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Removal of Hydrogen Sulfide from Biogas by Using the Water Scrubbing Techniques

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ABSTRACT

Renewable energy is one of the most important sources of energy supply in the world. Biomass power plants produce biogas under anaerobic conditions by burying organic waste. Biogas is being produced in the Mashhad Recycling Industrial Complex. This fuel is for consumers in the biogas plant to generate electricity. In this study, we performed the removal of hydrogen sulfide using water-scrubbing techniques in the form of gravity and stairs from biogas. The results show that the removal value of hydrogen sulfide varied between 34 to 87 and the removal efficiency of hydrogen sulfide varied between 34 to 97%. In addition, the loading rate of hydrogen sulfide varied between 8.1 to 40.8 g/m^3.h. Moreover, the elimination capacity of hydrogen sulfide varied between 7.3 to 20.9 g/m^3. h. This investigation is a novelty for design and construction in water Scrubbing. Water scrubbing systems compared to similar examples have distinguishing features in the vertical and stepped arrangement and suction to separate the remaining gases by a vacuum pump. The most important feature is the gravitational force-displacement of the water pump to flow water. Therefore, fewer water pumps are used. In this case, energy consumption is reduced.

1. Introduction

1.1. Biogas properties

The biological digestion of organic matter under anaerobic conditions produces biogas [1, 2]. Depending on the chemical composition of the material, and the time and conditions of anaerobic digestion, the biogas produced will vary in terms of the percentage of gaseous composition [2-4]. Biogas contains methane, carbon dioxide, hydrogen sulfide, nitrogen, hydrogen, oxygen, ammonia, and a small number of other elements so various scientific articles have reported the amount of methane about 40-75%, the amount of carbon dioxide to be about 25-50% and the amount of hydrogen sulfide between 0-6 percent. [1-6]. Methane is the main substance in biogas, which is known as a source of clean new energy [1]. Hydrogen sulfide in biogas causes corrosion and wear in power generators, pumps, compressors, storage tanks, control valves, connecting pipes, and concrete and steel [1, 3, 7, 8]. Hydrogen sulfide biogas has adverse and harmful effects on the environment and health [9]. In combination with oxygen in the air, it produces sulfuric acid. Sulfuric acid reacts with water and causes corrosion [8]. Hydrogen sulfide produces sulfur dioxide by combustion [8, 9]. Sulfur dioxide has harmful effects on the environment [9]. Sulfur reacts with air vapor to cause acid rain [1]. In addition, hydrogen sulfide at 500 ppm can cause lung damage and death [10]. The presence of carbon dioxide and hydrogen sulfide is undesirable in many processes and currents. It is therefore important to remove them from the gas [11]. Various methods are used to separate the gas mixture. One of the most important methods is absorbed in the liquids [12]. One of the new methods of gas separation is the formation of gaseous hydrates. Hydrated gas crystals are made from host gas molecules and water [13]. Remove impurities from biogas with pressurized water using a biogas treatment method. In this method, pollutant compounds could be physically adsorbed or dissolved in a liquid solution. [14]. Biogas is similar to natural gas in physical and chemical properties [1].

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