

Microbiological and Chemical Composition of Animal Feed Produced from Cheese Whey and Vegetable Residues Following Thermal Drying Rate

¹D. Chochlakis, ¹A. Xylouri, ¹M. Pitsaki, ¹V. Sandalakis, ¹N. Thalassinaki, ²F. Galliou, ²N. Papastefanakis, ²E. Stathopoulou, ²G. Daskalakis, ²N. Markakis, ²C. Bouki, ²M. Sabathianakis, ¹A. Psaroulaki and ²T. Manios

¹*Unit of Food, Water and Environmental Microbiology, Laboratory of Clinical Microbiology and Microbial Pathogenesis, School of Medicine, University of Crete, Heraklion, 71110, Greece*

²*Laboratory of Natural Resources, Management & Agricultural Engineering. Department of Agriculture. School of Agricultural Science. Hellenic Mediterranean University. Heraklion, 71410, Crete, Greece*

Abstract

The BEATLE project investigates the possibility of utilization of whey and green waste from supermarkets, in order to produce high added value products, such as feed and high quality compost. Within this survey, vegetable wastes were mixed with whey [30% (v/v)] and then were thermal dried in three different temperatures (35 °C, 45 °C and 55 °C). The product raised from this procedure was evaluated for specific microbiological parameters. For the microbiological analysis, the collected products were homogenized using suitable pre-enrichment substrates. The samples were tested for *E. coli*, *E. coli* O157:H7, *E. coli* STEC, *L. monocytogenes*, *Salmonella spp.*, *S. aureus*, total coliforms and Total mesophilic Count (TMC) following the corresponding ISO methodologies. The presence of metals (Fe, Cd, Pb, etc.) was tested by flame atomic absorption spectrometry; the amount of total aflatoxins and ochratoxins was determined by competitive ELISA; the concentrations of F- and of Hg were determined by UV-VIS spectrometer. A total of 39 samples were tested. As regards the effect of heat drying of the initial samples, it seems that for *L. monocytogenes*, *S. aureus* and *Salmonella spp.* the process results in the removal of these two pathogens from the final product. Increased counts of total coliforms were observed either in fresh products (before the drying process) or in vegetable residues mixed with whey which were dried at the lowest possible temperature (35 °C). The concentration values of heavy metals Pb and Cd were low (0.8-10.4 mg/kg and 0.01-0.03 mg/kg respectively) however, high values of mercury (3.8- 16.0 mg/kg) were observed. The amount of total ochratoxin and total aflatoxin were well below the permissible limits of the European legislation except for one sample. Drying temperature of the fresh products seems to play a crucial role since TMC was preserved at tolerable

levels at 55 °C while drying at 45 °C increased TMC by 1-2 logarithms and drying at 35 °C resulted in a 4-5 logarithmic increase. No *L. monocytogenes* or *Salmonella spp.* were recorded at the final products. The concentration of heavy metals, ochratoxin and aflatoxin was not affected by any of the conditions of preservation and/or drying. The varied values are probably linked to the heterogeneity of the vegetable residues used for the feed produce that depends at the time of collection.

Keywords: vegetable residues, thermal drying, animal feed, cheese whey

Acknowledgments: This research is funded by the Business Program Crete 2014 - 2020 and co-funded by the European Regional Development Fund in the framework of "Strengthening the competitiveness, innovation and entrepreneurship of Crete", Action 1.b.1: Demonstration - experimental development projects. The above promotes research and innovation in areas of RIS3Crete (Regional Innovation System of Crete). Project BEATLE (MIS 5029193): Innovative Low Cost Processes for the Production of animal feed or Soil Improvement by whey and Hypermarket Vegetable Residues.