National Institute of Technology Rourkela

Progress Seminar

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| Seminar Title | : Development of a process for improving functionality of little millet flour using Cold Plasma |
| Speaker | : Jaddu Samuel ( Rollno : 521fp6001) |
| Supervisor | : Prof. Rama Chandra Pradhan |
| Venue | : Department of Food Process Engineering (CH-113) |
| Date and Time | : 10 Sep 2024 (03:00 PM) |
| Abstract | : This study investigates the effects of multipin electrical discharge atmospheric cold plasma treatment on the functional properties of little millet flour for value addition. Little millet flour (LMF) was treated at powers of 10 and 20 kV with exposure times of 10, 20, and 30 minutes. Functional properties such as water and oil absorption capacity, swelling capacity, and solubility index were enhanced significantly ($p<0.05$) by plasma treatment from 1.34 &ndash 1.51 g/g, 1.10 &ndash 1.35 g/g, 2.92 &ndash 4.23 g/g and 0.054 &ndash 0.085 g/g respectively, while physical properties such as bulk density, dispersibility remained unchanged and not significant. Microstructural analysis showed starch granule breakdown, and X-ray diffraction indicated decreased crystallinity from 47.98 % to 43.97% due to starch depolymerization by reactive oxygen and nitrogen species. Rheological studies using varying voltages (10 &ndash 20 kV) and durations (10, 20 & 30 min) demonstrated that plasma-treated LMF exhibited improved storage and loss moduli and pseudoplastic behavior, fitting the Herschel-Bulkley model with an $R^2 > 0.99$. Comparison studies such as functional rheological properties conducted between direct plasma and plasma activated water treatment. Enhanced functional properties such as water absorption capacity, solubility index, and emulsification stability were observed, particularly in samples treated with direct plasma at 15 kV for 30 minutes. Plasma treatment also increased significantly ($p<0.05$) total phenolic content and antioxidant activity from 527.54 ± 8.94 to 575.82 ± 3.58 mg gallic acid equivalent (GAE)/100 g, 14.39±0.77 to 22.94±1.84 %. On other hand, anti-nutritional factors like tannins and saponins from 226.96±27.54 to 135.65±2.90 mg tannic acid/100 g of d.m and 454.33±50.75 to 190.15±35.82 mg diosgenin/100 g of d.m were reduced and significantly differed at $p<0.05$. Between nutritional composition, increase in protein and carbohydrate while fat and moisture was decreased upon plasma treatment. Pasta was made from using incorporation of 10% and 20% little millet flour with and without plasma treatment. Physical properties of pasta samples were measured. Bulk and tapped densities were unchanged with plasma treatment. Optimal cooking time (OCT) was increased with incorporation of millet flour, but in comparison with plasma treatment, OCT was decreased with plasma effect. Instrumental analysis such as infrared spectra, diffractograms, thermographs and micrographs were analyzed. |