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Insights into the relationship between nitrogen assimilation and lipid accumulation in algae

Understanding the relationship between nitrogen assimilation and lipid accumulation in algae is pivotal for advancing biofuel production and developing sustainable biotechnological applications. Nitrogen availability is a key regulator of algal metabolism, influencing not only growth rates but also the partitioning of carbon flux toward lipid biosynthesis. Under nitrogen-replete conditions, algal cells prioritize protein synthesis and biomass accumulation. Conversely, nitrogen deprivation triggers a metabolic shift that suppresses protein synthesis and enhances carbon storage in the form of lipids, particularly triacylglycerols (TAGs). This review explores the biochemical and molecular mechanisms underlying nitrogen assimilation and its impact on lipid metabolism during algal growth. It highlights the roles of nitrogen transporters, key enzymes in the nitrogen assimilation pathway, and transcriptional regulators that mediate the metabolic switch. Additionally, the review discusses how environmental factors and cultivation strategies can modulate this relationship to optimize lipid yields for biofuel applications. Insights gained from this understanding will inform strain engineering and process optimization efforts aimed at improving the economic viability of algal biofuels.

Biography

Huiying Zhang has completed her PhD at the age of 27 years from Chongqing University and postdoctoral studies from Tsinghua University School of Environmental Science and Engineering. She is the Chinese expert representative of the Australasia Practical Zero Emissions Society. She has published more than 30 papers in the Chemical Engineering Journal, Science of the Total Environment, Algal Research and other reputed journals and has been serving as an editorial board member of repute. In the International Genetically Engineered Machine Competition, she won 3 gold awards, best hardware awards, best environmental bioremediation awards, and best sustainable development nomination award.