# Yeast can develop the next generation of **speciality chemicals**

**Dr John Husnik**, co-CEO and CSO of **Renaissance BioScience**, showcases the potential of a new yeast technology platform

For thousands of years, baker's (or brewer's) yeast has been synonymous with bread, beer and wine. Today, the same organism has become something far bigger: a programmable platform for manufacturing high-value speciality chemicals with improved sustainability, supply reliability, low cost of production and product consistency.

With the right modifications, yeast can tailor-make molecules that are either difficult to extract from plant or animal sources, expensive to synthesise chemically or prone to supply shortages. As a result, this versatile microorganism is often used as a 'biological factory' to produce a wide range of products through fermentation and biotechnology. Beyond traditional food uses, modern engineering tools allow yeast to produce advanced biofuels, pharmaceutical compounds and sustainable materials.

What makes yeast a compelling vessel for producing speciality chemicals is its combination of traits: it is familiar to regulators, robust and cost-effective to produce at scale, and easy to manipulate genetically. These traits make the organism an attractive and sustainable system for reducing our reliance on petroleum-derived chemicals.

Renaissance BioScience is developing a yeast technology platform for three high-value applications:

- Nature-identical aroma and fragrance ingredients
- Peptides for health, wellness, cosmetics and personal care
- Yeast-based RNA interference (RNAi) biopesticides

Flavours, aromas and cosmetics are among the key applications for yeast-based chemicals

## Flavours, aromas & fragrances

Aroma, flavour and fragrance ingredients sit at the intersection of chemistry, consumer preference and supply chain volatility. Many desirable molecules are found in plants at low concentrations, which makes extraction costly and, in some cases, environmentally and economically unsustainable. Yeast offers an elegant alternative: instead of growing enormous tracts of botanical crops and extracting tiny yields, producers can manufacture the nature-identical molecule at industrial scale.

One particularly promising route comes from engineering yeast to produce plant-derived aromatic and bioactive compounds. These ring-structured compounds include high-recognition, high-value scents that serve as a versatile foundation for broader speciality chemical development.

The appeal is straightforward, as fermentation-derived compounds deliver the same sensory attributes for flavours and fragrances but in an environmentally responsible manner that many consumers are now seeking. Importantly, the reach of these natural compounds can extend beyond sensory applications. Other uses include:

- Antioxidants with applications in wellness products and functional formulations
- Natural preservative candidates that help address shelf-life challenges across food categories, an area where clean-label pressures and procurement reliability often clash

- Bioplastics building blocks (more accurately, sub-units and precursors) that can feed into broader materials innovation

For formulators and manufacturers, yeast-based, nature-identical compounds can be positioned as a double-win, with sustainability and procurement in mind. Yeast-based solutions can reduce reliance on environmentally fragile botanical supply chains, limit the waste associated with certain chemical synthesis routes and improve lot-to-lot consistency by tightly controlling the process conditions.

While the term 'bioengineering' sometimes triggers immediate questions about GMOs, the industry reality is more nuanced: in many instances, the yeast-as-production organism is removed during downstream purification, so the final ingredient would contain the nature-identical molecule and be free of yeast. In other words, the yeast acts solely as the manufacturing method, helping companies bridge performance, sustainability and consumer expectations.

## Peptides

If yeast-produced plant-derived aromatic and bioactive compounds showcase yeast as a speciality chemical factory, peptides demonstrate its capability as a precision biomanufacturer for high-value functional molecules. While they are far smaller than a protein, peptides can deliver specific biological or functional effects, which is why they are increasingly sought after across personal care, wellness and adjacent sectors.

In the personal care world, peptides with anti-ageing, skin appearance, hair and scalp support and other performance cosmetic claims are already associated with premium positioning. Demand is rising but production can be challenging. Chemical synthesis routes are expensive and waste-intensive, whereas biological systems only require fine-tuning to produce the desired peptide cleanly and efficiently.

This is where a plug-and-play approach becomes powerful: engineered yeast chassis strains can be optimised as a reusable platform for producing many different peptides independently with similar manufacturing logic. Once the chassis strain is established with robust expression systems, secretion or recovery methods and downstream processing, new peptides can be easily swapped in, accelerating product development cycles.

The economic appeal is also clear. Compared with commodity food ingredients, peptides for premium cosmetics and personal care products can support higher margins, which helps justify investment in strain development and production scale-up. With peptides sitting in a broad innovation zone that straddles cosmetics, wellness, and in some cases pharma-adjacent applications, they are attractive targets for companies seeking differentiated products and defensible IP.

Beyond topical personal care, small peptides are also gaining attention in health and wellness for their roles in satiety, metabolism, gut health and other emerging consumer trends. While application specifics vary widely, the larger pattern is consistent with the discovery of new peptide sequences bearing specific functionality, followed by industry-scale production and incorporation into trend-setting products.

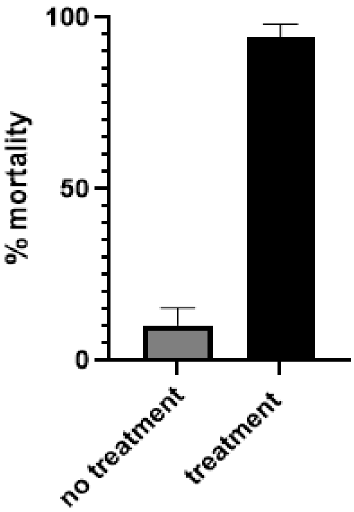
## RNAi biopesticides

Renaissance's most commercial-ready application for its yeast technology is for the development of RNAi-based biopesticides. RNAi is a natural, highly precise and efficient biological mechanism found in plants, animals and fungi that turns off, or 'silences', a specific gene.

When the target insects take up the RNAi bioactive against a gene important for feeding, locomotion, fecundity or other essential biological functions, they exhibit severe physiological changes that cause lethality. RNAi-based biopesticides offer a highly targeted approach to pest control, reducing reliance on broad-spectrum synthetic chemical pesticides that are often harmful to other insects, animals, human and plants.

The commercialisation of RNAi biopesticides faces two major hurdles: the high cost of manufacturing bioactives at scale; and the fragility of double-stranded RNA molecules. These degrade easily in real-world conditions, such as UV exposure, moisture, environmental nucleases and temperature swings, often requiring expensive synthetic carriers or protective formulations. A yeast-based RNAi biopesticides technology that significantly lowers both hurdles could be a game-changer here.

The core innovation is elegantly simple: the yeast produces the bioactives and keeps them inside the cell, where they are naturally



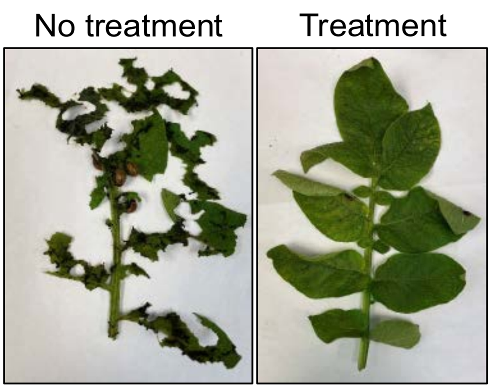




Figure 1 - Kill graph of Colorado potato beetle on benchtop

protected by the robust yeast cell wall. Instead of relying on a separate synthetic encapsulation system, the yeast itself functions as a durable biological 'suitcase' that safeguards the bioactives after they are manufactured, ensuring their integrity during field application through to insect uptake.

This platform is also designed for real-world farm logistics. As yeast production is an established industrial process with strong manufacturing ecosystems globally, the approach is positioned to deliver a cost structure that is industrially viable and affordable to farmers.

RNAi yeast can be shipped in powdered form, which maximises shelf life, improves transport efficiency and supports tank mixing for foliar spray application. Farmers can apply it using standard spray equipment, enabling seamless integration with existing crop protection practices rather than demanding new machinery or complicated protocols.

This approach is in advanced commercial development, with field trials ongoing to validate performance under real agronomic conditions. Current pest targets include beetles that cause significant yield reductions in potato, canola (or rapeseed) and other row crops. These chewing insects are known for their ability to develop resistance against conventional, synthetic chemical pesticides.

The RNAi yeast approach can address this issue, where a single yeast formulation can be designed to carry multiple RNAi bioactives to silence multiple essential genes at once. This multi-target approach can increase potency, greatly reduce the probability of resistance evolution and create more consistent pest control performance across the growing season.

### Why yeast protection matters scientifically

- **Physical shielding:** The yeast cell wall provides a naturally strong barrier against harsh environmental exposure that would otherwise degrade the RNAi bioactives
- **Stability through the value chain:** Because the RNAi bioactives remain intracellular, their bioavailability is maintained during storage and handling
- **Reduced need for synthetic carriers:** Eliminating or minimising speciality encapsulation systems is a direct pathway to lower cost and greater scalability, while also reducing reliance on non-biodegradable materials and downstream environmental burden .

The Colorado potato beetle has developed resistance against chemical pesticides

## Wider opportunities

As global regulatory momentum continues to push toward safer, more sustainable crop protection tools, a yeast-based RNAi approach that is precise, non-broad-spectrum and designed to avoid harming non-target species aligns strongly with what regulators and consumers increasingly want from modern pest management.

A broader economic angle is also at play: protecting crops from infestations supports international trade stability by reducing the risk of pest-driven export restrictions or bans, an often overlooked but material consequence for export-dependent agricultural economies.

Finally, the platform's strategic horizon goes beyond agriculture. IP around yeast-based RNA delivery is positioned to support RNA-based applications beyond agriculture.

There are longer-term possibilities in animal health, including vaccines and immune support for livestock and aquaculture, and, further ahead, human vaccines and therapeutics for delivering RNA to targeted areas of the gut to address challenging medical issues such as irritable bowel disease and digestive tract cancers. Partnerships involving academic research groups are already underway to help achieve this vision.

## A versatile workhorse

The speciality chemical sector is increasingly defined by a need to do three things at once: innovate faster, reduce environmental footprint, and stabilise supply chains in a changing world. Engineered yeast sits at the centre of that convergence and is proving to be a strategic manufacturing platform.

For speciality chemical companies, the question is shifting from 'Can yeast do it?' to 'Which products should we move to yeast first?' The winners will be those who identify the molecules where yeast-engineered products deliver a clear advantage—cost, consistency, sustainability or speed—and then build partnerships and production strategies that turn engineered biology into dependable industrial reality.

**Dr John Husnik**
CO-CEO & CSO
**RENAISSANCE BIOSCIENCE**
info@renaissancebioscience.com
www.renaissancebioscience.com