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ORIGINAL ARTICLE

Assaying Total Carotenoids in Flours of Corn and Sweetpotato by Laser Photoacoustic Spectroscopy

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Abstract This study describes the application of the laser photoacoustic spectroscopy (PAS) for quantification of total carotenoids (TC) in corn flours and sweetpotato flours. Overall, thirty-three different corn flours and nine sweetpotato flours were investigated. All PAS measurements were performed at room temperature using 488-nm argon laser radiation for excitation and mechanical modulation of 9 and 30 Hz. The measurements were repeated within a run and within several days or months. The UV–Vis spectrophotometry was used as the reference method. The concentration range that allows for the reliable analysis of TC spans a region from 1 to 40 mg kg^{-1} for corn flours and from 9 to 40 mg kg^{-1} for sweetpotato flours. In the case of sweetpotato flours, the quantification may extend even to 240 mg kg^{-1} TC. The estimated detection limit values for TC in corn and sweetpotato flours were 0.1 and 0.3 mg kg^{-1}, respectively. The computed repeatability (n=3–12) and intermediate precision (n=6–28) RSD values at 9 and 30 Hz are comparable: 0.1–17.1% and 5.3–14.7% for corn flours as compared with 1.4–9.1% and 4.2–23.0% for sweetpotato flours. Our results show that PAS can be successfully used as a new analytical tool to simply and rapidly screen the flours for their nutritional potential based on the total carotenoid concentration.

Keywords Photoacoustic spectroscopy (PAS) · Total carotenoids assay · Corn flours · Sweetpotato flours

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Introduction

Photoacoustic spectroscopy (PAS) relies on the indirect measurement of absorbance in the optically thin, as well as in the opaque and light scattering media. This makes PAS a unique method in the comparison with conventional spectroscopy where the specimen's transparency is an absolute necessity. In addition, PAS is simple to use, requires only a small quantity of sample for analysis, involves a minimum of preparation (samples are studied just as they are), and is also less susceptible to the reflectance and morphology of the sample.