Development of an effective bioprocess for fast production of enriched biocompost from municipal solid wastes

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Bioconversion of municipal solid waste (MSW) into useful organic material such as biocompost is of important for environmental protection and biofertilizer supply in the modern agriculture. In spite of rising interest to the production of organic-grade MSW compost, there are many unresolved problems in composting process technologies. These problems, including low quality because of incomplete maturation, presence of pathogenic microorganisms and presence of toxic materials such as heavy metals, cause this process to be uneconomic and inefficient. As composting is a self-heating, aerobic, solid-phase process driven by the microbiological decomposition of organic materials, the most important factor affecting the compost quality is kind and quantity of microorganisms present in the process. Therefore, identification and inoculation of these beneficial microorganisms could play an important role in improving the quality of the produced compost. So, the objectives of the present study was to identify bacterial and fungal strains effective in biocomposting process, evaluation of their enzyme activity for degradation, hydrolysis of solid wastes (SW) and application of these strains as a microbial cocktail for reduction of biocomposting process period in an open system at industrial scale. Bacterial and fungal strains isolated from biocomposting process in compost plant of Isfahan were identified using biochemical methodologies and *16srDNA* and *18SrDNA* genes sequencing. Finally, 3 *Aspergillus fumigates* and 11 *Thermoactinomyces intermedius, Geobacillus thermodenitrificans, Geobacillus sp., Bacillus licheniformis, Brevibacillus parabrevis, Brevibacillus formosus, Brevibacillus agri, Bordetella petrii, Aneurinibacillus migulanus,* and *Pseudoxanthomonas sp.* strains were identified. Qualitattive and quantitative evaluations of cellulose, xylanase, amylase, protease and lipase activities of the strains showed that the strains had different enzyme activity but totally they showed a high enzyme activities. So, these strains have the ability to degrade cellulosic and lignocellulosic compounds, starch, protein and lipids available in the composition of wastes. The growth conditions of the strains were optimized at fermentor level. To reduce the biocomposting process and enhance quality of the produced compost, the biomass of the strains were produced up to CFU= 10^7-10^8. The biomass of the strains and wood chips (as agent for increasing biocompost quality (1:3 w/w)) were used in biocomposting process in a statistical designing manner. During the process, sampling and product analysis were performed. The results showed that addition of the native microbial cocktail and wood chips could reduce the biocomposting process from 3 month (control) to 28 days. The quality of produced compost was evaluated based on analysis of moisture, pH, nitrogen and carbon content, C/N ratio, NH4/NO3, organic matters, nutrient elements, electricity conduction, heavy metals contents and plant yield index. The results showed that the produced compost has a good quality (enriched compost) and observe all national and international standard indexes. In addition, the produced compost showed siderophore production and PGPR characteristics. Finally, microbial diversity and community during the process was evaluated by a PCR and DGGE electrophoresis techniques. The metagenomic survey showed that there was significant differences in the microbial activity and genetic diversity between different the treatments.