

Future of frying: Healthier, cleaner and more sustainable oils

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Cold-pressed oils are valued for their natural antioxidants and flavour. However, they can turn rancid quickly when heated, often before you can even serve a dish. In contrast, refined oils can withstand high temperatures but lose much of their nutritional value and contribute significantly to carbon emissions during production.

Austrian startup Lipid Legends GmbH claims to have found a solution that bridges this gap. Led by food chemist Prof. Marc Pignitter from the University of Vienna, the company has developed a patented low-energy, chemical-free process that re-infuses cold-pressed sunflower and rapeseed oils with antioxidants derived from their press cake. This innovative method provides these oils with fry-life and oxidative stability that can match or even exceed those of fully refined oils.

The result offers cleaner ingredient labels for chefs, extended shelf life for retailers, and a significantly lower environmental impact. In an interview with NUFFOODS Spectrum, Prof. Pignitter discusses the science behind this breakthrough, the potential savings for commercial kitchens, and the importance of crowdfunding in scaling a technology that could redefine the concept of "cold-pressed" in both professional and home cooking.

1. What was the initial inspiration behind developing these heat-stable cold-pressed oils? Could you also highlight the key differences between this innovation and the traditional refined oils commonly used in commercial kitchens?

The inspiration came from a rather pragmatic observation we made with reference to both in-home and in commercial kitchens; cold pressed oils are often admired for their natural aspects and health benefits, however, when cold pressed oils are heated, they deteriorate quite quickly. Conversely, refined oils are more heat stable but significantly lose many of their natural antioxidants and flavours during the refining process and they are produced through energy-intensive processes, which can sometimes even involve the addition of harmful chemicals.

We wanted to develop a cold-pressed oil to try to bridge the gap, providing a cold-pressed oil that retains some natural quality, but can perform better in frying and cooking applications, especially with respect to shelf life and heat stability. The idea was that we could process the oil mechanically by using the most gentle means to keep as many of the oil's bioactive characteristics intact while improving its frying characteristics.

Our oils differ from traditional refined oils in these important ways:

- No chemical refining: no chemical treatments including neutralisation, bleaching, deodorisation, etc.
- Higher oxidative stability: We can utilise our patent-filed processing technique to enrich the oil with natural antioxidants from the press cake, which provides the oil with much better heat stability.
- Lower energy cost: Our process also uses less energy than conventional refining, about five times less per litre of oil, thus being more sustainable.
- Cleaner label: Given that we do not use any additives or chemical steps, the oils fit neatly into clean-label product strategies.
- Extended shelf life: Even though we cold-press our oils, they may even outperform refined oils, since they remain below regulatory limits for polar compounds, even after multiple fry cycles.

In summary, we combined traditional craftsmanship with scientific optimisation to launch a new category of cold-pressed oils that can, in terms of functionality, truly compete with refined oils—without sacrificing health, taste, or sustainability.

2. Could you elaborate on the scientific breakthrough that allows these oils to remain stable at high temperatures? What specific properties make your cold-pressed oils more resilient compared to conventional products?

The significant innovation is how we utilise the natural antioxidant content of the oils during and after the pressing process. In conventional cold pressing systems, a large part of the valuable compounds (mostly polyphenols and other antioxidants) remain in the press cake, and are essentially "wasted." These compounds are important in protecting oils against oxidation and polymerisation when they are heated.

Our proprietary, patent-filed approach involves a specific re-mixing of oil with finely ground press cake under controlled conditions. This allows the specifically targeted transfer of the natural and non-bitter-tasting antioxidant compounds, like phenolic compounds, back to the oil. We then subject the oil to a low-energy repressing and filtering process (as opposed to industry-standard techniques and processes of high-energy centrifuging or refinery using chemical solvents), into a clear, high-quality oil with improved stability.

What makes these oils more resistant are:

- Higher levels of native polyphenols and secondary metabolites.
- No prooxidant refining residuals, including trace metals and degraded (byproducts) compounds that are typically introduced by chemical refining.

So our outcome is a cold-pressed oil that has a longer time before thermal breakdown and produces less harmful by-products during frying. For example, regular refined oils exceeded Codex limits for polar compounds after several frying sessions, while the optimised cold-pressed oils remain far below those limits, even after prolonged use. Ultimately, we have utilised science-based processing to reveal the hidden potential of cold-pressed oils, without abandoning the oil's identity.

3. From the perspective of catering businesses, what tangible benefits can they anticipate in terms of cost savings, operational efficiency, and sustainability by using these oils?

There are numerous direct benefits for catering operations to use our optimised cold-pressed oils—economically and operationally:

1. Longer fry life = oil savings:

The oil can maintain a 50% higher stability during frying than many refined oils. Reduced oil usage over time; we not only use less oil as our oils are stable over longer periods, it also means less downtime not just for changes but cleaning and replenishing the oil.

2. Less waste; better food quality:

As the condition of the oil remains stable, there is less off-flavour, and fewer degrading elements during service. This results in more consistent food quality and fewer unsellable food outputs. This can be extremely important when a kitchen works with

more fragile/delicate food items.

3. Lower energy inputs in production= lower carbon footprint:

Our oils require about five times less energy to produce than conventional refined oils. This represents a lower overall carbon footprint, which is important for the supply chain when responding to sustainability level reporting, certifications, and E-Tenders with environmentally conscious clients.

4. Clean-Label Ingredient = Marketing Benefit:

Offering high-performance cold-pressed oils gives a caterer the ability to promote a natural, unrefined product; a great asset for clean-label and health-oriented marketing strategies, particularly in the case of premium foodservice, wellness food offerings, or institutional kitchens (e.g. hospitals, schools) where transparency and nutritional quality are significant.

In conclusion, these oils offer long-term cost savings, enhance product quality, and align with sustainability objectives—all of which will not require anticipating large changes to existing processes or equipment.

4. During the development process, how was consumer health and safety prioritised, especially concerning the reduction of harmful by-products such as polar compounds?

One of the main objectives was to reduce the potential for harm caused by the degradation products that oils produce, especially the polar compounds of oils, evolved during extended heating at high temperatures, indicating the oil might even be toxic if it were degraded sufficiently.

To overcome this issue, there were three main strategies that we followed:

1. Enrichment with Natural Antioxidants - By redeploying the natural antioxidants from the presscake back into the oil, we improved the oxidative stability of the oil considerably. These natural antioxidants protect the oil during heating and slow the degradation and the formation of harmful by-products.

2. Not relying on extreme processing - Our process did not use high temperatures, or chemical solvents, including bleaching agents like refined oils and would not leave any residues or pre-oxidised molecules in the oil that would further induce degradation during heating and frying. We also avoided the starting load of pro-oxidants by using natural oil.

3. Rigorous Thermal Testing Under Realistic Conditions:

We conducted standardised frying trials where we measured total polar compounds and other quality markers after repeated frying cycles. In these tests, our oils consistently remained below the 24% threshold set by the Codex Alimentarius for total polar compounds, often staying below 15% even after multiple cycles, while many unoptimized cold-pressed or even refined oils exceeded these limits.

Moreover, we assessed the safety profile of the oils not only during production but also after typical use in commercial kitchens.

In short, the entire process—from ingredient handling to final product testing—was guided by the goal of offering a healthier, more stable oil that helps reduce consumer exposure to thermal degradation by-products.

5. Lipid Legends GmbH previously launched an optimised flaxseed oil. How does the performance and market reception of that product compare with your new sunflower and rapeseed oils?

Our optimised flaxseed oil was our first significant product and represented our proof-of-concept for our patent-filed enrichment and processing technology, primarily for nutritional use — it contains omega-3 fatty acids, but with increased oxidative stability and substantially lower bitterness than normal flaxseed oils which degrade quickly and develop off-flavour.

Overall reception from conscious consumers was favourable and it had a very positive reception from premium product consumers who wanted a plant-based omega-3 source with better shelf life and better sensory profile. However, the general appeal of flaxseed oil is relatively limited, as it is used in a niche way, mostly as an unheated product and less as foodservice or frying.

On the other hand, our new optimised high oleic sunflower and rapeseed oils were developed with commercial kitchens and high-temperature application processes in mind. Not only do they retain most natural antioxidants and flavour profile, but they also possess exceptional thermal stability performance and demonstrate longer thermal frying performance than some refined

oils.

From a market size perspective:

- Increased Use Case: Sunflower and rapeseed oils are used across foodservice and retail and are therefore much more scalable.
- Higher Demand: Chefs, catering operations, and institutional kitchens provided strong feedback as to the oils' frying performance and clean-label characteristics.
- Fit with Operations: The oils fit well in existing workflows with no requirement to change equipment or handling.
- Economic: The production costs of our optimised rapeseed oil are lower than its flaxseed oil counterpart, therefore supporting the maintenance of price market sensitivity.

To summarise, while the optimised flaxseed oil established our scientific and brand foundation, the sunflower and rapeseed oils represent commercial progression, achieving high performance and applicability in wider markets.

6. What role do you envision crowdfunding playing in scaling this innovation, and what are your strategies for introducing these oils to wider commercial and consumer markets?

Crowdfunding has double utility in our model—more than a funding mechanism, it also serves as a significant source of market validation. For an innovation that crosses new boundaries in health, sustainability, and performance, crowdfunding also provides us with a way to engage with early adopters not just as consumers, but as people who ultimately see value in these ideals. This allows us to build a community around our mission, achieve direct, ongoing feedback, and obtain cash to distribute to us as we expand our manufacturing capacity.

There are a few areas where we see crowdfunding as highly beneficial:

1. Raising awareness and education: Cold-pressed oils performing like refined oils is an entirely new category. Initiating a crowdfunding campaign facilitates brand storytelling—where we have a clear opportunity to lay out benefits and reach conscious consumers or chefs searching for clean, functional alternatives.

2. Minimising go-to-market risk: We can establish product-market fit in varied geographies and channels before going to large-scale retail or B2B distribution, testing a small community size and capacity before a full expansion to either platform.

3. Utilising the crowd as ambassadors: Even someone who supports our crowdfunding with a small investment typically becomes an advocate after helping us spread our message to others through word-of-mouth and social media.

In terms of a much broader market strategy, we plan to take a dual-path approach:

1. Commercial Foodservice Sector (B2B):

We are engaging with catering services, gastronomy organisations, and institutional kitchens (schools, hospitals, canteens) that are looking for sustainable, health-oriented products. These clients understand the longer frying life, the value of consistently good-quality food production, and decreased cost of ownership from oil waste and downtime.

2. Premium Consumer Segment (B2C):

We are entering the market with oils for health-conscious, sustainable consumers, through select retail partners, organic stores and online vectors. We will be focused on the story, clarity, and clean-label messaging to differentiate ourselves in a crowded oil market.

Lastly, we are also in discussions for licensing deals and other industry collaborations with food producers and private label producers looking to improve their oil quality in their product line.

In conclusion, crowdfunding enables us to accelerate our innovation early on, and we have a good plan in the commercial foodservice and premium consumer segment, with a built-in path to scale and license through B2B partnerships.

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