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ALGAL BIOFUEL : BIOLOGY AND APPLICATION

Qiang Wang
Institute of Hydrobiology, Chinese Academy of Sciences, China

Energy is a key issue for sustainable development of human society. Biomass and lipid, the accumulated products in microalgae through photosynthesis, have been extensively reported to be the most promising feedstock for future biofuel production, thus are considered as the basis for the third generation of biofuels. By using the model of oil-producing green alga strain *Chlorella sorokiniana*, we have been focusing on the basic biology, especially the energetic and signal transduction issues of microalgal biofuel related study for years, and discovered the signal transduction and energy balance mechanism of lipid biosynthesis in the organism. Based on our findings, a theory of Ca^{2+}-regulated photosynthesis of cyclic phosphorylation supplies ATP for nitrogen starvation-induced lipid biosynthesis was suggested, and a regulatory model of neutral lipid synthesis in green alga subjected to Nitrogen starvation was proposed accordingly. We further explored biological basis of the synergistic combination of biological $DeNO_x$ of industrial flue gases and algal biodiesel production, proved its industrial feasibility and put forward the algal bio-$DeNO_x$ Ver1.0 and its upgrade version algal bio-$DeNO_x$ Ver2.0, which provides for the first time a real possibility and applicability in algal biofuel-based bio-$DeNO_x$ for scaling up and practical industrial applications. Most recently, we aimed to establish an integrated technique for algal-based lipid production and bioremediation of biomass power plant wastes (i.e., ash and flue gas), we proposed the bio-$DeNO_x$ Ver3.0, by reusing the contaminants from biomass power plants to nourish the microalgae cultivation, a route for carbon-negative bioenergy production.

wangqiang@ihb.ac.cn