

How Carbon-Kai Works in the Rumen

A plain-English summary · drawn from the Carbon-Kai Scientific Evidence Review

The problem: methane wastes energy

- A cow's stomach (the rumen) uses microbes to break down grass into nutrients the cow can use.
- This process creates leftover hydrogen and CO₂.
- Tiny microbes called methanogens grab that hydrogen and CO₂ and turn it into methane gas, which the cow burps out.
- Making methane is a dead loss — it serves no purpose for the cow, and it throws away roughly **2–12% of the energy** in the cow's feed. That's energy that could have gone into milk or growth instead.

What Carbon-Kai does

Carbon-Kai is an engineered carbon-and-mineral material that changes the rumen chemistry through four mechanisms working together:

- 1. It moves electrons around (electron storage & transfer)** — Carbon-Kai's surfaces conduct electricity. Inside the rumen this lets it act like a “wire” and a temporary battery, giving electrons somewhere else to go instead of ending up locked into methane.
- 2. It gives hydrogen and electrons a different home (alternative sinks)** — Normally, making methane is the main way the rumen gets rid of spare hydrogen and electrons. Carbon-Kai and its added minerals offer other places for them to go — ideally into useful products like fatty acids the cow absorbs to make milk and meat.
- 3. It changes the mix of microbes (microbial communities)** — Carbon-Kai's porous, conductive surface is a good home for helpful microbes to settle and grow on. This shifts the population away from the methane-makers. In the published Queensland trial, carbon supplementation cut methane-producing microbes by about 30%. Carbon-Kai's own lab trials have shown its formulation clearly outperforming the reference carbon on methane production — supporting the potential for even greater reductions in live herd scientific trials.
- 4. It mops up and balances chemicals (concentration modulation)** — Its large surface area soaks up excess hydrogen, toxins, and other compounds, smoothing out the highs and lows. Steadier conditions mean the rumen runs more efficiently. The added minerals also let it grab compounds that ordinary biochar can't.

The bottom line By steering hydrogen and electrons away from methane and into useful pathways, Carbon-Kai aims to do two things at once: cut methane emissions and redirect that wasted energy back into milk production and animal growth.

It does all that — but that's only the beginning

The rumen is just step one. The same material keeps working as it passes through the cow and into the soil, delivering benefits across the whole farm:

- **Healthier animals** — its surfaces bind toxins, mycotoxins, heavy metals and harmful bacteria in the gut, supporting liver, kidney and immune health, and have been linked to fewer internal parasites, less drenching, and higher pregnancy rates.
- **More milk, naturally** — the energy redirected away from methane shows up as productivity. Published dairy trials recorded more milk volume and higher milk fat and protein, plus better feed efficiency and conception rates.
- **Cleaner manure** — most of the CCM passes through the cow intact, then helps cut ammonia and nitrous oxide losses from manure during storage and when it's spread on pasture.
- **Better soil** — once in the ground via manure, it locks carbon away long-term, improves soil structure and water-holding, lifts fertility, and reduces nitrate leaching into streams and groundwater.
- **Whole-farm emissions** — it tackles methane, nitrous oxide and carbon together — all three main agricultural greenhouse gases, not just one.
- **Good use of forestry** — Carbon-Kai is a natural product made from NZ pine with a precise mix of essential minerals, capturing carbon into a stable solid and returning it to the soil for hundreds of years.