

普通、甜、糯玉米果穗不同部位籽粒淀粉理化特性和颗粒分布差异

陆大雷, 郭换粉, 董策, 陆卫平**

扬州大学江苏省作物遗传生理重点实验室 / 农业部长江中下游作物生理生态与栽培重点开放实验室, 江苏扬州 225009

Starch Physicochemical Characteristics and Granule Size Distribution at Apical, Middle and Basal Ear Positions in Normal, Sweet, and Waxy Maize

LU Da-Lei, GUO Huan-Fen, DONG Ce, LU Wei-Ping**

Key Laboratory of Crop Genetics and Physiology of Jiangsu Province / Key Laboratory of Crop Physiology, Ecology and Cultivation in Middle and Lower Reaches of Yangtze River of Ministry of Agriculture, Yangzhou University, Yangzhou 225009, China

摘要

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摘要 以普通玉米、甜玉米和糯玉米为材料,研究了淀粉糊化特性、热力学特性和颗粒分布等在果穗不同部位(基部、中部和顶部)间的变异情况。结果表明,甜玉米淀粉的糊化特征值各项指标均为顶部籽粒较高;普通玉米淀粉的峰值黏度和崩解值亦为顶部籽粒较高,回复值在各部位间无显著差异。糯玉米淀粉崩解值为顶部籽粒最高,峰值黏度和回复值在各部位间相对稳定。甜玉米淀粉转变温度(起始温度、峰值温度和终值温度)均为基部籽粒较高,而普通玉米在各部位间差异较小,糯玉米以中部籽粒较高,热焓值在3个类型玉米各部位间变化不一。淀粉颗粒体积均呈双峰分布,>17 μm的体积比例以顶部籽粒最低,中部籽粒最高,<17 μm的体积比例以顶部籽粒最高,中部籽粒最低。碘结合力在糯玉米不同部位间差异较小,而甜玉米和普通玉米以顶部籽粒最低。相关分析表明,淀粉颗粒体积分布和碘结合力等指标与糊化和热力学特征值存在一定的相关关系,表明果穗不同部位淀粉糊化和热力学特性的差异主要由颗粒分布及淀粉链长分布变化所致。

关键词: 玉米淀粉 糊化特性 热力学特性 果穗部位 粒度分布 碘结合力

Abstract: The starch physicochemical characteristics and granule size distribution at different ear positions (apical, middle, and basal) were studied using normal, sweet, and waxy maize. The results indicated that values of viscosity characteristics for sweet maize starch were higher at apical position. Normal maize starch peak viscosity (PV) and breakdown (BD) were higher at apical position; while setback (SB) was similar for three positions. Waxy maize starch presented the highest BD at apical position; while PV and SB were similar for three positions. The transition temperature (onset-, peak-, and conclusion temperatures) was higher at basal position for sweet maize, similar among three positions for normal maize, and higher at middle position for waxy maize. The change tendency for the enthalpy of gelatinization among three ear positions was different for three types of maize. Starch granule volume distribution frequency showed a typical two-peak curve. The percentage for starch granule diameter higher than 17 μm was the lowest at apical position and the highest at middle position. Iodine binding capacity was similar among three positions for waxy maize, whereas it was the lowest at apical position for sweet and normal maize. Correlations of starch granule volume distribution and iodine binding capacity with pasting and thermal characteristics indicated that the differences for pasting and thermal characteristics among different ear positions were resulted from the differences for starch granule size distribution and chain-length.

Keywords: Maize starch Pasting property Thermal property Ear position Granule size distribution Iodine binding capacity

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Corresponding Authors: 陆卫平, E-mail: wplu@yzu.edu.cn, Tel: 0514-87979377

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