ABSTRACT

Environmental pollution like global warming is rising from the excess consumption of mineral fertilizers and is a serious disturbing factor. These chemical fertilizers also decrease soil holding capacity, causes imbalance of nutrients in soil and increases salinity. The present study focused on the sustainability analysis of anaerobically digested bio-fertilizers produced from large industrial-scale, bio-energy plant in Pakistan. Bio-fertilizers were assessed for their nutritional and heavy metals concentrations, environmental impacts and economic sustainability of converting organic waste into biogas and a highly valuable by-product called digestate. Three types of feed stocks slurries i.e. a) 100% pure cow-dung, b) 100% potato waste and c) 85% Cow dung+ 15% potato waste were examined. Results indicated that nitrogen, phosphorous and potassium (NPK) concentrations were in the order of cow-dung> cow-dung+ potato waste> potato waste digested slurries. For environmental sustainability, a functional unit of 2000 kg was selected and the relative life cycle assessment (LCA) of said feed stocks was further performed in six illustrative environmental impact categories i.e. Global warming potential (GWP), Acidification potential (AD), Eutrophication potential (EP), Ozone depletion potential (ODP), Human toxicity potential (HTP) and Freshwater eco-toxicity potential (FEP). It has resulted that pure cow dung digested slurry had highest savings in terms of Freshwater eco-toxicity as 0.005 kg CTU equivalent, Human toxicity as 0.015 kg TEP equivalent, Global warming potential as 0.3 kg CO_2 equivalent, Acidification potential as 1.03 kg SO_2 equivalent, Ozone depletion as 0.57 kg CFC equivalent, and slightly more eutrophication potential i.e. 0.04 kg PO_4 equivalent. An economic analysis in terms of financial indicators such as the net present value (NPV) of USD 97,313, 1.2 benefit / cost ratio (BCR), and 15.5 % internal rate of return (IRR) have made it quite significant. The current study will help in better understanding the benefits of organic fertilizers in terms of improved soil health with least environmental pollution.