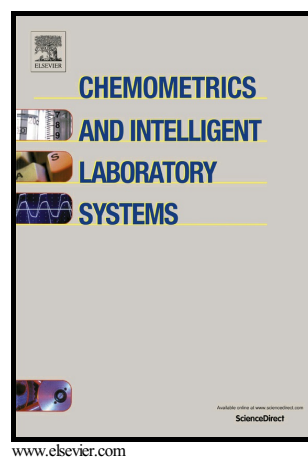


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A useful tool for computation and interpretation of trading-off solutions through pareto-optimal front in the field of experimental designs for mixtures

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Abstract

An algorithmic implementation is presented to deal with several responses in mixtures problems, without theoretical limits on the number of responses or on the factors to be blended. Also, constrained and unconstrained domains are handled, as well as domains with both mixtures and discrete variables. Besides, an alternative way of interpreting the results coming from the experimental design for mixtures is presented. It is based on the parallel coordinates plots for visualization in more than the usual three-dimensional Cartesian diagrams or the simplex mixture spaces for at most four experimental factors.

Specifically, this is done in cases in which more than one experimental response should be handled, tackling the conflict by estimating trading-off solutions via the computation of the pareto-optimal front, which is fully explored with the parallel coordinates plots.

The procedure is shown by two case-studies, taken from the literature. The first one deals with several factors in a constrained experimental domain when trying to optimize a detergent by taking into account two severely conflicting characteristics. The second one is about five chemical components blended with different dosage levels for getting a concrete strong enough, experimental results that are re-evaluated by posing a unique blocked design for analysing the data.

The joint use of the pareto-optimal front for mixtures designs and the parallel coordinates plots for its visualization provide the researcher a deeper understanding of the problem under study to make accurate decisions.

Keywords

mixtures design; Scheffé designs; pareto optimal front; genetic algorithm; parallel coordinates plot

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