Optimization of infrared drying process of solid residues remained after essential oil distillation of salvia, melissa and satureja

SKENDI A. (1,2), IRAKLI M. (1), BOULOUMPASI E. (1), CHATZOPOULOU P. (1)
1 Hellenic Agricultural Organization Dimitra, Institute of Plant Breeding and Genetic Resources, Thessaloniki, Greece
2 International Hellenic University, Department of Food Science and Technology, Thessaloniki, Greece

The utilization of solid plant residues (SPR) remaining after extraction of essential oil from aromatic plants represents an attractive solution that helps the essential oil industry to reduce waste and increase earnings. Utilization of SPR from these plants to obtain rich phenolic extracts (PE) presupposes a proper drying process. Infrared radiation (IR) heating is considered an attractive drying process since it allows uniform heating and high quality of the final product. The current research focuses on the optimization of the IR conditions for drying salvia, melissa and satureja solid residues (SR) obtained after the extraction of essential oil.
A response surface methodology (RSM) that consisted of a two-level full factorial central composite design (CCD) (?=1,414, 5 center points, total 13 runs) and was used to optimize drying time (X1, 20–60 min) and drying temperature (X2, 40–60°C) of IR process. The responses for each plant (salvia, melissa and satureja) were moisture content (%), total phenolic (TPC) and flavonoid content (TFC), DPPH (2,2-diphenyl-1-picrylhydrazyl), and ABTS (2'-azino-bis-3-ethylbenzthiazoline-6-sulphonic acid) tests. The minimization of moisture content and maximization of the values of the other parameters was set as the goal of optimization. Moreover, the moisture content was constrained to be less than 10% in order to keep the SR safe from microbial/fungal contamination.
The equations resulting from the analysis of response surface design showed to predict more than 76% of the variation. The optimized conditions were 11.7 min at 46.7°C for salvia, 11.7 min at 42.4°C for melissa and 11.7 min at 41.9°C for satureja SR giving overall desirability of 0.93, 0.87 and 0.78, respectively. Among the three plant SR, highest temperature was applied to salvia in order to achieve a decrease of the moisture to less than 10% without decreasing the content of phenolics and antioxidant potential followed by melissa and satureja. The results obtained revealed that optimization of the IR drying process assured safe storage, preserved phenolic content and at the same time ensured a low environmental impact due to rapid and cheap approach, suggesting perspective for its use in industrial scale.