

HOW THE DESIGN OF EXPERIMENTS (DOE) CAN REDUCE THE SYSTEMATIC AND RANDOM SOURCES OF VARIATION DURING THE EXTRACTION OF LABILE BIOACTIVE CONSTITUENTS.

Mantzouridou F.

Aristotle University of Thessaloniki, School of Chemistry, Laboratory of Food Chemistry and Technology, 54124, Thessaloniki (Greece) – fmantz@chem.auth.gr

Experimentation in academia and industry is widely used to obtain a better understanding of existing or new processes/ products, but is very expensive. The Design of Experiments (DoE) approach makes available well established experimental designs to plan, conduct and analyze a systematic series of trials, in which the experimenter deliberately changes the input factors to observe the significant changes in the output responses. In this way, cause-and-effect relationships can be extracted in an efficient and cost effective way [1]. A response of a process, for example, the extraction yield of a labile bioactive constituent, may be highly dependent, apart from the potential design factors, on nuisance factors classified as controllable, uncontrollable (but measurable) and noise factors that are all sources of experimental error. The confusing effects of the random error and the elimination of systematic bias can be greatly reduced by finding the appropriate settings of the experimental design and applying adequate statistical analysis [1, 2]. The main objective of this work is to discuss the principles of DOE - replication, blocking, randomization, analysis of covariance and process robustness studies - that are employed to identify and quantify the sources of errors and decrease their impact to a large extent. Characteristic DOE application examples to extract labile bioactive constituents from natural sources are presented to illustrate how DOE can ensure the validity and reliability of measurements.

References: [1] Montgomery, Douglas C. (2012). *Design and Analysis of Experiments* (8 ed.). Hoboken, NJ: Wiley. [2] Box, George E. P., Hunter, J. Stuart, & Hunter, William G. (2005). *Statistics for Experimenters: Design, Innovation, and Discovery* (2 ed.). Hoboken, NJ: Wiley.