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Dairy effluent conversion into biofertilizer using tailor made microbial consortium

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Statement of the Problem: Dairy industry generates 3 m^3 of effluent per m^3 of processed milk which comes mostly from the cleaning process that uses fresh water. The effluent is nutrient rich and can cause environmental problem unless properly treated. The conventional treatment is tedious, energy intense, cost ineffective. Adopting this technology is a burden for the larger establishments and crippling for the small-scale installations. Hence technologies are sought to make the process of effluent treatment ecofriendly and economically viable.

Methodology & Theoretical Orientation: Tailor made consortium was developed for conversion of the nitrogenous waste in dairy effluent into ammonia. The process was carried out using biofilm bioreactors to ensure one-time bacterial charging with continued performance. The process was scaled to industrial scale (more than 5000 liters). The treated effluent was used for field trail and pot trial for cultivation of economic crops as per standard procedure.

Findings & Conclusion: Tailor made microbial consortium produced ammonia from dairy effluent at a rate of 1.66×10^{-4} mol s^{-1} within 1 hour of incubation in a biofilm bioreactor at 37 °C with highest production at 16th hours of incubation (56.81 mg/100 ml) demonstrating 95.7% ammonia production with 72.3% nitrate and a concomitant 33.2% phosphate reduction from an initial load of 32-270 ppm nitrate and 15-40 ppm phosphate, respectively with 82.55% BOD reduction in 16th hour, as compared with 66.6% in 48 hours through constructed wetlands. The treated effluent increased biomass in case of mung bean (Mb) and Sorghum Sudan grass; decreased root nodulation while enhanced seed yield with improved protein and carbohydrate content in Mb while providing protection from aphid infestation. This treated effluent significantly enhances the basal diameter and fiber yield in case of Ramie, a plant of immense economic value. It could also enhance production in case of potato, hence functioning as a biofertilizer. This approach enables the conversion of effluent into a byproduct of immense economic value hence making the process of dairy effluent treatment self-sustainable. The process was scalable from 1 liter to more than 5000 liters for treating actual dairy effluent with associated field trial.

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