

Green Crackers

1. What are Green Crackers?

- **Definition:**

Green crackers are **environmentally improved firecrackers** developed by the **Council of Scientific and Industrial Research - National Environmental Engineering Research Institute (CSIR-NEERI)**.

They are designed to **reduce emissions** of harmful gases, particulate matter, and noise levels.

- **Objective:**

To balance **traditional festive celebrations** with **environmental safety** and public health concerns.

2. Chemical Composition

Aspect	Conventional Crackers	Green Crackers
Key oxidizer	Barium nitrate (toxic)	<i>Removed</i>
Substitutes used	-	Potassium nitrate, strontium salts, iron oxide, zeolite
Heavy metals	Aluminium, copper (cause metallic smoke)	Reduced or replaced
Soot & residue	High	Lower due to zeolite and controlled combustion

- **Zeolite** acts as an **absorbent** for particulate matter and toxic gases.

- The **controlled oxidation process** reduces the formation of **PM_{2.5}**, **SO₂**, and **NO_x**.

3. How Do Green Crackers Work?

- They use a **modified combustion process** with:

- Lower **oxidation temperature**
- **Controlled release** of energy and gases

- This ensures:

- **30-40% reduction** in emissions of PM_{2.5}, SO₂, and NO_x
- **Lower noise levels** (within permissible limits)

- **Cleaner and safer smoke** output

4. Variants of Green Crackers (Developed by CSIR-NEERI)

Variant	Full Form	Key Feature
SWAS	Safe Water Releaser	Releases water vapor & air as dust suppressants; no potassium nitrate or sulphur
STAR	Safe Thermite Cracker	Uses thermite reaction with reduced metal content
SAFAL	Safe Minimal Aluminium	Uses less aluminium to reduce sound intensity & metallic emissions

- Each variant carries a **QR code** to verify **authenticity** and **CSIR-NEERI certification**.

5. Legal & Regulatory Framework

- **Supreme Court (2018):**
 - Allowed only **green crackers** to be sold and used.
 - Imposed **time limits** for bursting crackers during festivals.
- **Pollution Control Boards (CPCB/SPCB):**
 - Mandated **emission compliance** and **labelling norms**.
- **Monitoring:**
 - QR codes help trace **manufacturers** and **prevent counterfeit** products.

6. Environmental Significance

1. Air Pollution Reduction:

- 30–40% lower emissions of PM_{2.5}, NO_x, SO₂
- Reduced smog formation post-Diwali

2. Noise Pollution Control:

- Noise limited to **110–125 dB**, as per CPCB norms

3. Health Benefits:

- Decreased respiratory issues, especially for children and elderly

4. Sustainability Link:

- Supports India's **Net Zero 2070** and **National Clean Air Programme (NCAP)** goals

5. Economic Balance:

- Preserves livelihood of traditional fireworks manufacturers through **eco-transition**, rather than total ban

7. India's Global Role

- India is **the first and only country** with a **government-backed "Green Crackers" programme**.
- CSIR-NEERI's model is being studied globally for **sustainable pyrotechnics**.

8. Challenges & Limitations

- **Partial Pollution Reduction:**
Green crackers are *less polluting*, not *pollution-free*.
- **Implementation Gaps:**
 - Limited public awareness
 - Counterfeit products without NEERI certification
 - Weak enforcement of sale & use restrictions
- **Testing & Availability:**
 - Limited testing infrastructure for small manufacturers

9. Way Forward

- Strengthen **certification and QR verification** mechanisms.
- Promote **public awareness campaigns** about safe use.
- Encourage **research into zero-emission fireworks**.

- Integrate **green fireworks** into **Make in India** and **sustainable industry policies**.

10. UPSC Relevance

Exam Type

Prelims (Science & Environment)

Possible Question

“Green crackers” are developed by which institution? / Which of the following chemicals are absent in green crackers?

Mains (GS Paper 3)

Discuss the significance of green crackers in balancing cultural traditions with environmental protection.

Essay Paper

“Technology for Sustainable Celebrations: The Case of Green Crackers.”

Summary in Simple Terms

Green crackers are **eco-friendly versions** of fireworks made by **CSIR-NEERI** to cut down harmful emissions and noise.

They replace **toxic chemicals like barium nitrate** with **safer compounds**, emit **30-40% less pollution**, and come with **QR-coded certification**.

Though not completely clean, they are a **significant step toward sustainable festive traditions** in India.

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