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大米抗性淀粉制备工艺优化及特性分析

Preparation technology optimization and characteristic analysis of rice resistance starch

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中文摘要:

宜糖米是新型高直链淀粉的大米品种，具有开发高抗性淀粉（resistant starch，RS）产品的潜力。该文采用响应面分析优化压热法制备宜糖米RS条件，通过碘吸收曲线、红外光谱、平均聚合度、扫描电镜、性质检测分析形成机理。结果表明：最佳制备条件为淀粉质量分数31%、pH值5.8、压热时间50 min（压强0.1 MPa）、冷藏时间15 h，此时RS得率达到20.1%。特性分析表明，宜糖米RS主要是以短直链淀粉为主体，分子量分布比较集中，淀粉颗粒表面为多孔状的结构，使得持水力高于其他常见RS和膳食纤维。研究结果为RS的研究提供技术方法的参考，同时促进宜糖米资源的深度开发利用。

英文摘要:

Abstract: Yitang is a new type rice with high amylose content, which was bred by spaceflight mutation and physical mutation. It has great potential for developing high resistant starch (RS) products. Until recently, most of the studies on the RS preparation have focused on high-amylose corn starch or root vegetables starch. In addition, there is a greater difference between rice starch and other kinds of starch in particle characteristics, composition, etc. The production processes of RS cannot simply be deduced from previous reports. In order to make use of Yitang rice rationally, this article focuses on the production processes of RS as a functional food ingredient. The production processes of Yitang Rice RS were optimized through a Box-Benhnken center-united experiment design and Response Surface Methodology (RSM), based on single-factor experiments of moisture content (starch concentration), pH value, autoclaving treatment temperature, cooling method, cold storage time, drying temperature, and the number of autoclaving treatments. RS characteristics analysis was discussed by assistant analyses of absorption curves of starch and I2-KI compound, infrared spectroscopy, average polymerization degree, scanning electron microscopy, solubility, and water-holding capacity. The results showed that the most influential process factors were moisture content (starch concentration), pH, autoclaving treatment time, and cold storage time. The optimum conditions were a starch concentration of 31%, pH value 5.8, heating time 50 min (under 0.1 MPa, 120℃), natural cooling and cold storage time 15 h, drying temperature 80℃, three autoclaving treatment times, together yielding an RS fraction of 20.1%. The characteristics analysis showed that the "Yitang Rice" RS has ordered crystalline structure which was formed by recrystallizing during starch retrogradation, and the major component of it is short amylose (polymerization degree is 21.43). The characteristics of RS crystal structure which has a narrow molecular-weight distribution and more hydro-keys than native starch are compact and solid. Therefore, its solubility decreased 85.9% as compared to native Yitang rice. However, the RS surface exhibits a multi-pore structure that makes its water-holding capacity higher than other common RS and dietary fiber products such as potatoes RS and corn RS. This research can provide a method for improving the yield of RS from "Yitang Rice" and an explanation of the mechanisms of RS formation, which can promote the wide development and utilization of "Yitang Rice" resources.

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