international market competition. It is not enough to simply cut everything down to a very loose general framework, as that would lead to endless hidden dangers.

7. References

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