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Phytophotonic Approach to Enhanced Photosynthesis

Stanford researchers have shown how to use fluorescent and phosphorescent materials to provide plants with photons in the photosynthetically active radiation (PAR) range for increased crop yields and CO_2 fixation. While genetically modifying plants with enhanced photosynthetic efficiency in a scalable manner has proven difficult, tailoring resources plants need is much easier. This invention increases the amount of PAR photons plants receive through a two-pronged approach: a) fluorescent down-conversion materials and 2) phosphorescent materials. The former down converts UV photos to green wavelengths to better target unsaturated photoreceptors deeper within the canopy or individual leaves. The second approach utilizes phosphorescent materials to address periods without direct illumination and overcoming saturated photosystems. Energy absorbed by the phosphorescent materials are emitted on a time delay to help spread excess solar energy over time. These materials can be applied via thin films on bioreactor surfaces, greenhouse roofing, directly onto plant surfaces, or in the soil surrounding the plants.

Stage of Research

- Proof of concept

Applications

- **Bioprocessing: bioreactors, fuels, chemicals, etc.**
- Agriculture: increased crop yields and/or CO_2 sequestration
- Forestry: CO_2 sequestration

Advantages

- **Wider applicability via conversion to green light**

- Targeting and saturation of cells deeper in foliage and canopy

Publications

- Kunz et at. Energy & Environmental Science (2020) A Phytophotonic Approach to Enhanced Photosynthesis

Patents

- Published Application: WO2022067258

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