



# Bio-Bitumen

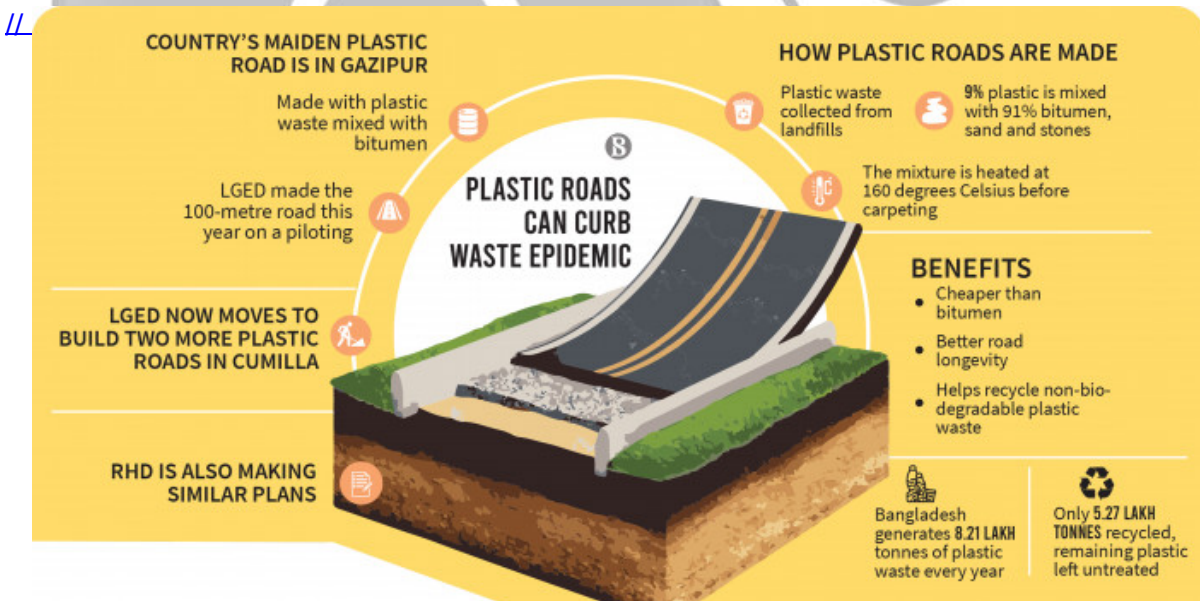
Source: ET

## Why in News?

Recently, India has embarked on plans to initiate large-scale production of bio-bitumen from biomass or agricultural waste.

## What is Bio-Bitumen?

- **About:**
- Bio-bitumen is a **bio-based binder** derived from renewable sources like vegetable oils, crop stubble, algae, lignin (a component of wood), or even animal manure.
- **Origin and Production:** Bitumen is primarily derived from the **distillation of crude oil**. During refining, the heavier bitumen remains after lighter components like **gasoline and diesel are removed**. It can also naturally occur in deposits, such as in oil sands.
- **Properties and Uses of Bitumen:**
  - It is known for its **waterproofing and adhesive properties** and is extensively used in [road construction \(asphalt paving\)](#) and waterproofing applications in buildings and marine structures.
- **Bio-bitumen can be Used in Various Ways:**
  - **Direct Replacement:** Completely replacing petroleum bitumen with bio-binder in asphalt.
  - **Modifier:** Adding bio-materials to traditional bitumen to improve its properties.
  - **Rejuvenator:** Restoring the elasticity and functionality of aged asphalt pavements.



- **Current Bitumen Scenario in India:**
  - **Import Dependency:** India currently imports **approximately half** of its annual bitumen

requirement, amounting to 3.21 million tonnes in the fiscal year 2023-24.

- **Domestic Production:** Indigenous bitumen production stood at 5.24 million tonnes during the same period.
- **Increasing Consumption:** Bitumen consumption has **risen steadily**, averaging 7.7 million tonnes annually over the past five years.
  - Construction of **national highways (NH)** touched around **12,300 km in 2023-24** which is almost 34 km per day.
- **Objectives of Bio-Bitumen Production Initiative:**
  - **Reducing Import Dependency:** The primary objective is to replace imported bitumen with domestically produced bio-bitumen over the next decade, thereby reducing foreign exchange expenditure.
  - **Addressing Environmental Concerns:** Bio-bitumen production aims to **mitigate environmental issues** associated with stubble burning by utilising biomass and agricultural waste as feedstocks.
  - **Promoting Sustainable Practices:** By leveraging bio-based materials, the initiative supports sustainable **road construction practices** and aligns with global environmental standards.
  - **Technological Development and Pilot Study:** The **Central Road Research Institute (CRRI)** is collaborating with the Indian Institute of Petroleum to conduct a pilot study on a 1-km road stretch using bio-bitumen.
- **Challenges:**
  - **Cost-Effectiveness:** Currently, bio-bitumen production can be **more expensive** than traditional methods.
  - **Long-Term Performance:** More extensive field trials are needed to assess the **long-term performance** and durability of bio-asphalt compared to traditional pavements.
  - **Standardisation:** Establishing **clear standards and specifications** for bio-bitumen is necessary for its wider adoption in the construction industry.

## Other Innovation Methods in Road Construction

- [Steel slag road technology](#) is a novel method of using steel slag, the waste generated during steel production, to build more robust and more durable roads.
  - For example, **Steel Slag Road technology was first used in Surat.**
- In Hamburg, Germany, companies developed **100% recycled asphalt pavement (RAP)** to meet reduce costs, save energy, and lower carbon emissions.
- India has built more than 2,500 km of **plastic roads** and globally too, **plastic roads** are proliferating in more than 15 countries.
  - For example, it is mandatory to make use of at **least 10% of plastic waste for road construction in Ladakh.**

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

### Prelims:

**Q. In rural road construction, the use of which of the following is preferred for ensuring environmental sustainability or to reduce carbon footprint? (2020)**

1. Copper slag
2. Cold mix asphalt technology
3. Geotextiles
4. Hot mix asphalt technology

5. Portland cement

**Select the correct answer using the code given below:**

**(a)** 1, 2 and 3 only

**(b)** 2, 3 and 4 only

**(c)** 4 and 5 only

**(d)** 1 and 5 only

**Ans: (a)**

**Q. In the Union Budget 2011-12, a full exemption from the basic customs duty was extended to bio-based asphalt (bioasphalt). What is the importance of this material? (2011)**

1. Unlike traditional asphalt, bio-asphalt is not based on fossil fuels.
2. Bioasphalt can be made from non-renewable resources.
3. Bioasphalt can be made from organic waste materials.
4. It is eco-friendly to use bioasphalt for surfacing of the roads.

**Which of the statements given above are correct?**

**(a)** 1, 2 and 3 only

**(b)** 1, 3 and 4 only

**(c)** 2 and 4 only

**(d)** 1, 2, 3 and 4

**Ans: (b)**