Research Article

Journal of Chemistry Letters
journal homepage: www.jchemlett.com
ISSN (online):2717-1892

Green removal of hospital-medical wastes by designed integrated pyrolysis-incineration system

Ali Khani [a, b,]*, Hamed Rasulzade[b], Nazli Aqapur[b]

[a]*Department of Chemistry, Miyaneh Branch, Islamic Azad University, Miyaneh, Iran*
[b]*Taher shimi-e- Miyaneh Co., Miyaneh, Iran*

ARTICLE INFO

Article history:
Received 15 July 2020
Received in revised form 10 September 2020
Accepted 30 September 2020
Available online 1 October 2020

Keywords:
Nosocomial waste
Pyrolysis
Incinerator
Environment
Hydrocarbon

ABSTRACT

The main purpose of the present paper is to introduce the designed integrated pyrolysis-incinerator system for green removing the hospital-medical wastes (nosocomial wastes). The pyrolysis unit and incinerator are two main component of the system. The results showed that the wastes convert to a) valuable products such as hydrocarbons, non-condensable gases, carbon black and scrap metal and glass, b) the safe flue gasses according EU emission limit. In the incinerator section, only drug mixture including solutes, liquids and powders previously dissolved in water burn at temperature of 850-950 ºC. The some physical properties of the obtained hydrocarbons produced from pyrolysis unit such as density (in 15.6 ºC), flash point and pour point are 0.81 g.cm-^{3}, free and <-30 ºC , respectively.

1. Introduction

With the development of global health as a result of improving the economic situation and living standards of people, the growth rate of hospital and medical wastes is accelerating [1]. Therefore, these hazardous and special wastes must be properly managed. For selecting the most efficient treatment method of hospital waste, the composition analysis is generally considered to be the fundamental information. The combustible wastes constituted paper (16.17%), textiles (9.77%), cardboard, wood, and leaves (1.12%), food waste (21.5l %), and plastics (50.45%). The noncombustible waste included 0.40% metal and 0.57% glass [2].

The first and most important step for this purpose is to disinfect and sterilize them. As healthcare institutions search for methods to decrease costs associated with medical waste disposal, many are turning to the use of steam autoclaves [3], because it is more accessible and cheaper than incinerators. However, there are no national standards for challenging medical waste autoclaves and no guidelines for parameters of sterilization for medical waste. On the other, problems such as lack of isolation, steam exudation and high-energy consumption increase the importance of using other methods. Steam did not fully penetrate the load, and bacteria were not killed. Despite assurances from marketers of medical waste autoclaves, institutions considering this method must test autoclaves carefully to ensure safety and compliance with local health regulations. After even sterilizing, when the waste are disposed at dumpsites, they can also cause serious human health, environmental and atmospheric problems [3].

The next general method is to use incinerators. The only purpose of waste combustion systems is to process this waste into safe material while maintaining required legal conditions; for instance, flue gas temperature at the thermoreactor chamber outlet should be at least 1100 ºC (for hazardous wastes). It is worth designing systems that not only handle waste properly, but are also highly effective in using the recovered energy for other purposes. This is of crucial importance especially in the case of medical waste being fuel with high calorific value [4].

There are also many publications, which describe waste-heat management in urban or industrial areas [5]. However, the problems concerning gas emissions such as dioxin to the atmosphere from waste incineration are very important in point of human health and environment [6]. Another method that solves the problem of toxic gases emission is the use of plasma technology in incinerators. In this case, the produced temperature is very high and its technology is relatively complex and expensive.

* Corresponding author. Tel.: +989143238611; e-mail: a.khani59@yahoo.com