Monitoring the change in particle size of dried egg-pasta due to different grinding parameters by diffuse reflection near-infrared spectroscopic techniques

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The pandemic has boosted demand for durable foods such as dried egg-pasta. Due to the increased production capacity, continuous QA/QC is an important task, in which near-infrared (NIR) spectroscopy, as a rapid test methods, plays an important role. Because the shape of dried egg-pasta (e.g., penne, farfalle, fusilli, etc.) has a significant influence on egg content calibrations developed for NIR spectra, it is necessary to prepare the sample by grinding (De Girolamo et al., 2020). Because different grinders (e.g., hammer mills, disc mills) are used in different laboratories, the question rightly arises as to how differences in particle size profile due to different milling techniques and settings affect the proprtion of light scattering (Dahm and Dahm, 2004), and as a result, predicted constituent values based on NIR spectra.

During our work, commercially available 1, 4 and 8 eggs per kg dry pasta samples were ground with two hammer mills (Konzum Trade KT100 and Perten LM 120) and one disc mill (Perten LM 3610). The ground samples were scanned using three different instruments parallel to collecting the reflection spectra: the dispersive NIRSystems 6500 monochromator system fitted with Rapid Content Analyzer (400-2498@2 nm, Si and PbS detectors) and the diode array Perten DA 7250 and Perten DA 7440 spectrometers (950-1650@2 and @5 nm, respectively, InGaAs detector array). Retsch AS 200 basic sieve shaker with analytical sieves was used to determine the particle size distribution.

Cluster analyses (CA) were performed to highlight the changes due to different parameters (egg content, mill). Based on these, 1) not only mills, but also degree of egg content can result in different particle sizes; 2) the mathematical treatments (normalizations, derivatives, etc.) and their combinations and sequences of application are able to eliminate the effects of light scattering to different degrees; 3) the optical differences between DA-based desktop and on-line devices are not significant, so calibration transfer is feasible.

**Keywords:** dried egg-pasta, particle size distribution, scattering, on-line NIR sensor

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