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New tech uses chicken feathers to generate clean electricity



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In an industry often criticized for its environmental impact, a creative solution for clean electricity emerges from an unexpected source: chicken feathers.

Typically, these by-products contribute significantly to the waste in poultry production, with an astonishing 40 million tons globally being incinerated annually. This disposal method not only exacerbates CO₂ emissions but is also responsible for releasing

harmful gases, including [sulfur dioxide](#), making it an environmentally detrimental practice.

However, a collaborative venture between researchers at [ETH Zurich](#) and [Nanyang Technological University Singapore](#) (NTU) promises a revolutionary repurposing for these feathers, potentially transforming a substantial environmental liability into a pioneering energy solution.

Converting keratin to energy

The innovation hinges on an intricate understanding of the composition of chicken feathers. Recognizing that the feathers are composed of 90% keratin, a protein also found in human hair and animal fur, the researchers developed a process to extract this protein and convert it into ultra-fine fibers known as amyloid fibrils.

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These fibrils present a remarkable application: forming the membrane of a fuel cell, a device that combines hydrogen and oxygen to produce electricity, heat, and water, thereby [generating CO₂-free electricity](#).

In stark contrast to conventional methods, this approach circumvents the use of toxic “forever chemicals” in fuel cell membranes. These traditional materials pose substantial environmental and health risks due to their non-biodegradable nature and high costs.

Inside the fuel cell

Fuel cells function through a delicate balance of chemical reactions, at the heart of which lies a semipermeable membrane. This membrane’s critical role is to allow protons to pass while blocking electrons, thereby directing these electrons through an external circuit, generating an electric current.

The keratin-based membrane, born from repurposed waste, is not only a more environmentally friendly option but also significantly cheaper. Laboratory demonstrations indicate that these new membranes are up to three times less costly than their

conventional counterparts, presenting an economically appealing alternative.

Professor Raffaele Mezzenga, a pivotal figure in this research from ETH Zurich, explains the profound environmental implications of their findings. He said, “Our latest development closes a cycle: we’re taking a substance that releases CO₂ and toxic gases when burned and using it in a different setting. With our new technology, it not only replaces toxic substances but also prevents the release of CO₂, decreasing the overall carbon footprint.”

Hydrogen production challenges

Despite the promise of hydrogen as a clean energy source, its widespread adoption faces significant hurdles. One primary challenge is the scarcity of naturally occurring hydrogen on Earth, necessitating energy-intensive production processes.

Here, the novel keratin membrane again demonstrates its potential. The membrane’s unique properties make it suitable for water electrolysis, a process where water is split into oxygen and hydrogen using an electric current. While traditional electrolysis methods require certain additives to enhance water’s conductivity, the keratin-based membrane facilitates efficient water splitting even in pure water, eliminating the need for these potentially harmful additives.

Electricity from chicken feathers: the path ahead

While the research has provided promising results, further investigations are necessary to determine the long-term stability and durability of the keratin membranes in real-world applications. Addressing these and other technical challenges is crucial for transitioning from laboratory success to full-scale commercial viability.

The team, driven by the potential global impact of their discovery, has filed a joint patent for the keratin-based membrane technology. They are actively seeking partnerships with investors and forward-thinking companies willing to join their quest in pioneering a cleaner, sustainable energy future. This collaboration

will be essential for refining the technology, scaling up production, and eventually introducing these innovative fuel cells to the market.

In transforming poultry waste into an opportunity, the researchers are not just proposing a more sustainable form of energy production; they are reimagining global resources management and setting the stage for a more sustainable industrial future.

The full study was published by the [American Chemical Society](#).

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