# Rechargeable zinc–air battery with vitamin B12 catalyst

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## News

A physical chemistry research group (FQM-204, IQUEMA institute) at the University of Córdoba, Spain, has developed a rechargeable zinc–air battery that uses vitamin B12 (cobalamin) as its catalyst. The results were published in the 'Journal of Materials Chemistry A' (Royal Society of Chemistry) in August 2026; the university issued a press release on 4 November 2026. Because B12 dissolves easily in water, the team anchored it to single-walled carbon nanotubes to form the air electrode (cathode). The cobalt(III) ion at the core of B12 helps reduce oxygen to water during discharge and release oxygen during charging. The researchers reported that the prototype ran for up to 250 charge–discharge cycles; Manuel Cano Luna is one of the study's authors. With a non-flammable aqueous electrolyte and abundant, recyclable zinc, they say it could be a cheaper, safer alternative to lithium-ion batteries and help store renewable electricity. The group had earlier used haemoglobin and catalase (iron-based biomolecules) as catalysts; B12 is its third biomolecule.

## Key facts for the exam

| Point | Details |
|---|---|
| **Institution** | University of Córdoba, Spain – FQM-204 group, IQUEMA |
| **Journal** | Journal of Materials Chemistry A (RSC) – August 2026 |
| **Battery type** | Rechargeable zinc–air battery |

| Point | Details |
|---|---|
| **Catalyst** | Vitamin B12 (cobalamin) – cobalt(III) at its core |
| **Support** | Single-walled carbon nanotubes |
| **Cycle life** | Up to 250 charge–discharge cycles |
| **Electrolyte** | Aqueous – non-flammable |
| **Earlier work** | Haemoglobin and catalase catalysts |
| **Tamil Nadu** | IIT Madras – zinc–air battery research (2022) |

## Background

- Battery basics: a battery converts chemical energy into electrical energy. During discharge, oxidation occurs at the anode and reduction at the cathode. Rechargeable cells are 'secondary cells' (e.g. lead-acid, lithium-ion); single-use ones are 'primary cells' (e.g. dry cell). Alessandro Volta built the first battery in 1800.
- Zinc–air battery: zinc is oxidised at the anode, while oxygen from the air is used at the cathode. As oxygen is not stored inside, the battery is light with high energy density. Button cells used in hearing aids are of this type (primary). The main challenge is a cheap, efficient catalyst that also releases oxygen on charging; costly metals such as platinum are usually needed.
- Catalyst: a substance that speeds up a reaction by lowering the activation energy while itself remaining unchanged. Enzymes are biological catalysts. This study is an example of a bio-inspired approach that uses natural biomolecules in place of costly metal catalysts.
- Vitamin B12: the only vitamin containing cobalt – hence 'cobalamin'. It is water-soluble, made in nature only by bacteria, and found mainly in animal foods such as meat, fish, eggs and milk. Its absorption needs 'intrinsic factor' secreted by the stomach; deficiency causes pernicious anaemia and nerve damage.
- Economic context: India relies heavily on imports of battery raw materials such as lithium, cobalt and nickel. Zinc is available in India (major mines in Rajasthan), so IIT Madras researchers noted in 2022 that zinc-based batteries could cut import dependence.

**Tamil Nadu link:** Tamil Nadu: (1) In May 2022 researchers of IIT Madras's Department of Chemical Engineering (Dr Aravind Kumar Chandiran's group) announced they were developing mechanically rechargeable zinc–air batteries for electric two- and three-wheelers, with used zinc cassettes swapped at 'Zinc Recharge Stations' and a fire-safe water-based electrolyte (IIT Madras press release). (2) CSIR-Central Electrochemical Research Institute (CECRI), Karaikudi is a key centre for battery research. (3) Hosur and Krishnagiri have grown into EV manufacturing hubs.

## Frequently asked questions

**What is this news about?**

A physical chemistry research group (FQM-204, IQUEMA institute) at the University of Córdoba, Spain, has developed a rechargeable zinc–air battery that uses vitamin B12 (cobalamin) as its catalyst.

**What are the key facts to remember for the exam?**

Institution: University of Córdoba, Spain – FQM-204 group, IQUEMA; Journal: Journal of Materials Chemistry A (RSC) – August 2026; Battery type: Rechargeable zinc–air battery; Catalyst: Vitamin B12 (cobalamin) – cobalt(III) at its core.

**What is the background to this news?**

Battery basics: a battery converts chemical energy into electrical energy. During discharge, oxidation occurs at the anode and reduction at the cathode.

## Practice questions (with answers)

**1. Which metal ion lies at the centre of the vitamin B12 molecule?**

**A)** Iron

**B)** Magnesium

**C)** Zinc

**D) Cobalt**

**Answer: D** – Explanation: Cobalt – hence the name cobalamin. Haemoglobin has iron at its core and chlorophyll has magnesium.

**2. How does a catalyst speed up a chemical reaction?**

**A)** Raises activation energy

**B)** Shifts the equilibrium

**C)** Changes reaction heat

**D) Lowers activation energy**

**Answer: D** – Explanation: It offers an alternative pathway with lower activation energy and stays unchanged; it alters neither the equilibrium nor the reaction enthalpy.

**3. In a zinc–air battery, which gas drawn from the surroundings reacts at the air electrode?**

**A) Oxygen**

**B)** Nitrogen

**C)** Carbon dioxide

**D)** Hydrogen

**Answer: A** – Explanation: Oxygen – it is reduced to water on discharge and released again on charging. Zinc serves as the anode.

**4. Which Tamil Nadu institution said in 2022 it was developing zinc–air EV batteries with swappable 'zinc cassettes'?**

**A)** Anna University

**B)** CSIR-CECRI

**C) IIT Madras**

**D)** VIT, Vellore

**Answer: C** – Explanation: IIT Madras, Dept of Chemical Engineering (May 2022) – for two- and three-wheelers; it said the water-based electrolyte would not catch fire.

**5. Who built the first electric battery in 1800 by stacking metal discs separated by brine-soaked cloth?**

**A) Alessandro Volta**

**B)** Luigi Galvani

**C)** Michael Faraday

**D)** Gaston Planté

**Answer: A** – Explanation: Italy's Volta – the 'voltaic pile'; the unit volt is named after him. Planté invented the lead-acid cell (1859).

**Sources:** University of Córdoba press release via EurekAlert! (4 Nov 2026); Journal of Materials Chemistry A (RSC), 25 Aug 2026 – DOI 10.1039/d6ta02773c; IIT Madras press release (30 May 2022). © Shanmugam IAS Academy.