A Fermentative Approach to Ameliorating Solid Waste Challenges within Food and Hospitality Industry

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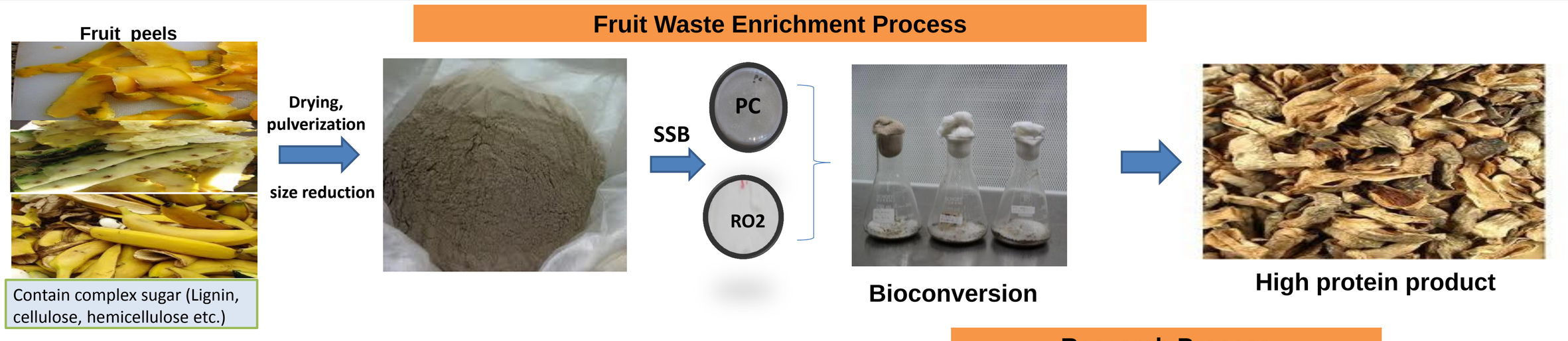
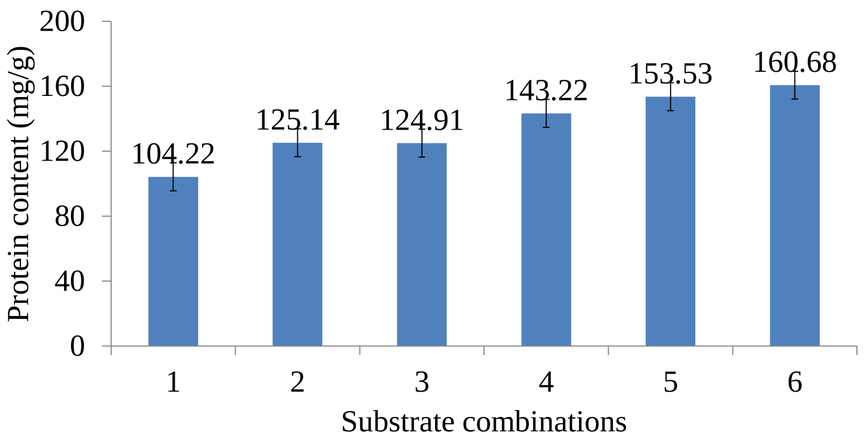
Abstract: Solid wastes emanating from food and hospitality domains constitute environmental challenges and their holistic management remained inevitable. Solid state bioconversion process involving mixed culture of microbes was conducted for 7 days. Bio-product synthesis by the microorganisms and bio-degradation extent of fruit peels' components were analyzed for chemical and structural changes. Chemical analysis showed improved protein enrichment when microbes were mixed together at different ratios (141.18 mg/g) compared with 4 cm apart (115.62 mg/g). Through substrate reformulation, fermentable sugar composition rose to 500.99 mg/g and protein enrichment increased to 160.68 mg/g, cellulase activity was 1.33±0.04 units/ml and α-amylase activity of 112.46±0.28 units/ml was synthesized. Analysis of reformulated substrates indicated presence of more metabolizable sugar while FT-IR analysis revealed immense modifications and consumption of complex sugars (cellulose, hemicellulose and lignin) by selected filamentous fungi.

Fruit Waste Enrichment Process

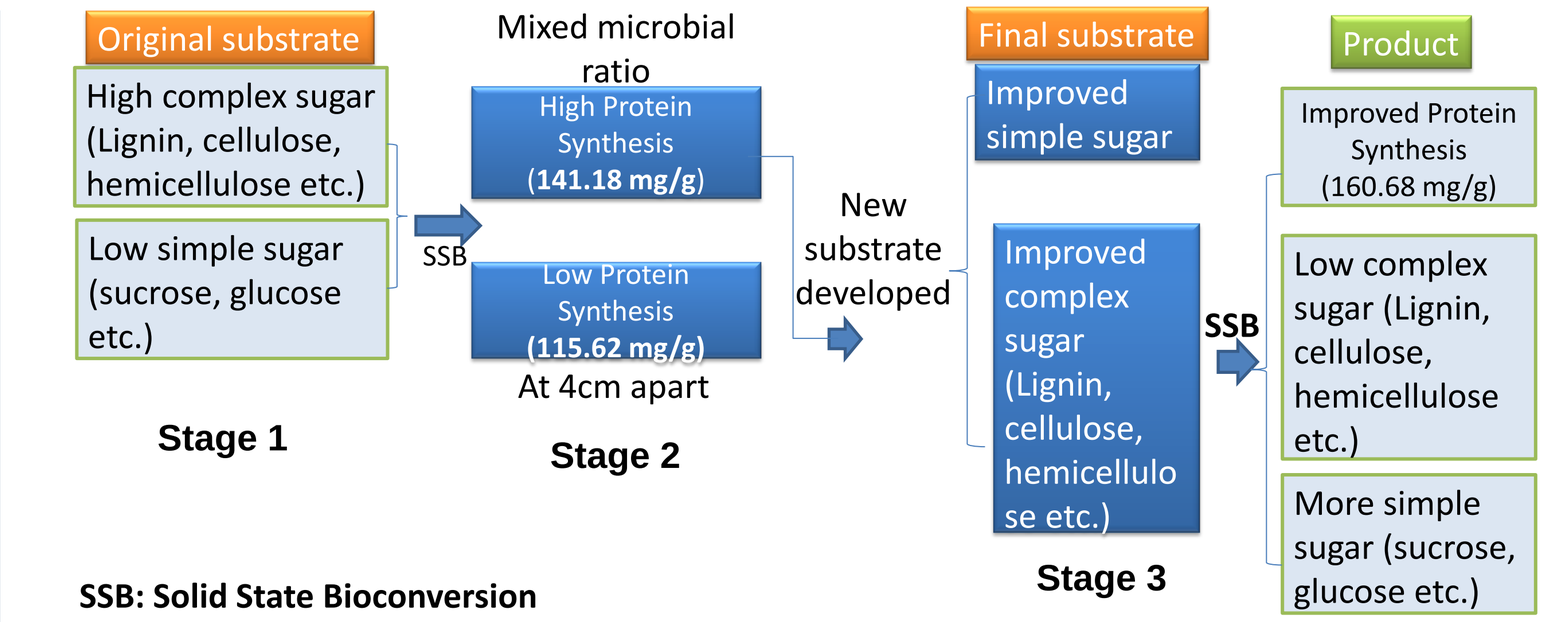


Research Process

Research Findings (Chemical changes at each stage)



Protein synthesis of mixed culture of fungi at different ratios

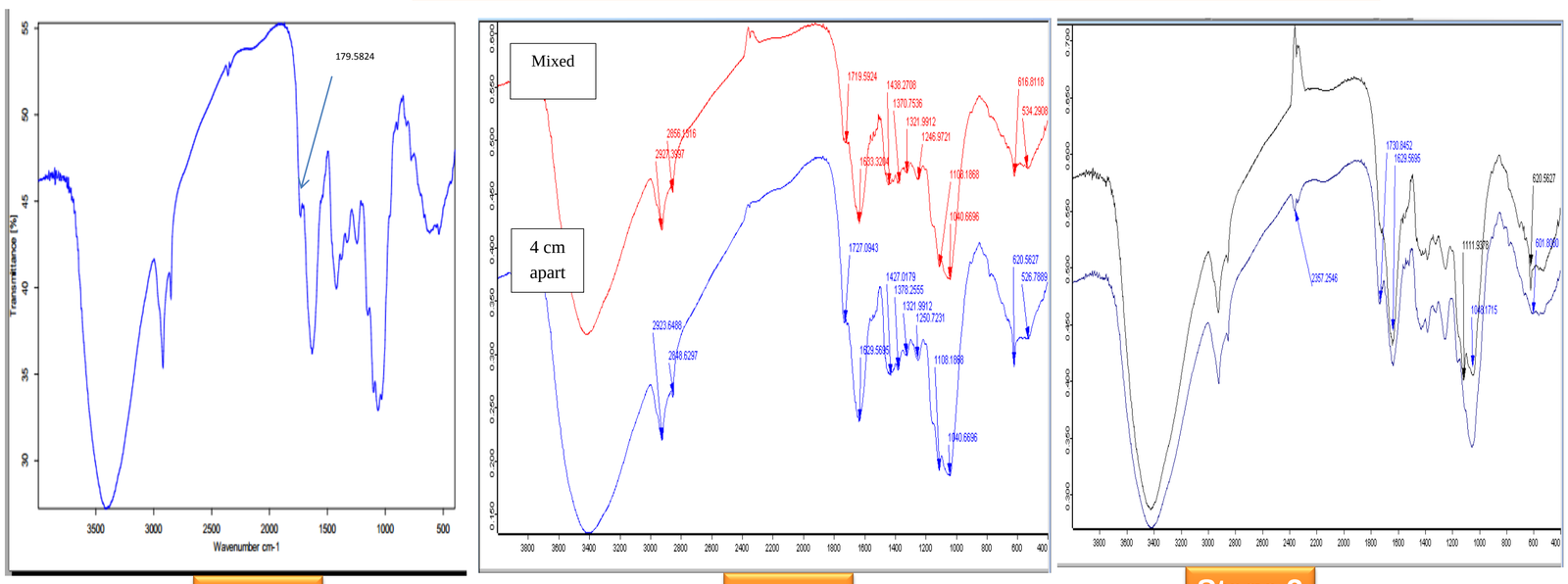


SSB: Solid State Bioconversion

Enzyme activities and residual bio-products concentration after bioconversion

Experimental run	Amylase (units/ml)	Cellulase (units/ml)	Reducing sugar (mg/g)	Soluble sugar (mg/g)	Carbohydrate (mg/g)
1	110.66±0.16	1.33±0.04	11.04±0.03	0.83±0.00	10.73±0.18
2	110.19±0.80	1.34±0.05	11.00±0.10	0.74±0.02	10.78±0.20
3	109.88±0.58	1.25±0.01	11.03±0.20	0.86±0.01	10.85±0.14
4	110.08±0.49	0.78±0.02	11.09±0.02	0.85±0.03	10.94±0.05
5	112.46±0.28	1.25±0.00	11.22±0.2	0.81±0.02	10.89±0.05
6	111.02±0.24	1.32±0.01	11.15±0.02	0.80±0.02	10.92±0.00

Research Findings (Chemical changes at each stage)



Spectra of lignin, cellulose and hemicellulose are visible

Absence of serrated spectra at 1438-1633 cm^{-1} and 1108-1250 cm^{-1}

- New peak 1111 cm^{-1} (C-O stretch vibration) signal presence of sucrose and glucose.
- Modification of complex sugars by C–H deformation of syringyl units

Product marketability

- ❑ Halal Animal feed ingredient
- ❑ Food industries
- ❑ Animal feed producers
- ❑ Solid waste management industries

Conclusions

- ❑ Fruit wastes supported Microbial growth Efficiently
- ❑ Fruit wastes are valuable substrates for improved animal feed production