

Edible-First Hempseed Biorefinery: Linking Nutritional Functionality with Sustainable Processing

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Introduction

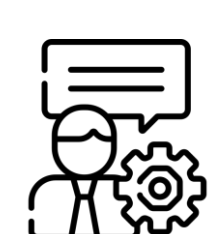
Hempseed is a **nutrient-rich** yet **underutilized** food resource with considerable potential for sustainable ingredient development.

However, existing research remains fragmented, limiting its full valorization within circular food systems.



Aim

To synthesize evidence on hempseed nutrition, processing, food applications, and environmental performance to develop an **edible-first biorefinery framework**.

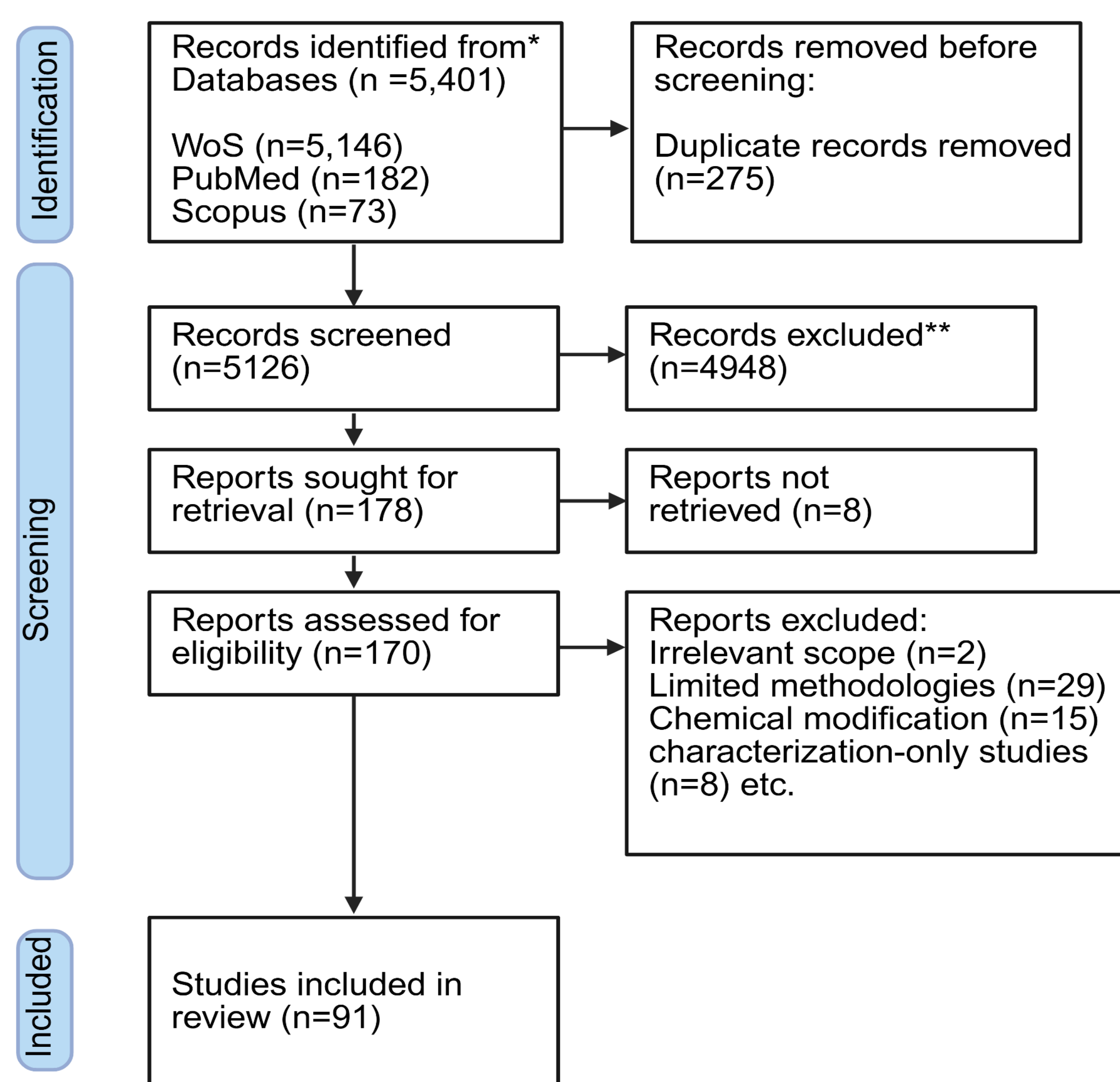


Materials and Methods

Following PRISMA 2020, studies published during 2022–2025 were retrieved from Web of Science, Scopus, and PubMed.

Original studies on edible hemp fractions and food-grade valorization were included. The selection process is presented in **Figure 1**.

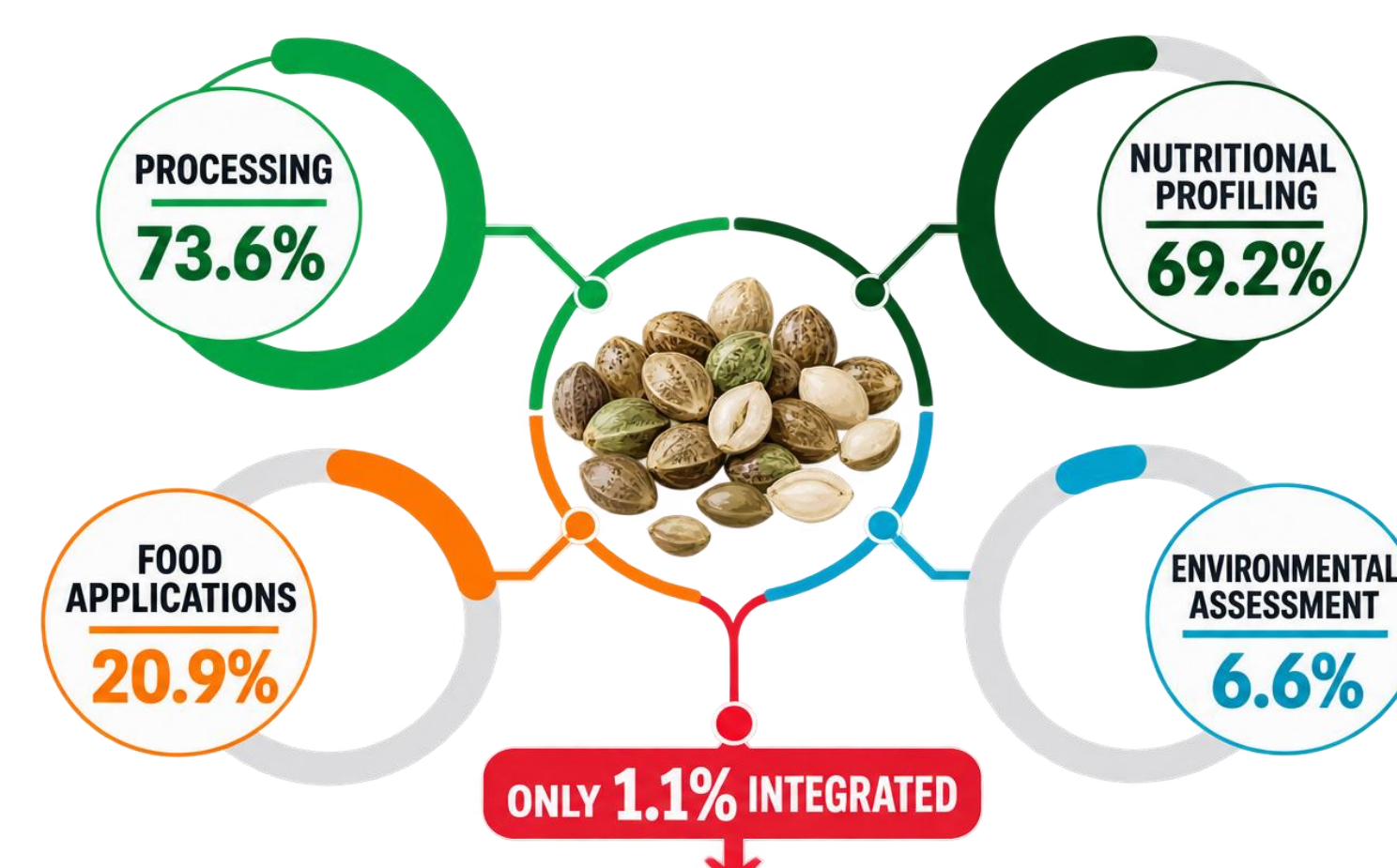
Identification of studies via databases and registers



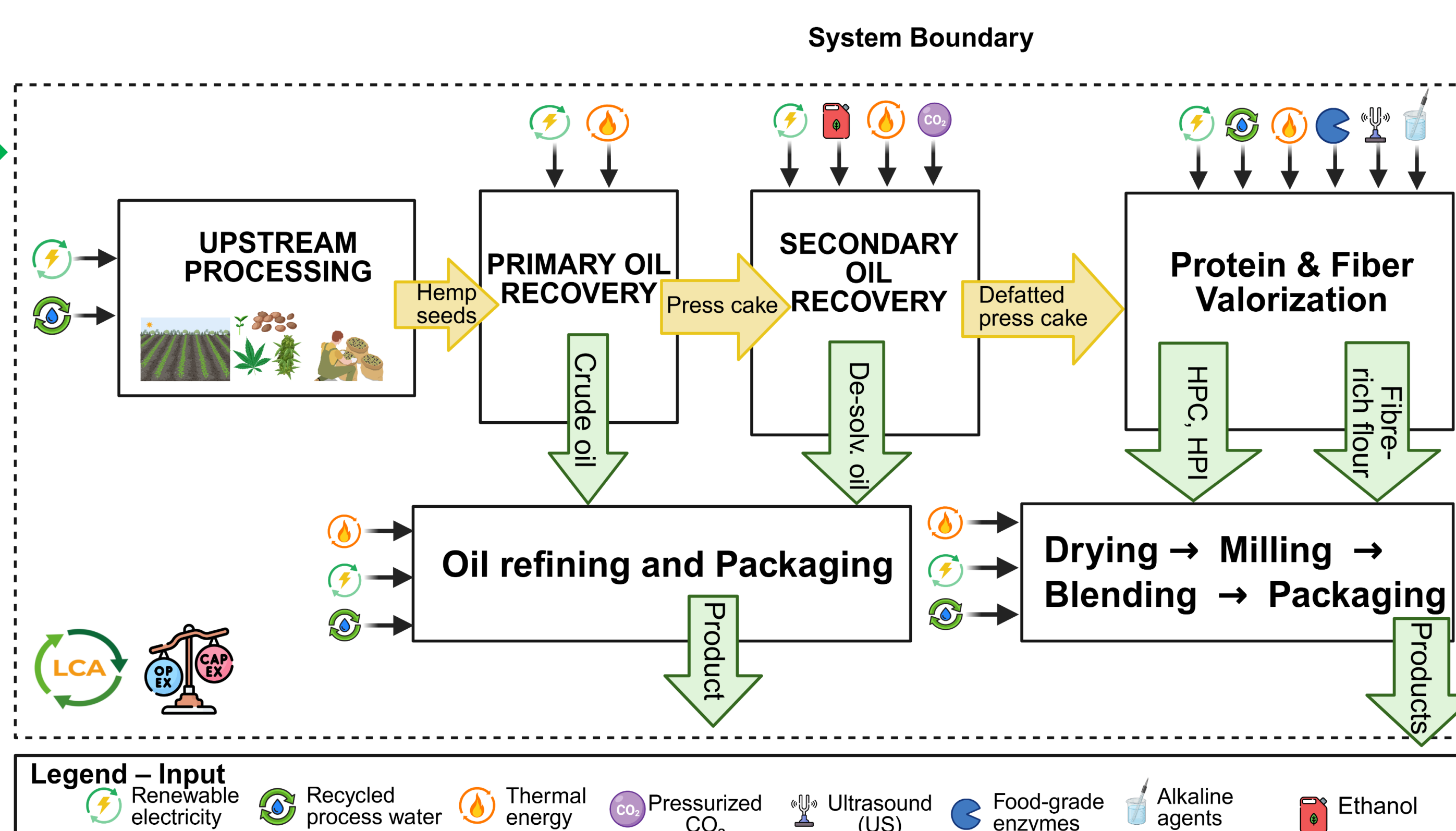
PRISMA 2020 flow diagram of the study-selection process.

Key findings

The evidence reveals a clear research imbalance and limited integration across below areas.



Greater integration is needed to advance an edible-first biorefinery.

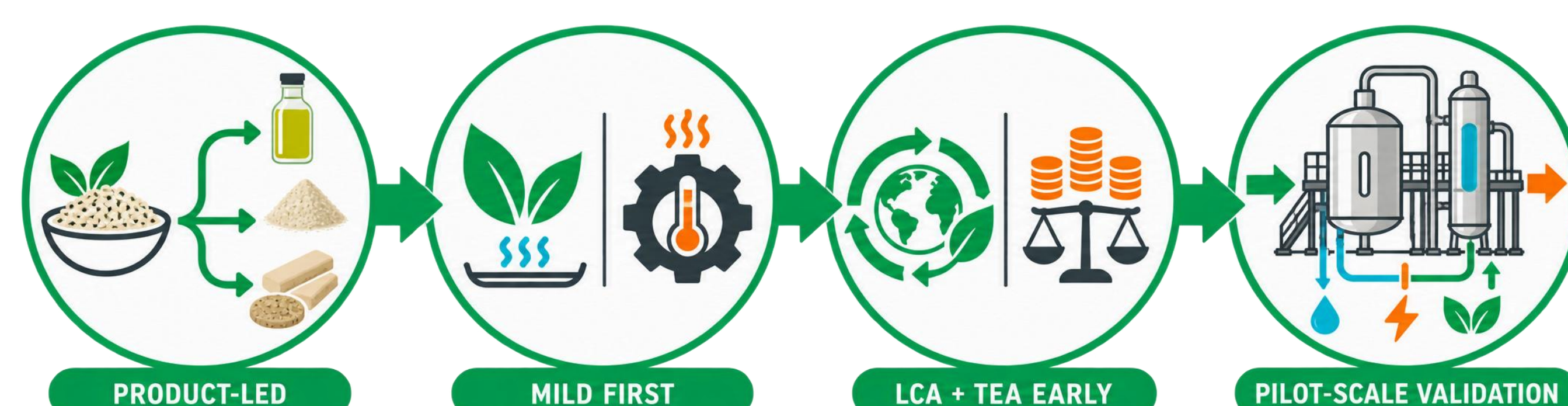


Proposed edible-first hempseed biorefinery framework.

The framework integrates sequential recovery of oil, protein, and fiber from hempseed within a multi-output system. It links resource-efficient processing and co-product valorization with environmental and techno-economic assessment to support circular, scalable food production.



Conclusion & Future Directions



- Final food-product requirements should guide processing decisions, supported by early sustainability assessment and pilot-scale validation.

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