

## Researchers Discovered Microbes Like *Ideonella Sakaiensis*

Since its discovery in 2016, the **bacterium *Ideonella sakaiensis*** has been a subject of ongoing research for its ability to naturally break down PET plastic. Recent news covers advanced genetic engineering to improve its enzymes, new findings on its degradation process, and efforts to scale the technology for industrial use, including breaking down microplastics in marine environments.

### Recent News and Advancements

#### Engineering for enhanced efficiency

- **Faster, more stable enzymes:** Researchers have genetically engineered mutant versions of the PET-degrading enzymes, PETase and MHETase, to function more efficiently and at higher temperatures. One mutant, for example, showed a 3.3-fold increase in activity on highly crystalline PET, the type used for most plastic bottles.
- **Tandem enzyme action:** A French biotechnology company, Carbios, has created a "super-enzyme" that combines the functions of PETase and MHETase. This engineered enzyme can break down 90% of a PET bottle in just 10 hours, a drastic improvement over the original bacteria.
- **Modified marine bacteria:** In 2023, scientists successfully genetically modified a fast-growing marine microbe, *Vibrio natriegens*, to produce the PET-degrading enzymes from *I. sakaiensis*. This advancement allows for PET to be broken down in saltwater at room temperature, offering a potential solution for ocean plastic pollution.

#### Bio-upcycling and the circular economy

- **Converting plastic to bioplastics:** News from 2021 reported that *I. sakaiensis* can not only break down PET but also convert it into biodegradable bioplastics, such as poly(3-hydroxybutyrate) (PHB). This process offers a sustainable pathway for recycling problematic plastics and creating valuable, eco-friendly materials.
- **Producing renewable monomers:** The enzymes break down PET into its original building blocks terephthalic acid (TPA) and ethylene glycol (EG). These monomers can be purified and used to produce new PET, allowing for an efficient closed-loop recycling system.

## Environmental applications

- **Addressing microplastics:** Research is underway to develop microbial systems that can target and remove microplastics and nanoplastics from soil and water. The modified marine bacteria are a crucial step toward addressing the widespread microplastic problem in oceans.
- **Wastewater treatment:** The bacteria show promise for breaking down plastic waste in sewage and wastewater treatment facilities, potentially using its abilities to degrade PET in fisheries without harming fish populations.

## Challenges and limitations

Despite the promising progress, several hurdles remain for widespread, industrial application:

- **Slow degradation rate:** While genetically enhanced enzymes work much faster than the natural bacteria, the process is still too slow for many large-scale industrial applications.
- **Cost of scalability:** The cost of manufacturing and deploying engineered enzymes or microbes at an industrial scale remains a significant challenge compared to conventional recycling and incineration.
- **Environmental release concerns:** The prospect of releasing genetically engineered organisms into the natural ecosystem raises ethical and regulatory concerns. Further research is needed to understand the long-term ecological impact.
- **Variable plastic composition:** Standard PET bottles are highly crystalline, which is more difficult for enzymes to break down than amorphous PET. Additionally, *I. sakaiensis* only targets PET, leaving other common plastics untouched, though other plastic-degrading organisms are also being investigated.

## Practice Questions:

1. Regarding the microbe *Ideonella sakaiensis*, consider the following statements:

- I. *Ideonella sakaiensis* was discovered at a recycling plant in Osaka, Japan
- II. It was the first known microorganism capable of naturally degrading PET plastic
- III. The bacteria was named after the city of Osaka where it was found

How many of the above statements are incorrect?

- a) Only one
- b) Only two
- c) All three
- d) None

**Answer: a**

**Explanation:** **Statement I is correct-** as *Ideonella sakaiensis* was discovered near a plastic recycling plant in Sakai, Japan. **Statement II is correct-** it was the first known microorganism with this capability. **Statement III is Incorrect-** While discovered in Sakai, the bacterium was named after the recycling plant in that city, not the city itself.

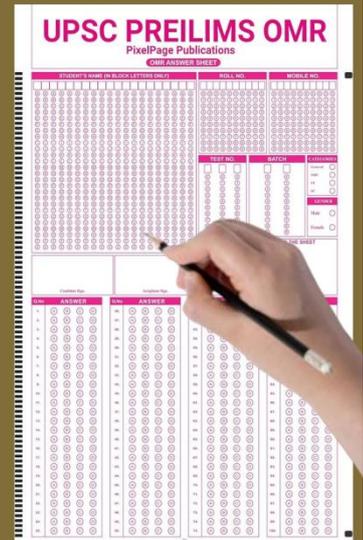


For More Practice Questions, visit:

[www.prelimspractice.com](http://www.prelimspractice.com)



# TARGET PRELIMS 2026



## PRELIMS PRACTICE PROGRAM

### Subject Wise Practice Module

2,000+ Practice Questions  
₹ 99 Only  
~~₹ 600~~

Art, Culture & Heritage | Ancient & Medieval History | Modern History | Physical Geography | Human Geography | Mapping | Indian Polity | Indian Governance | International Organisations | Environment & Ecology | Economy | Science & Technology

### Current Affairs Practice Module

2,000+ Practice Questions  
₹ 99 Only  
~~₹ 600~~

Press Information Bureau | The Hindu | Indian Express | Press Trust of India | Business Line | Business Standard | Times of India

### Contemporary Issues Practice Module

1,000+ Practice Questions  
₹ 69 Only  
~~₹ 350~~

Press Information Bureau- (PIB) | The Hindu | Indian Express | Press Trust of India | Rajya Sabha TV | Times of India | Lok Sabha TV

### Essential Editorials Practice Module

1,000+ Practice Questions  
₹ 69 Only  
~~₹ 350~~

The Hindu | Indian Express | Times of India | Business Line | Business Standard | Times of India | The Sunday Guardian | MINT

# LIVE

# Classes



Current Affairs



Contemporary Issues



Essential Editorials

[www.prelimspractice.com](http://www.prelimspractice.com)

## Class Discussion Space

a	b	c	d
a	b	●	d
●	b	c	d
a	b	c	●
a	●	c	d

**Prelims**  
Practice.com