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COMBUSTION AND CO-COMBUSTION OF ALTERNATIVE FUELS

MSc Arkadiusz Szydełko

Supervisor: Prof. Wiesław Rybak, PhD, Eng.

Abstract

According to GUS data, 10.3 million tons of municipal waste were generated in Poland in 2014 and their quantity has been grown every year. The ban on storing waste with a net calorific value higher than 6 MJ / kg is valid in EU countries. The solution of this problem is to change the existing waste management system, i.e. through incineration at incineration plants. Another possible solution is to produce alternative fuels called solid recovery fuels (SRF), which can be co-combustion with conventional fuels. Alternative fuels, because of their high calorific value, significant quantity and wide availability, are valuable raw materials that can be used for energy production. Co-firing of coal with SRF in professional fossil fuels allows for reducing waste dumps and consequently reducing greenhouse gases by reducing methane emissions, reducing fossil fuel consumption, and meeting the requirements of EU directives. Because of a large number of power plants and an extensive district heating network in Poland there is high potential of the energetic management of municipal waste. Currently alternative fuels are practically used only in cement plants. Concerns about the use of alternative fuels in the energy sector stem from the lack of EU and local regulations on co-combustion of fossil fuels from the SRF, with few examples of installations being installed to co-incinerate them, as well as the lack of knowledge of the combustion and co-combustion of these fuels and the risks that may arise during their use. The current classification system for these fuels, which only considers the calorific value of the SRF and its chlorine and mercury content, is also insufficient as it does not ensure the homogeneity of the fuel composition and meets the quality standards required for CO_2 / RES clearance.

In the thesis of work is postulated that it is possible the energetic use of the SRF during co-combustion with fossil fuels. The main objective of the study is to learn about the combustion and co-combustion of alternative fuels with coal. The detailed aims relate to learning the processes that influenced on combustion: transport and comminution, increased formation of deposits on heating surfaces, increased emissions of pollutants, increased corrosion. One of the aims is also to try to improve the SRF classification method with consideration of the biomass content. The practical purpose of the work is to gather basic data useful for assessing the suitability of SRF for co-firing them in the power industry.

SRF fuels originated from different regions of Poland, characterized by different content of mercury, chlorine and caloric content, as well as hard coal, brown coal and sludge. Raw materials that are the main constituents of particular SRF fractions (mixed paper, cardboard and politetraethylene waste) and mixtures of alternative fuels with coal, were also tested.

Based on the research, it has been found that SRF fuels have very different physicochemical properties, so the SRF combustion mechanism is complex and complicating, involving a multi-stage degassing process with complex chemical kinetics and burning of coke residue. Using of municipal waste can increase the risk of sediment formation due to the presence of a large amount of sodium and potassium –containing mineral substances that affect the reduction of the ash melting temperature. Use of SRF can increase potential fire and explosion hazards during storage, transport, grinding and grinding with coal. Due to the increased content of chlorine compounds in alternative fuels, their co-firing may increase the risk of corrosion. This can be countered by the use of minerals tested in the workplace such as haloisite, kaolin, dolomite, limestone, sludge.

An important issue of work was the evaluation of the biodegradable fraction of SRF, and due to the ambiguity of the results obtained by the normative methods, a new, much more accurate, cheaper and more accessible method for the determination of biodegradable fractions and fractions of plastics in alternative fuels was proposed. It relayed on the degassing of the fuel sample under a nitrogen atmosphere. These studies have shown that an important parameter influencing on the quality of the fuel is the biomass content. Therefore, was suggested that this parameter should be determine during classifying of the SRF (apart from calorific value, mercury and chlorine levels).

On the basis of the research, it is possible to co-incinerate SRF with coal without causing any risk to boiler operation with a share of no more than 10% of SRF content.

Arkadiusz Szydełko