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Processing and Comprehensive Utilization of Corn Byproduct Resources

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Abstract

This study used corn by-products from Lvliang City as raw materials to determine the functional components in corn whiskers and corn husks. Various functional components from corn by-products were extracted using different methods and their activities were studied. It was found that the functional components of total polyphenols, total polysaccharides, and total flavonoids in corn whiskers have antioxidant and anti allergic activities, while the total polyphenols, total polysaccharides, and flavonoids in corn husks have antioxidant and anti allergic activities.

Keywords

Corn whiskers, Corn husks, Polyphenols, Polysaccharides.

1. INTRODUCTION

Corn is an annual herbaceous plant of the Gramineae family, native to Central and South America. It is an important food crop in the world, widely distributed in the United States, China, Brazil, and other countries[1]. China is a major producer and consumer of corn. With the continuous progress of natural product extraction and processing technology, the deep transformation of corn by-product resources has become a research hotspot in the fields of food science, nutrition, and health products, with broad development and application prospects. The byproducts of corn mainly include four parts: corn whiskers, corn husks, corn bracts, and corn straw. Corn stalks are the flower styles of corn plants in the Poaceae family, and contain various nutrients necessary for metabolism, such as fatty oil, VK, malic acid, alkaloids, polysaccharides, cryptoxanthin, sitosterol, and pantothenic acid[2]. They have high edible value. Research shows that corn whisker has significant effects on lowering blood sugar, blood pressure and blood lipids. It can not only protect the liver and cholangitis, diminish inflammation and diuresis, but also improve the immunity of the body. It has anti-cancer ability and is used to treat hypertension, nephritis, gallstones, diabetes and other diseases. Corn husk is a byproduct of deep processing of corn, which means that the corn skin after soaking and crushing accounts for about 14% of the dry weight of corn. Corn husk is rich in natural substances such as polyphenols and dietary fiber, and has high research value. Corn bracts are the outer leaves of corn ears, and their existence is of great significance for protecting corn fruits.

Research shows that corn bracts contain rich active substances such as flavonoids, anthocyanins, anthocyanins, dietary fiber, xylitol, etc., which can prevent and improve atherosclerosis, regulate human lipid metabolism, and prevent hyperlipidemia. Corn stem usually refers to the remaining part of mature crops after harvesting seeds, which is rich in carbohydrates such as cellulose and hemicellulose, and has high utilization value in the extraction and research of polysaccharides. Although China has abundant resources of corn by-products, there are not many processed products. Therefore, it is necessary to timely improve the level of deep processing of corn by-products and form a series of foods, such as corn whisker

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flavored tea drinks, corn stem new drinks, and corn fiber oil series of health foods, to increase the added value of corn by-products[3].

Corn is one of the important food crops in China, and the extraction of corn starch has been industrialized. However, its by-products, such as corn whiskers, corn husks, bracts, and stems, are still underutilized. With the optimization of technical equipment conditions and the maturity of industrialization conditions, corn by-products have a very broad development and application prospect.

Corn whiskers have abundant sources, low prices, and are easy to collect, making them a potential by-product resource for development. In recent years, clinical application shows that corn silk contains active ingredients such as polysaccharide, polyphenol, flavone, chlorogenic acid, etc., which has multiple effects such as anti-cancer, anti-oxidation, and has good effects on the treatment of hypertension, diabetes and other diseases[4]. As a medical resource, corn silk has broad research and development prospects. Currently, there is a considerable amount of research on water extraction of corn whiskers, total saponins, and hypoglycemic effects. Yang Lingling et al. found that the polysaccharide from stigma maydis is effective in reducing wasting[5], overeating, thirst and other symptoms of alloxan induced experimental diabetes mice. Du Juan found through her research that corn silk polysaccharides can significantly lower body temperature, and the antipyretic effect is continuously enhanced with increasing dosage within a certain range.

Corn husk has a rich source, low cost, and is rich in natural substances such as polyphenols and dietary fiber, which has high research value. But currently, corn husks are mostly used as feed. Man Zhaokun et al. used a combination of ultrasonic assisted method and enzymatic hydrolysis method to extract corn husk polyphenols[6], and optimized the extraction process using the central composite response surface analysis method.

Corn bracts are the outer leaves of corn ears, and their existence is of great significance for protecting corn fruits[7]. Research shows that corn bracts contain rich active substances such as flavonoids, anthocyanins, anthocyanins, dietary fiber, xylitol, etc., which can prevent and improve atherosclerosis, regulate human lipid metabolism, and prevent hyperlipidemia. Therefore, corn bracts have also been a research hotspot in recent years[8].

Corn stalks contain more than half of the products of crop photosynthesis, therefore they are rich in carbohydrates such as cellulose and hemicellulose. Due to these characteristics, corn stalks are a good source of polysaccharide extraction, and therefore demonstrate high utilization value in the extraction and research of their polysaccharides.

2. MATERIALS AND METHODS

2.1 Extracting total polyphenols from corn whiskers using microwave assisted ultrasound to study their antioxidant activity; Extracting corn silk polysaccharides through acid and studying their antioxidant activity; Extracting total flavonoids from corn whiskers by reflux method and establishing an OVA induced allergic model in BALB/C mice to evaluate the anti allergic activity of total flavonoids from corn whiskers.

2.2 Extracting total polyphenols from corn husk using ultrasound assisted enzyme method and studying the antioxidant activity of corn husk polyphenols; Extracting corn husk polysaccharides by ultrasonic assisted method and studying their antioxidant activity; To study the anti allergic activity of flavonoids from corn husk by ultrasonic-assisted extraction of flavonoids.

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3. RESULT ANALYSIS

3.1. Extraction Results of Multiple Functional Components from Corn Whiskers

Extracting total polyphenols and polysaccharides from corn stalks, it was found that corn stalks contain multiple active ingredients, among which polyphenols and polysaccharides have high antioxidant activity. The total flavonoids from corn stalks were extracted by reflux method, and the anti allergic activity of total flavonoids from corn stalks was evaluated using the OVA induced BALB/C mouse allergic model. The anti allergic activity of total flavonoids from corn stalks was found to be beneficial for hypertension The treatment of diabetes and other diseases has good results.

3.2. Extraction Results of Functional Components from Corn Peel

Through ultrasonic assisted enzymatic extraction of total polyphenols and polysaccharides from corn husks, it was found that the antioxidant activity of corn husk polyphenols was higher than other components. Through ultrasonic assisted extraction of flavonoids, it was found that flavonoids in corn husks also have anti allergic activity.

4. DISCUSSION

This study solves the problem of comprehensive development and utilization of corn by-product resources through experiments. It is theoretically and operationally feasible to extract total polyphenols, polysaccharides, flavonoids, and saponins from corn by-products by searching for suitable extraction methods; Studying the antioxidant and anti allergic activities of functional ingredients can provide basic materials for pharmaceutical research and the development of health functional foods. Using corn by-products as raw materials to form a series of food products, such as corn whisker flavored tea drinks, corn stem new drinks, and corn fiber oil health foods, to increase the added value of corn by-products. Vigorously developing deep processing of corn by-products, making them have both health and nutritional value, and have good social and economic benefits.

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