Development of a Cleaning Vinegar Product from Fruit Waste

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The fruit waste is being openly disposed in an uncontrolled manner in most cases, which causes several environmental and socio-economic issues in Sri Lanka. Direct resource recovery is also unsafe due to higher microbial and enzymatic activities in the rotten fruits. Hence, a study was conducted to produce a cleaning vinegar product using fruit waste through anaerobic and oxidative fermentation processes. A mixture of rotten fruits was prepared into a 1:4 water-pulp mash and incubated at 70 °C for 24 hours for higher sugar extraction. Subsequently, alcohol fermentation was performed at 30 ^{o}C using bakery yeasts (*Saccharomyces cerevisiae*) in a developed prototype anaerobic fermenter. The alcoholic fermented product was then physically separated and acetic fermentation was carried out at ambient temperature in a developed bio-tower using an acetic bacteria strain inoculated from unpasteurized coconut toddy vinegar. The optimum alcohol yield percentage (v/v) reached within four days and subsequent acetic acid fermentation in the bio-tower yielded optimum titratable acidity as acetic acid within seven days. Finally, it resulted in vinegar with a titratable acidity of 53.4 g/L, ethanol concentration of 1.9% (v/v), Brix value of 3.2% and pH of 3.27. The developed vinegar product is good for grease removal, removing of rust on iron, removing of calcium salt deposited in ceramics and tile cleaning. The developed reactors can be up-scaled for large scale production. This product is bio-degradable, thus environmentally friendly and potential for commercialization. It is very likely to be economically viable because the product is derived from wastes. In a life cycle perspective, it is less polluting and less toxic compared to commercially available similar products.

Key words: Anaerobic fermentation, Cleaning vinegar, Ethanol, Fruit waste, Oxidative fermentation