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Evaluation of the feasibility of a process leading to the production of protein – rich functional vegetable sauce enriched with bio-carotenoids using SuperProDesign

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Three different types of novel functional vegetable based sauces enriched with bio-colorants and miso like products of Greek origin produced, their antioxidant capacity evaluated, while the best functional sauce regarding its nutritional value evaluated for its economic feasibility. The highest total carotenoid content of $267,56 \pm 0,14$ mg/100g, phenolic content of $320,346 \pm 0,25$, antioxidant capacity of $9,21 \pm ,72$ mmol $\text{Fe}_2\text{SO}_4/\text{mL}$ and protein content of $16,32 \pm 0,13$ mg/100g, measured to novel functional sauce produced as follows: 100 g of solid material (50% cereal milling by-products at a ratio 2:1:1 mavgani, wheat and corn by-product streams mixed with 50% chickpeas of third sorting) inoculated with 0.05 % (w/w) *A. oryzae* spores and incubated for 48 h at 28°C. Fermented mass were mixed with water so as to achieve final 15% humidity of the medium. The mixture was left at 4°C, the initial 10 days of bioprocessing. Then the miso product mixed with salt solution, so as to achieve a final concentration at the end product of 15% w/v salt solution and the temperature increased to 35°C, until the 30 day of the fermentation. The salt solution contained 15g NaCl while the rest 85 ml consisted of water ethanol extracts (mixture containing 30% carrot, 30% orange, 20% apple, 10% banana, 5% kiwi fruit by-product extracts, while extraction took place under optimized conditions, using ethanol: water (60:40%, v/v) solvent, extraction took place at 50°C for 140 min, under 250W Ultrasound power with initial solid to liquid concentration of 0.05mg/mL. Process design and techno-economic evaluation of the whole process took place using SuperProDesigner (Intelligen, Inc). The analyzed techno-economic evaluation elaborated and developed for the production plant of the aforementioned novel functional sauce production plant with a capacity to produce 44 tons/year. From the obtained results the unit production cost of one 1.5gr jar of Greek miso like product with highest total protein, carotenoid, phenolic as well as protein content was \$10; the total capital investment required to build up the plant was \$ 1.102. 000; the total amount of 1.5gr jars to obtain was 30 620 jars/yr, the ROI value was 11.93 %, the project payback time was 5.70 years, while the NPV and IRR values obtained were \$ 416 000 and 2.13%, respectively. All that results indicate that the development of a Greek miso like plant project is feasible to implement both from the technical and economical points of view.

Keywords: total production costs, novel functional foods, miso like products, protein, antioxidants, carotenoids, SuperProDesign.

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Biography:

Dimou Charalampia is currently working as researcher at the University of the Aegean at the department of Food Science and Nutrition (Lemnos island). She completed her Masters on 2006 & 2010 and received her PhD on 2016 from the Agricultural University of Athens. She then worked as post-doctoral researcher and served as lecturer at the University of the Aegean. Dr. Dimou Charalampia has authored publications in various journals and books. Her publications reflect her research interests in Food Science and Technology, Bioprocessing and Nutrition. Dr. Dimou Charalampia is currently in charge (scientific director) of ongoing project entitled "Valorization of agro-industrial by-product streams from Aegean for the production of carotenoids, proteins and novel functional foods" BIO-CAPROF - founded from General Secretariat for Research and Technology (GSRT) and Hellenic Foundation for Research and Innovation (HFRI) under grant agreement No. 2342.

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