

# UC Davis

## 2026 Postdoctoral Research Symposium

### Title

Almond-Ash Activated Concrete: Scaling Biomass Ash & Paver Production

### Permalink

<https://escholarship.org/uc/item/94g045kk>

### Journal

Book of Abstracts from the UC Davis Postdoctoral Scholars Association 2026 Postdoctoral Research Symposium

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### Publication Date

2026-04-24

Peer reviewed

## **Almond-Ash Activated Concrete: Scaling Biomass Ash & Paver Production**

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**Keywords:** Almond Biomass Ash, Alkali-Activated Binder, Concrete Paver, Low CO<sub>2</sub> Cement

### ***Abstract:***

Portland cement (PC) consumption of 4.2 billion metric tons yearly is responsible for about 8% of annual global greenhouse gas (GHG) emissions. Alkali-activated binders, which use no portland cement, offer a convenient alternative to conventional PC-based concrete to reduce GHG emissions. However, uptake of these binders in the industry has been slow, mostly due to their caustic nature and high cost of activators, typically reagent-grade chemicals, used to obtain the high pH necessary for binder dissolution and subsequent strength development. This research demonstrates that full replacement of reagents with potassium mineral-rich almond biomass ash in alkali-activated slag binders can achieve compressive strengths comparable to conventional PC-based mortar and concrete. Biomass ash obtained from a full-scale combustion trial with blended almond co-products (shells and hulls) from Northern California was characterized and used to produce pavers and conventional concrete. Ashes produced from almond biomass co-products in Australia and California were compared based on physical and chemical properties and performance in mortar at laboratory scale. While current work is predominantly focused on precast pavers, formulations containing additives for set time control were investigated to explore applications in conventional ready-mix concrete.

***Funding Acknowledgements:*** *This work is supported by the Resnick Agricultural Innovation Grant and the Almond Board of California.*

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