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1 **Effect of Retrogradation Time on Preparation and Characterization**
2 **of Proso Millet Starch Nanoparticles**

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9 **Abstract**

10 Starch nanoparticles were prepared from proso millet starch using a green and facile method
11 combined with enzymolysis and recrystallization. Scanning electron microscopy (SEM), X-ray
12 diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), differential scanning
13 calorimeter (DSC) and thermal gravimetric analysis (TGA) were used to characterize the
14 morphology and crystal structure of the starch nanoparticles prepared with different retrogradation
15 time (0.5, 4, 12, and 24 h). The results showed that the sizes of the starch nanoparticles were
16 between 20 nm and 100 nm. The crystal pattern changed from A-type (native starch) to B-type
17 (nanoparticles), and the relative crystallinity of the nanoparticles increased obviously, as compared
18 with the native starch. The nanoparticles prepared with the 12 h retrogradation time had the
19 highest degree of crystallinity (47.04%). Compared to conventional acid hydrolysis to make starch
20 nanoparticles, the present approach has the advantage of being quite rapid and presenting a higher
21 yield (about 55%).

22 **Keywords:** proso millet starch, starch nanoparticles, debranching, recrystallized, retrogradation

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