organic substrates with reduced peat and added biochar have high carbon sequestration potential and can be reused as soil amendments. Biochar increases carbon content and cation exchange capacity, enabling a cascade use model—first as a cultivation substrate, then as a soil amendment (Vandecasteele et al., 2023b).

Looking ahead, the development of environmentally friendly substrates should be based on local resources (such as wood, crop residues, livestock manure, and sediments), combined with pretreatment and precise nutrient management. Attention should also be given to microbial community changes and pathogen risks during reuse. Achieving coordinated optimization in terms of physical structure, nutrient buffering capacity, and compatibility with precision fertigation systems will be essential for building efficient and low-environmental-impact greenhouse strawberry production systems.

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