Fast-track product and process

design

By Anny Dentener

You have finally secured that brilliant recipe from a website, a friendly chef, or maybe after a rainy Sunday afternoon exploring the cookbook section of Borders in Auckland, which at last count had 2,745 titles. But how do you now translate that into a food product that can be produced commercially?

First you probably want to contact your friendly suppliers to get the right selection of locally available ingredients, technical information and samples to try. The web still is only of limited use. Trying out numerous ingredient supplier websites listed in a recent international food ingredients magazine shows that most offer only glorified brochures, and only a few went beyond that. However most sites, such as www.germantwn.com, allow queries, which I recently found helpful for an overseas project. An ingredient supplier database with 7,500 trade name links is available at www.ingrid.co.uk with a free trial period.

Having sourced your materials, should you now approach the development in the "change One Factor At a Time" way, or more systematically? That may depend a lot on the complexity of the product. If the processing is not that involved and there are few interactions between ingredients and the processing (e.g. a simple flavour and ingredient combination), development flair and product knowledge, and the trial and error "bucket chemistry" approach may be all that is needed.

However in the 10-20% of projects where more complex product and process combinations come into play, I strongly

suggest the use of Design (and analysis) Of Experiment (DOE) software to get to the best result faster, and to end up with a cost effective and reliable product. Remember that product/manufacturing problems often have their origin in poor design. Products need to be sturdy and work all year round with everyday variability in raw materials and process. Find that "sweet spot" that best meets all your objectives at a cost you are willing to pay. I have also found that with the use of software, I have become more daring, explored wider and found the best solutions with unexpected combinations of ingredients and process. When using "trial and error" our natural instinct is to play it safe with small changes of about 10-25% to see whether that will improve the product. With DOE software it becomes safe to explore 50-100% changes, and this is often required to find a significant change above the "noise" of natural variation. The beauty of DOE software is that it designed for industrial use and speed, and that a limited number of selected points can get you the full picture on what makes your product or process "tick". No need to test all possibly combinations of factors.

Many people hold back from using experimental design due to a reluctance to use statistics. Fortunately several packages these days cater for the "statistically innocent", and have a user-friendly interface. The assumption that you don't need DOE because your prototypes only need minor fine-tuning is also often wrong. It is the old Pareto saying that 20% of the effort gets you there 80% of the way. In practice, that last 20% will require 4 times

as much effort. This is often difficult to explain to non-technologists, once they have seen that "promising" prototype product. It is essential to put your prototype knowledge into an experimental design to get through this stage, to save time and to get the product into the market faster. Note that DOE is also useful when product improvement, cost reduction, copying or process optimisation are needed.

So where can you find DOE software? The New England Biometrics site (www.nebiometrics.com) has 17 links to software suppliers. DOE is often made available as part of "standard" statistics packages (e.g. Minitab: www.minitab.com) or they can be an add-on, for instance with JMP Software (SAS: www.sas.com) and Statistica (Statsoft: www.statsoft.com). Download Statsoft's *Electronic Statistics Textbook* for useful reference. Examples of tailor-made DOE software are *Design Expert 6 f*rom Stat-Ease (www.statease.com), *ECHIP* from ECHIP Inc (www.echip.com) and *D.o.E. FUSION* from S-Matrix Corp (www.s-matrix-corp.com). Camo (www.camo.no) has *Guideline* and *Unscrambler*, and Umetrics (www.umetrics.com) offers *Modde*. These packages vary considerably in features, and consequently may cost from US$129 for a starter package, to US$5,700 for a completely guided system. Expect to pay in the US$1,000-$1,500 range for a professional all-round package. This pays for itself quickly with the gains made.

What features should you expect from a package to successfully develop food products? First of all it needs to be able to work in "real" units such as temperature or concentration (i.e. not the "–1,0,+1" style), so you can relate to it. It needs to be statistically robust, while user friendly and easy to understand. Quick screening designs are essential to find the crucial factors, and to take these to a response surface design which finds the optimum with interacting factors. It needs to have "mixture" design when ingredients need to add up to 100%, with the option of adding usage limits, processing and ingredient variables.

In terms of trial results it should not only handle measurement data but also consumer ratings and acceptability (yes/no) scores. Easy to understand and manipulate graphs are a "must", as are optimisations and predictions of results. For logistics reasons, a DOE package should have a "blocking" function allowing you to spread your trials over time. An ability to deal with missing data from the odd botched trial is always welcome. In addition, the package needs to randomise trials, provide trial sheets and allow for quick entering of calculated results from a spreadsheet. And last but not least it should do it with a manageable number of trials. A tall order? We will see in future columns.

Be daring, explore with the safety net of an experimental design software package. Don't feel intimidated by statistics. Save time and money, reduce frustration and improve quality. Discover that "sweet spot".

Coming up: reviews of individual DOE packages, and comparisons.

Anny Dentener is an independent Food Technology Consultant, and founding FoodInc member (www.foodinc.co.nz/). Contact: anny.dentener@xtra.co.nz.