



# Recombinant Proteins Using Monosodium Glutamate

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## Why in News?

Researchers at the **Indian Institute of Science (IISc), Bengaluru** have made a significant breakthrough in the mass production of **recombinant proteins** by utilising **Monosodium Glutamate (MSG)**.

- This advancement is crucial for producing essential substances like vaccine antigens, insulin, and monoclonal antibodies.

## What are Recombinant Proteins?

- **About:**
  - Recombinant proteins are proteins engineered in the lab by inserting the **gene coding for the protein into bacterial, viral, or mammalian cells.**
- **Production:**
  - Typically, these proteins are produced in large bioreactors using the cells of a specific yeast which contains a unique promoter, called the **alcohol oxidase (AOX) promoter.**
  - The AOX promoter can be activated by **methanol** to produce recombinant proteins in large quantities.
    - The process involves inserting the **desired gene next to the AOX promoter,** feeding the **yeast with glycerol or glucose,** and then adding **methanol** to activate protein production.
- **Risks with Methanol:**
  - **It is highly flammable and hazardous,** requiring stringent safety measures. It can also produce harmful byproducts like **hydrogen peroxide,** which can induce oxidative stress in yeast cells or damage the recombinant proteins.
- **Monosodium Glutamate (MSG) - a Safer Alternative:**
  - MSG can activate a different promoter in the yeast genome that codes for an enzyme called **phosphoenolpyruvate carboxykinase (PEPCK),** leading to protein production similar to the methanol-induced process, without the associated risks.
  - MSG is safer and more **environmentally friendly compared to the traditional methanol-induced process.** It can be used in biotech industries to mass-produce valuable proteins, including: milk and egg proteins, baby food supplements, nutraceuticals, and therapeutic molecules.

## Methanol

- It is the simplest alcohol (also known as **Wood alcohol or Methyl alcohol**) with the **chemical formula CH<sub>3</sub>OH.** It appears as a **colourless, fairly volatile liquid** with a faintly sweet pungent odour, and completely mixes with water.
  - Methanol is flammable, light, and poisonous, and its consumption can cause blindness.
- Methanol was first isolated by **Robert Boyle** and is now prepared by the direct combination of carbon monoxide gas and hydrogen in the presence of a catalyst.
  - It is commonly used as a laboratory solvent and as a denaturant additive in the

manufacturing of **ethanol**.

- Methanol has various uses, including in **polymers**, production of **hydrocarbons**, and as a fuel for **internal combustion engines**.

## UPSC Civil Services Examination, Previous Year Question (PYQ)

### **Prelims**

**Q. What is Cas9 protein that is often mentioned in news? (2019)**

- (a)** A molecular scissors used in targeted gene editing
- (b)** A biosensor used in the accurate detection of pathogens in patients
- (c)** A gene that makes plants pest-resistant
- (d)** A herbicidal substance synthesised in genetically modified crops

**Ans: (a)**

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