

Kokumi flavour ingredient from beef lung-development of pilot scale processing

Project code
2025-1063

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Project description

In the previous project (No: 2024-1087), bench-scale evaluations confirmed the potential of beef lung and liver as kokumi seasoning ingredients, which enhance food flavour by adding depth and richness. Building on these findings, the current project (No: 2025-1063) focused on developing a pilot-scale production process for beef lung-derived Lung-G, targeting human consumption and export to Australia. The objectives included establishing a food-grade production process, estimating manufacturing costs, and assessing Lung-G's nutritional and functional properties to promote sustainable use of underutilised carcass parts.

The project was structured around three key milestones:

1. Milestone 1: Pilot-Scale Production Process

A food-grade pilot-scale production process was developed (Figure 1. Key steps in producing kokumi-rich beef lung hydrolysate), with data collected on mass balance, including ingredient quantities and waste generation. From 54 kg (wet basis) of beef lung, 7.35 kg (dry basis) of Lung-G was produced. The kokumi activity of Lung-G was validated using the calcium-sensing receptor assay, confirming the presence of abundant kokumi compounds, ensuring its efficacy as a flavour enhancer.

2. Milestone 2: Cost Estimation for Commercial Production

A preliminary cost estimate for commercial production was conducted, considering raw material costs, yields, and equipment expenses. Three drying scenarios were evaluated: (1) fully in-house freeze-drying, (2) outsourced freeze-drying and milling, and (3) an alternative roller-drying process without ultra-high temperature treatment. The third scenario, which replaced freeze-drying (identified as the primary cost driver), reduced manufacturing costs from approximately AUD 100/kg to AUD 60/kg, significantly improving economic feasibility.

3. Milestone 3: Nutritional and Functional Analysis

Chemical analyses were performed to evaluate Lung-G's nutrient profile, including amino acid composition, vitamins, minerals, and bioactive peptides. These analyses provide insights into potential applications, such as health supplements, in addition to its use as a kokumi seasoning ingredient.

Overall, this study validated beef lung's potential as a sustainable kokumi ingredient, offering the meat industry opportunities to utilise animal offal effectively and generate additional revenue streams through flavour enhancement and potential nutritional applications.

Key Steps in Producing Kokumi-Rich Beef Lung Hydrolysate

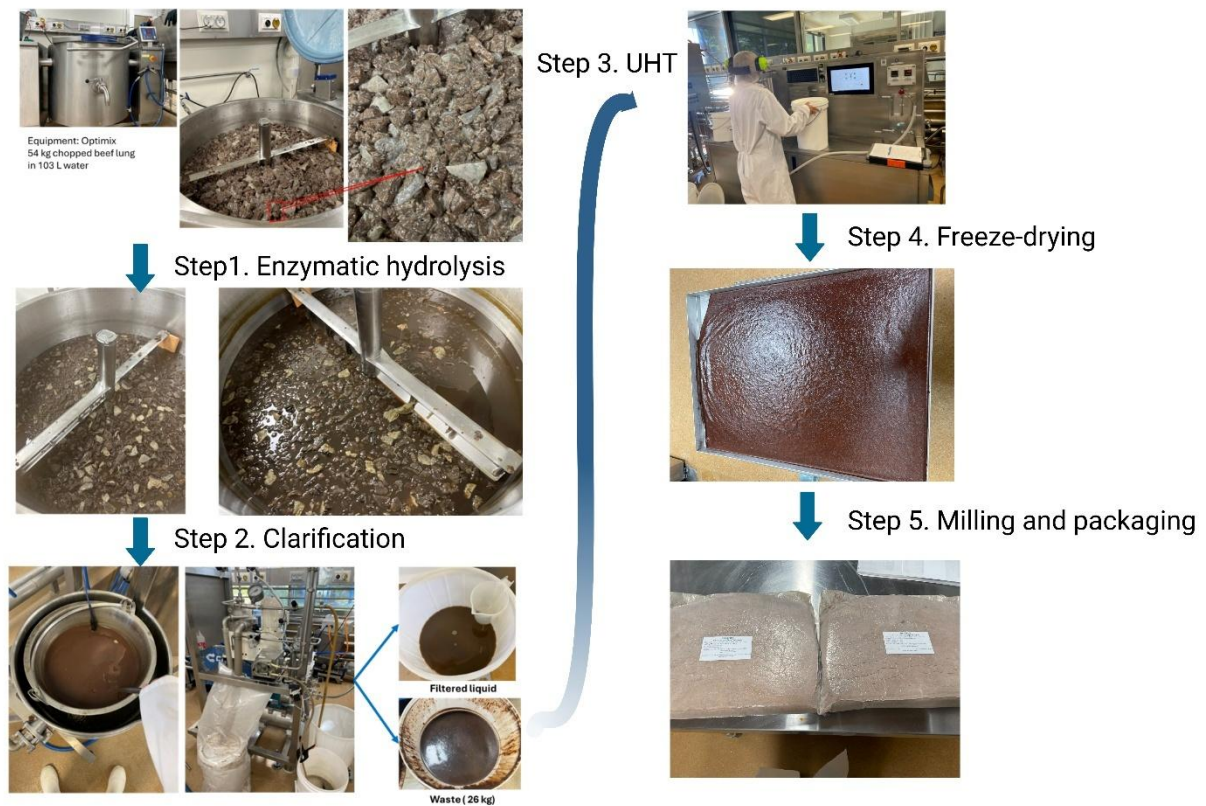


Figure 1. Key steps in producing kokumi-rich beef lung hydrolysate

Project content

This project focused on turning beef lung into a flavour-enhancing seasoning called Lung-G, suitable for human consumption and export to Australia. It built on earlier small-scale tests and included three main activities to develop, test, and assess Lung-G for commercial use.

1. Developing a Pilot-Scale Production Process

- Set up a food-safe process to produce Lung-G from beef lung on a larger scale.
- Processed 54 kg of wet beef lung to produce 7.35 kg of dry Lung-G.
- Measured material use and waste to understand efficiency.
- Tested Lung-G's flavour-enhancing ability using a calcium-sensing receptor assay, confirming it contains strong kokumi compounds that make food taste richer.

2. Estimating Costs for Commercial Production

- Calculated rough costs for making Lung-G on a larger scale, including raw materials, yields, and equipment.
- Compared two drying options: (1) in-house freeze-drying, and (2) outsourcing freeze-drying and milling.
- Added a third option in the final report: using a roller dryer without high-temperature treatment, which lowered costs from about AUD 100/kg to AUD 60/kg.

3. Checking Nutritional and Functional Value

- Analysed Lung-G's nutrients, including amino acids, vitamins, minerals, and bioactive peptides.
- Identified potential uses, such as health supplements, in addition to its role as a flavour enhancer.

The project deliverables include:

- A food-grade pilot-scale production process for Lung-G.
- A cost estimate report comparing three drying scenarios.
- A nutritional and functional analysis report to support Lung-G's applications.

These activities show how beef lung can be used sustainably to create a valuable kokumi seasoning, offering the meat industry new ways to make money from underused animal parts.

Project outcome

This project successfully showed that Lung-G, a flavour-enhancing powder made from beef lung, can be produced on a larger scale and has strong potential for commercial use. Here are the main outcomes:

1. Successful Pilot-Scale Production

- We developed a food-safe process to make 7.35 kg of dry Lung-G from 54 kg of wet beef lung, proving it can be scaled up from lab tests.
- Tests (using the calcium-sensing receptor assay) confirmed that Lung-G keeps its kokumi flavour-enhancing ability after processing, whether evaporated, oven-dried, or freeze-dried. This means it works well as a natural, clean-label seasoning for food.
- Challenges like maintaining enzyme activity and flavour were solved by fine-tuning the process, controlling pH and temperature, and meeting New Zealand's MPI food safety standards. These improvements ensure a high-quality product and set a solid base for future large-scale production.
- Using oven drying instead of freeze-drying preserved Lung-G's flavour, opening the door to cheaper production methods.

2. Cost Estimates for Commercial Production

- We estimated costs for making Lung-G on a larger scale, looking at three options: (1) in-house freeze-drying (AUD \$100/kg), (2) outsourcing freeze-drying (AUD \$96/kg), and (3) in-house roller drying (AUD \$61/kg).
- The roller drying option cut costs significantly, showing a way to make Lung-G more affordable. These estimates, accurate within $\pm 30\%$, give early guidance for planning investments.
- The study highlighted high-cost areas like enzymes and freeze-drying and showed that outsourcing costs can vary due to market changes. A full techno-economic analysis is needed next to confirm if Lung-G can be profitable.

3. Nutritional and Functional Benefits

- Lung-G is nutrient-rich, with 59 g of protein per 100 g, a balanced amino acid mix (538.6 mg/g total, 44.5% free amino acids), and key minerals (e.g., 24 mg iron, 1,100 mg potassium) and vitamins (e.g., 11.4 μg Vitamin B12).
- It contains bioactive peptides from collagen and haemoglobin, which may help with blood pressure or blood sugar control, but high sodium (5,100 mg/100 g) limits its use as a health supplement under FSANZ rules.
- Compared to other beef organ supplements (like Mitchell's Beef Liver & Spleen), Lung-G stands out for its protein and peptide content, making it suitable for both flavouring and potential health products.

Benefit for industry

Lung-G benefits the meat industry by:

- **Increasing Profitability:** Transforms low-value beef lung ingredient into high-value kokumi seasoning and potential health supplements, creating new revenue streams.
- **Meeting Consumer Demand:** Offers a natural, clean-label flavour enhancer, aligning with market trends for sustainable and health-conscious products.

- **Enhancing Sustainability:** Reduces waste through upcycling, supporting circular economy principles and lowering environmental impact.
- **Diversifying Opportunities:** Dual applications (seasoning and potential health supplements) attract investment and broaden market potential, pending further development like sodium reduction.