Open Source Molecular Cuisine

An experimental approach to restoring a degree of freshness and character to a wide range of food products.

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My favorite tapas dish is an extremely simple Catalan classic called pan con tomate*, or "toasted bread with tomatoes"; it is so simple that it is almost impossible to get wrong.*

I have a passion for cooking. Sometimes the concoction might not quite match the inspiration, but that is, at least for the cook, part of the fun. In any case, my family has a fortunate and frequently demonstrated capacity to bring me back to earth. The questions from my wife—"What exactly were you trying to make?"—and, even worse, from my kids—"Can we please order in pizza instead?"—certainly serve to ground my overblown culinary ambitions in bitter reality. In that type of cooking environment, one can imagine the unique combination of culinary enthusiasm and trepidation I faced a couple of years ago when my old friend and famous MIT technological innovation guru, Eric von Hippel, came to stay with us.

Eric's visit and two very enjoyable family trips to Spain reignited our already considerable enthusiasm for tapas. We purchased several tapas recipe books, which were fine enough, but sadly did not really quite live up to our expectations or our memories of the real thing. We had experimented to improve on the recipe book dishes for a number of dinner parties and were confident that we had a few successes under our belts. Tapas had the additional advantage that if one dish proved to be overly experimental, there would be other dishes from which to choose.

Here is my recipe:

Whole ripe tomatoes	500 g
Garlic, fresh-crushed	1 clove
Lemon juice, freshly squeezed	70 g
Salt	2.5 g
Olive oil, cold-pressed	15 g

Read more about John Wright's insights and applications for damascenone in "Flavor Bites: Damascenone" on Page 14 of the October 2009 issue of *Perfumer & Flavorist* Magazine, as well as "Diethyl Succinate" on Page 22 of the April 2012 issue of *Perfumer & Flavorist* Magazine.

Remove the tomato skins quickly using boiling water. Crush them coarsely and discard the hard tomato cores. Mix the ingredients together and refrigerate. Slice a baguette or similar bread diagonally and toast until very slightly burnt. Finally, coat each slice with the tomato mixture and serve.

I served the tapas for lunch and they were much appreciated. However the one sad exception was my much-prized *pan con tomate*. The recipe had worked well enough but the tomatoes had that disappointing lack of flavor that seems to be the inevitable byproduct of the long and winding road between the field and the supermarket.

Eric has long been the leading champion of user innovation. In Eric's hands, user innovation is a pirate ship set against the complacent navy of the traditional approach to innovation. (Steve Jobs famously declared, "It's better to be a pirate than join the navy.") It is fatally easy, and much more comfortable, to see things from the point of view of the navy. Most of us suffer under the reassuring illusion that progress can only be driven by dedicated R&D departments, inspired and directed by consumer insights that have been generously provided by omniscient marketing departments. This is a reassuringly structured approach but, at best, it only provides a dim view of past consumer preferences. It gives no credible insight into the future and requires considerable interpretation to even begin to understand the past.

Innovating a Better Tomato Flavor

Eric has demonstrated consistently that, in the real world, users themselves are often responsible for innovation because they are uniquely motivated. This might seem to be an obvious truth in the software industry. Many of us are familiar with open-source software that is arguably better written and more functional than the commercial alternatives. Flavor professionals might feel our own industry is unique and so complex that users could not begin to contribute. In reality, the successes of the software industry have been reproduced in almost every other industry. Eric has written several highly successful books on the subject, most recently *Democratizing Innovation*.[1] This intriguing approach is the basis of the famous MIT Innovation Laboratory. To be fair, the pirate ship analogy is only really a half truth. Eric needs to adopt a somewhat piratical approach to challenge deep seated ideas. One has to imagine a pirate ship crewed not by the likes of Jack Sparrow but more by benevolent pirates with a Robin Hood philosophy.

Faced with my plainly inadequate *pan con tomate*, Eric and I sat down to conduct a little user innovation of our own. Our first idea was to simply increase the tomato flavor. The dish was notably lacking in flavor, and the most obvious problem was the way the tomatoes had been handled. They had probably been picked before their flavor had developed properly. Therefore, our first attempts at molecular cuisine consisted of adding several individual major components of tomato flavor, in ppb and ppm quantities, to the mixture. This seemed to be the most logical approach.

We tried 2-isobutylthiazole (FEMA# 3134, CAS# 18640-74-9), 6-methyl hept-5-en-2-one and 3-methyl mercaptopropionaldehyde alone and in combination, but the effects were not impressive. The rawness persisted and the lack of flavor remained painfully evident. As molecular chefs, Eric and I were clearly not on the way to receiving any Michelin stars.

Our next idea was to look at those chemicals that might give a less raw character in tomatoes that had been allowed to ripen naturally on the vine. β-Ionone (FEMA# 4144, CAS# 23267-57-4) and 2-phenylacetaldehyde seemed to fit very well into this category but, once again, the results were disappointing.

When the obvious routes are exhausted, I tend to turn to notes that I personally like individually. After much experimentation, and no small amount of frustration, we finally discovered that the effect we wanted could best be achieved by an unusual combination of a number of distinctly secondary notes, none of which had any element that was recognizably tomato in character:

Maltol 5.0 ppm
β-Damascenone 0.1 ppm
Diethyl succinate 2.0 ppm

Maltol provides a subtle hint of lingering sweetness coupled with a memory-evoking, candy-floss character. β-Damascenone is, at least in my mind, first and foremost the key chemical that differentiates a superb old Gevrey-Chambertin wine from the many lesser vinous offerings that sit unloved on the liquor store shelves. Diethyl succinate (FEMA# 2377, CAS# 123-25-1) has a deceptively subtle fresh, fruity aroma but does seem to add richness and an indefinable mouthwatering taste character to many flavor profiles. The last two chemicals have been the subject of earlier "Flavor Bites" columns, so readers will be well aware of my enthusiasm for them.

Applying Lessons Learned

The problem of the long and winding road for fresh produce is by no means confined to tomatoes. Many fresh fruits exhibit similar problems of rawness and Lilliputian flavor. Encouraged by our success with tomatoes, we tried the same chemicals at the same levels in raspberries, strawberries and apples, with similar success. Clearly this mixture is capable of restoring a degree of attractiveness and character to a wide range of food products that routinely suffer from the long gap between the field and the store.

Eric was more than happy to forgo his not inconsiderable role in this highly practical innovation. Quite frankly, his enthusiasm and ideas were vital. I would have been happy to resolve to only make pan con tomate in the future with local tomatoes in season. Eric encouraged me to try to actually do something about it on the spot. We later had many rather circular conversations on the subject. We wondered, "Should we try to patent it?" and countered, "but surely we would still want to make it freely available." Neither of us were really great enthusiasts for patents. Finally, we came up with a solution entirely in keeping with the Robin Hood pirate ship approach. We came to the conclusion that the best approach should be to write up the discovery in an article and offer it freely in the spirit of open innovation. No sooner said than done.

References

1. E von Hippel, *Democratizing Innovation*, MIT Press, Cambridge, MA (2005)