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Bioenergy 2020: Unlocking the limitaiton of wastewater on algal viability and biomass accumulation with phytohormone

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Wastewater has historically been seen as an efficient and economically alternative medium for microalgal biofuels, however, algae currently suffered from low viability and biomass productivity and required pretreatment of wastewater. Anaerobic digestion of kitchen waste (ADE-KW) was characterized as high ratio of nitrogen and phosphorus and contained ample bacteria inside. To optimize treatment methods, here, phosphate supplement, phytohormone GA3 addition and sterilization were individually or interactively employed to market biomass production of Chlorella SDEC-11 from ADEKW. Phosphate supplement slightly enhanced biomass production, had no impact on lipid accumulation, and trigged bacterial bloom. Compared to ADE-KW control, sterilized ADE-KW obtained less biomass, while GA3 increased biomass concentration by 1.8 times and improved lipid productivity to an equivalent level of BG11, without bacterial bloom occurring. GA3 also decreased the polyunsaturated carboxylic acid C18:3 to but 10% and matched the EN 14214 biodiesel standard. Considering the interactions between nutrient, phytohormone and sterilization, phosphate hindered the promotion of GA3 on algae in ADE-KW, concluding from less biomass when adding P and GA3 simultaneously than that in sole GA3 treatment. However, phosphate and GA3 synergistically facilitated algal growth in sterilized ADE-KW and obtained the very best biomass production. These results indicated that wastewater-borne bacteria benefited from nutrients supplemented, followed by competing with or negatively influencing on algae, which might be avoided by sterilization and be ignored by GA3 addition. Supported energy and nutrient consumption, the only addition of phytohormone was an appropriate, sustainable and economic treatment method for promoting algal growth in wastewater.

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