

Fatty Acids as PCM: Full Analysis for Peltier + PCM AC Model

Q1: Can melting and grating paraffin wax lower its melting point from 58°C to 22°C?

No. The melting point is a chemical property and cannot be altered by physical changes like grating, melting, or reshaping. Paraffin will still melt around 58°C. Grating only helps it melt faster, not at a lower temperature.

Q2: Can fatty acids be used instead of paraffin wax for PCMs in a Peltier-based AC model?

Yes. Fatty acids like Lauric Acid and Oleic Acid are excellent alternatives to paraffin wax. They are biodegradable, safe, have tunable melting points, and offer good latent heat for thermal storage.

Q3: Which fatty acid blend satisfies these criteria: eco-friendly, ~22°C melting point, safe, available,

A blend of 60% Lauric Acid and 40% Oleic Acid is ideal. It meets all 6 criteria:

1. Environmentally safe
2. Melts around 22-25°C
3. High latent heat (~180-210 J/g)
4. Stable and effective paraffin alternative
5. Safe to handle
6. Available online and in cosmetic/soap supply stores.

Q4: Will this Lauric + Oleic blend be efficient as paraffin?

Yes. It performs similarly to paraffin in terms of latent heat, thermal cycling stability, and phase change behavior. While it has slightly lower thermal conductivity and may need sealing to prevent leaks, it's safer, greener, and highly efficient for your use case.

Q5: What are the disadvantages of using fatty acids like Lauric + Oleic as PCM?

- Lower thermal conductivity (needs enhancement)
- Risk of leakage if not sealed well
- Mild odor in unrefined form
- Possible oxidation on long exposure to air/light
- Slight chance of phase separation if not mixed properly

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- Slightly more expensive than paraffin if lab-grade is used

Q6: Can we reuse Lauric + Oleic acid blends like paraffin wax?

Yes. Fatty acids are reusable for 300-500+ cycles with minimal degradation, just like paraffin. Ensure airtight storage and complete phase change during each cycle to maintain performance.

Q7: Does Lauric + Oleic blend work *similarly* to paraffin wax in a practical setup?

Yes. It undergoes solid-liquid phase change at room temperature, stores and releases thermal energy efficiently, and is comparable to paraffin in performance. It's a greener and safer alternative, with only minor handling adjustments needed.