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## Fuzzy Logic Assisted Hydroponic Growing Boxes in integrated bio-energy cycles

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In integrated bio-energy cycles, devoted to capitalize the use of cattle manure-derived-biomass for energy production, a bottleneck is represented by the costs related to the wastewater treatment. Off streams from cattle manure-derived-biomass anaerobic digestion for the production of biogas are rich in nitrates, at a quite high concentration (up to 2.5 g/Kg). These substances thus represent a potential source of nutrients for plants so much as their use as feed of hydroponic cultures is attracting an increasing interest. On the other hand, given their chemical and physical characteristics (chemical composition, pH), smart systems to manage the feed of both nutrients and light may allow hydroponic cultivation an indoor multiplane vertical development, increasing the number of plants growing per unit of land surface available. The scope of this work was to design a fuzzy logic assisted grow box for indoor, organic grade, hydroponic cultivation of officinal plants, fed with off streams cattle manure-derived-biomass anaerobic digestion. The realized fuzzy control system guarantees continuous conformity of the air inside the grow box to the desired values of temperature and moisture. A matrix of led lights, completely remote controlled, ensures the proper wavelength and intensity of plants irradiation. Two measurement stations, installed upstream and downstream of the growing box, allow monitoring of the air conditions.
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## Comparison of biofilm formation between non-pathogenic Listeria strains under different stress conditions

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Micro-organisms attach to surfaces and develop biofilms which are a concern in food and environmental safety. The main goal of the current study was to investigate the biofilm formation by six non-pathogenic Listeria strains under different stress conditions using a microplate assay. The effect of the weak biofilm forming non-pathogenic Listeria strains on the biofilm formation of a strong biofilm forming pathogenic Listeria strain (L. monocytogenes #8) was also examined. While L. innocua CCM4030 and L. seeligeri/welshimeri 292 showed same patterns of biofilm formation with just slightly increase of OD 595 when grown on 0.05 to 15 % NaCl concentrations, all the other strains have showed a continuously decreasing trend of OD 595. This study showed that in case of non-pathogenic Listeria strains, higher concentrations of NaCl do not present a stress condition that enhance the biofilm forming ability. Nonetheless the decrease of pH showed to be an inhibition effect for biofilm formation of all the non-pathogenic Listeria strains. Our results showed also that the weak biofilm forming non-pathogenic Listeria strains (L. innocua 2885 and L. innocua CCM4030) may overgrow the strong biofilm forming Listeria strain (L. monocytogenes #8) during biofilm formation. This phenomenon could be beneficial for the food industry, since L. innocua is not a human pathogenic bacterium.