ПРИЛОЖЕНИЕ НА ПИРОЛИЗНО МАСЛО В РЕАЛНИ УСЛОВИЯ

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APPLICATION OF PIROLYSIS OIL IN REAL CONDITIONS

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ABSTRACT

In recent years, approximately 15 million tonnes of post consumer plastic waste is generated throughout Europe each year, while in the United State 20 million tonnes of waste is generated. In general, plastic waste has been mainly disposed of by landfill or incineration, but these processes are not fully acceptable under current international policy, which focuses on efficient recovery of raw material and energy. Pyrolysis and gasification processes are promising routes for optimal upgrading from waste. Moreover, pyrolysis of plastic mixture or protected vulcanizates, based on the decomposition of polymers and rubbers at different temperatures, allow the treatment of the last with simultaneous decomposition and separation. These processes allow the obtainment of combustible, gases and/or energy, with the reduction of land filling as an added advantage.

***Key words**: waste tire, thermal cracking, oil*

INTRODUCTION

In recent years, approximately 15 million tonnes of post consumer plastic waste is generated throughout Europe each year, while in the United State 20 million tonnes of waste is generated [3]. In general, plastic waste has been mainly disposed of by landfill or incineration, but these processes are not fully acceptable under current international policy, which focuses on efficient recovery of raw material and energy. Pyrolysis and gasification processes are promising routes for optimal upgrading from waste. Moreover, pyrolysis of plastic mixture, based on the decomposition of polymers at different temperatures, allows the treatment of polymers with simultaneous decomposition and separation [2,3]. These processes allow the obtainment of combustible, gases and/or energy, with the reduction of land filling as an added advantage [4].The first step for a suitable design of any pyrolysis reactor is knowledge of the kinetics.

Thermogravimetric analysis (TGA) is widely considered as a useful technique to study solid decomposition processes, including their kinetic. The information that can be obtained from this technique can be useful for the design of reactor where the thermal decomposition of the solid takes place [5,6]. The mechanism of thermal degradation of waste plastic is very complex and includes, amongst others, the following reactions: chain fission, radical recombination, carbon–hydrogen bond fission, hydrogen abstraction, mild-chain β- scision, radial addition, etc. [7,8] .

In some cases, sources of waste may generate a single type of plastic waste, but in the majority of cases, the plastic will be a mixture of types. Obviously, this fact implies an additional complication, and for this motive there are many studies on the pyrolysis of individual single types of plastic, simple plastic mixtures, mixed-plastic waste, and also copyrolysis of wood biomass and synthetic polymer mixtures [1,4].

Waste management is an important issue in both developed and developing countries nowadays [1–5]. Organic wastes, such as used rubber [6,7] and plastic [8–10] are among the waste materials that represent problematic wastes on one hand and valuable potential as secondary raw materials on the other hand. To alleviate part of our energy crisis and environmental degradation, it has become imperative to make use of appropriate technologies for recovery of resources from non-conventional sources like organic waste. As the general trend is to limit landfill sites, the disposal alternatives left for organic waste will be incineration and recycling. Incineration may utilize the energy content of organic waste but is associated with the generation of SO_2, NOx and other hazardous emissions. The problems that occurred in the earlier recycling technologies based on pyrolysis and gasification are such as low gas productivity and the wide spectrum of products. These problems are difficult to overcome due to only limited control of the product composition in pyrolysis and gasification processes. Thermal plasma technology has been under active development for a long time [11]. The technology is now well established in metallurgical processing, materials synthesis etc. [12]. The extremely high temperatures generated by plasma torches have spurred development of their application to waste processing, as they are capable of significantly decreasing the waste volume to a non-leachable residue. By far the most important application of thermal plasma waste treatment is focused on the destruction of hazardous wastes [13] rather than recycling because of economic issues. Nevertheless, in recent years, the interest in energy and resource recovery from waste has grown significantly, and substantial research about the use of plasmas in organic waste treatment has been conducted. A review of the progress is presented in this paper. Because the progress of plasma pyrolysis technology is heavily dependent upon the availability of appropriate plasma generating devices, a brief discussion is also included on this topic.

Attempts to improve polymer–asphalt compatibility through addition of oils [1] or chemical modification of the asphalt binder have been reported in the literature [2].

Mixtures containing different types of polyolefins become softer in the presence of 5–30 wt.% oils in asphalt [1]. On the other hand, there are two types of residual pyrolytic oils, H09 and H18, available from the vacuum pyrolysis process of used tires. H09 is the heaviest cut of the vacuum pyrolysis process, which contains a high level of carbon black (10%) while H18 oil contains 1.8%. The process generates pyrolytic carbon black which can be totally separated from the pyrolysis oil. This pyrolytic carbon black is already used to modify asphalt [3]. Ciochina [4] and Chaala et al. [5] used both H09 and H18 along with some other pyrolytic oils to modify asphalt. They found that, depending on the type of asphalt, adding up to 10% of H18 to asphalt results in a decrease of the freezing point of the mixture due to the very low freezing point of H_{18}. However, they reported that for concentrations higher than 10%, the resulting mixture possesses a higher freezing point. Asphalt mixtures containing 5–10% of H18 are expected to result in materials with enhanced overall properties [6].

MATERIALS AND METHODS

The aim of these investigations is to study the effect of pirolysis oil as additive from one hand and from another to decrease cost price of boiler fuel.

We decided to investigate a possibility for applying obtained pirolysis oil as additive in boiler fuel on the base of provided laboratory investigations and literature data.

It must be noticed that the influence of pirolysis oil was investigated in industrial conditions. The corresponding researches were done in Rubber Products Plant – Yambol on the real working kettle aggregate.

The investigations were conducted with three mixtures from boiler fuel and different percent additive. The physico-chemical properties of mixtures and method of mixing are given in [14, 15]. The kettle aggregate had been worked for 30 days. It were measured the emissions of CO, SO_2 as well as the CPA of the investigated boiler and it was calculated the coefficient – number of Baharah for the three mixtures each other. The summarized results are given in figures from 1 to 4.

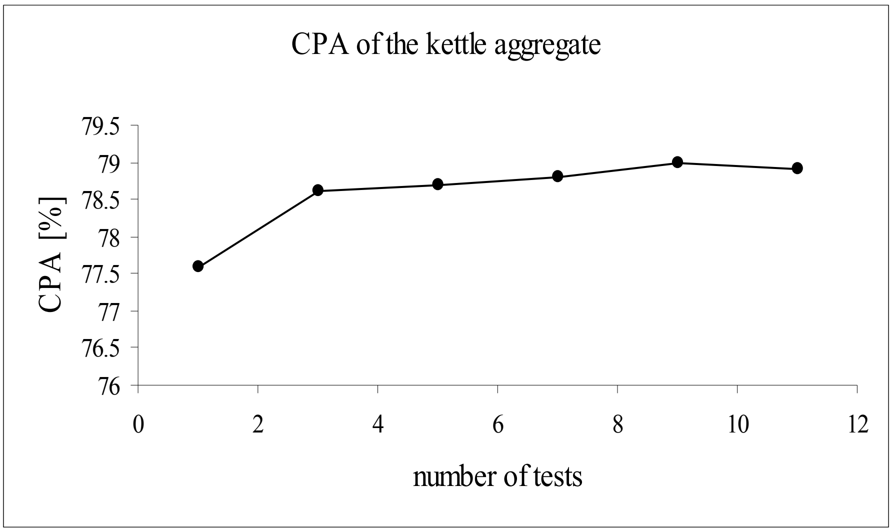

fig. 1. The changing of CPA of investigated kettle aggregate

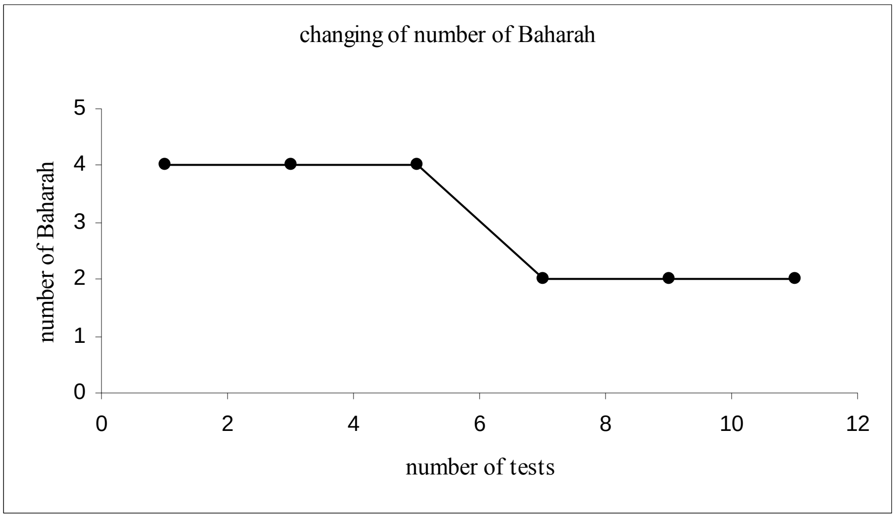

Fig.. 2. The changing of number of Baharah

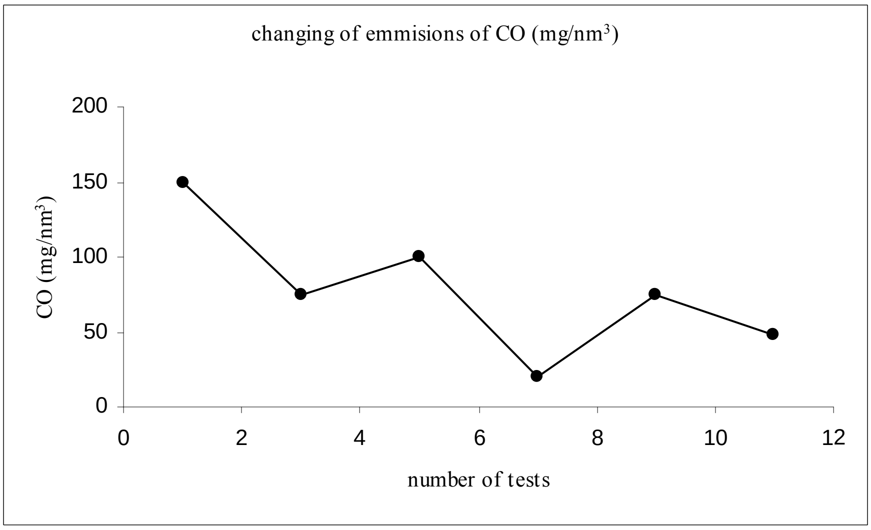

Fig .3. The changing of emissions of CO, mg/nm^3

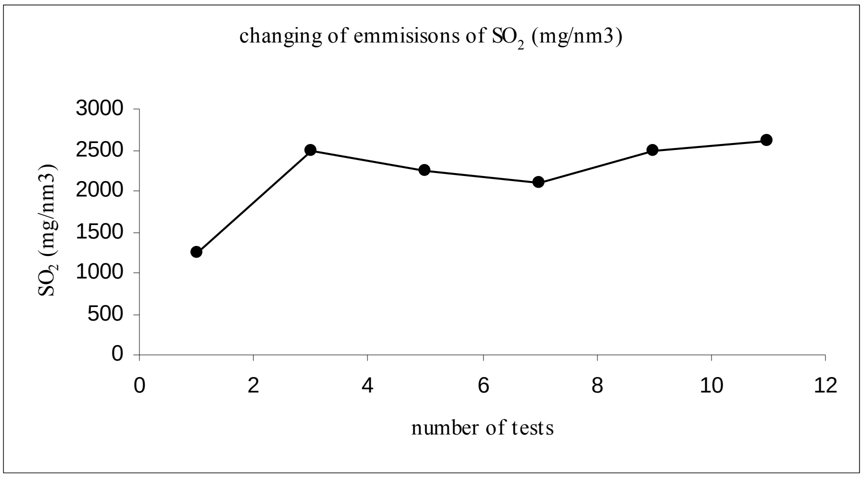

fig. 4. The changing of emissions of SO_2, mg/nm[3]

The presented experimental data and results show that after using of pyrolysis oil as additive for boiler fuel the CPA of kettle aggregate (fig.1) is increased as such as the emissions of SO_2 content (fig.4), but the number of Baharah (fig. 2) and the emissions of CO content (fig. 3) are decreased.

CONCLUSIONS

1. The increase of CPA as well as decrease of emissions from coke and CO as we established experimentally led to improving of burning process.
2. The obtained negative data for increasing of emissions of SO_2 may be explain with afterburning of accumulated before that deposits, which are sulphur-rich or different sulphur compounds.

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