



Energy Production from Sewage Sludge in a Proposed Wastewater Treatment Plant

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Abstract

The implemented technologies for sewage sludge processing are still very limited in Egypt. Unfortunately, dealing with the produced sludge is mainly given to the drying process through natural drying beds neglecting quality of the dried sludge. The undertaken work is devoted to provide a design proposal for a typical wastewater treatment plant suitable for the small communities on a very limited area of land compared to that required to construct the conventional treatment plant that serves the same population. The proposed sewage treatment plant is certainly beneficial in reducing the capital costs by 26%, in addition to about 20% reduction in the running costs. On the other hand, electricity generated from energy produced by anaerobic digestion of sewage sludge reduces the electrical power requirements from the main grid network to about 27% in the proposed wastewater treatment plant.

Keywords: Capital Costs; Electricity; Energy Production; Running Costs; Sewage Sludge Processing; Wastewater Treatment.

1. Introduction

Egypt faces great challenges due to the deficit in the balance of power and the gap between what is available and what is required for economic and social development. Therefore, it is necessary to seek non-conventional sources of energy and cost-appropriate, in the same context.

The sewage sludge production in Egypt is rapidly increasing due to the continuous growth of population, urban planning, expanding in construction of the infrastructure projects and the industrial developments. This sludge needs to be effectively treated and environmentally managed to reduce the negative impacts of its application or disposal [1, 2]. On the other hand, the Egyptian communities with high population density suffer from scarcity and limited land availability to accommodate new sewage treatment plants. Therefore, this problem creates a research challenge to optimize occupying the available land or more precisely reduce the land requirements for construction of new sewage treatment plants if available [3].

The implemented technologies for sewage sludge processing are still very limited in Egypt. Unfortunately, dealing with the produced sludge is mainly given to the drying process through natural drying beds neglecting quality of the dried sludge, in addition to disadvantages of the drying beds (i.e. large land requirements, stabilization of the sludge, and dealing with climate change conditions). Recently, there has been a great interest for the sewage sludge management because of the various and serious environmental impacts [1, 3-5]. The innovative sludge treatment methods focus on energy recovery, reuse of valuable products from sludge after eliminating the toxins, and acceptable running costs [4, 6].

The formation of sewage sludge is characterized by six groups of components: (1) nontoxic organic carbon compounds (approximately 60% on a dry basis), for a large part from biological origin, (2) nitrogen and phosphorous containing components, (3) toxic organic and inorganic pollutants, i.e., (a) heavy metals, such as Zn, Pb, Cu, Cr, Ni,

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