National Institute of Technology Rourkela

Synopsis Seminar

Seminar Title	: Integrating Microalgae in Hydroponic Systems for Yield Enhancement and Nutrient Recycling for Food-Water Nexus
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Venue	: BM Dept Seminar Hall (# 103)
Date and Time	: 01 Apr 2025 (03:00PM)
Abstract	: The growing global population and increasing food demand call for more sustainable and resource-efficient agricultural practices. Conventional farming faces limitations due to land scarcity, climate change, and declining soil and water quality. Hydroponics offers a solution by enabling high-efficiency, soilless cultivation however, challenges remain in nutrient waste management and yield optimization. This study explored two key strategies to address these issues: (a) nutrient recovery from hydroponic effluent using microalgae and (b) crop yield enhancement through microalgal co-cultivation or exopolysaccharide (EPS) application. Hydroponic effluent was used to cultivate a native microalgal consortium under mixotrophic conditions with low-cost carbon sources. Glucose and glycerol supplementation significantly improved biomass productivity (by up to 59%), nutrient removal (up to 72%), and lipid content (up to 70%). For crop enhancement, co-cultivation with spinach and basil revealed that lower algal inoculum with aeration improved plant biomass by 17&ndash18%. In contrast, higher inoculum densities reduced plant growth due to nutrient competition. EPS derived from *Spirulina* cultures further boosted yields, with spinach showing a 27% increase under normal conditions and up to 1.4-fold improvement under salinity stress, indicating enhanced stress tolerance. Biochemical markers such as proline, phenolics, and improved K•/Na• ratios supported this finding. Comparative analysis showed that EPS treatment was more effective than co-cultivation in promoting growth and pigment accumulation. Overall, the integration of microalgal EPS application and effluent reuse through mixotrophic microalgal cultivation offers a dual benefit: enhancing crop productivity and maximizing nutrient recovery, contributing to a more sustainable hydroponic farming system.