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Structural and thermal properties of nanofibrillated whey protein isolate in the glassy state

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11 **Abstract**

12 Structural and thermal properties of freeze dried nanofibrillated whey protein at different
13 concentrations were studied in the glassy state. By increasing protein concentration to 5.5 g/100
14 mL, the formation of nanofibrils rose significantly, monitored by thioflavin T fluorescence.
15 Atomic force microscopy images showed the formation of nanofibrils and their growth as a
16 function of protein concentration. Studying the molecular morphology of the freeze dried
17 nanofibrills, using X-ray diffraction showed that fibrillated whey protein have a semi crystalline
18 structure. The extent of crystalline part increased with increasing protein concentration. Thermal
19 properties of the proteins were monitored by differential scanning calorimetry (DSC). The results
20 showed that both native globular and nanofibrillated proteins were in the glassy state at room
21 temperature and underwent a glass to rubber transition over heating in DSC. The glass transition
22 temperature of the amorphous parts was found to increase when the fibril concentration
23 increased, which can be concluded that the mobility of the amorphous parts was restricted at
24 higher fibril concentrations. Protein solubility dropped by protein fibrillization, and the

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