Effect of Natural Zeolite on Flash Pyrolysis of Sewage Sludge

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Zeolites are aluminosilicate minerals with rigid, 3-dimensional crystalline structure consisting of a network of interconnected cavities. The framework aluminum and silicon are bound to each other through shared oxygen atoms. The SiO_4 units are neutral but the AlO_4 results in a net negative charge. This negative charge is balanced by mobile cations that are present during the formation.

Mobile cations and water molecules present in the structural framework of zeolite can be exchange to other cationic species, such as heavy metals in ion-exchange process. Another special aspect of this structure is that the pore and channel sizes are nearly uniform, allowing the crystal to act as a molecular sieve.

Many other applications of natural zeolites are known. Natural zeolites are used as catalysts for example during refining of crude oil. Pütün reported positive effect of natural zeolite on bio-oil yield during pyrolysis of cottonseed cake [1]. Miskolczi reported positive effects of clinoptilolite on composition of bio-oil and temperature of thermal degradation of polyethylene and polystyrene [2].

The zeolite under investigation in our study is a natural Slovakian zeolite clinoptilolite with empirical formula: $(Ca, K_2, Na_2, Mg)_4Al_8Si_{40}O_{96}.24H_2O$. Sludge used in our experiments was special treated dried excessive activated sludge from wastewater treatment plant Pardubice.

Effect of this natural zeolite on flash pyrolysis of sewage sludge will be discussed in this presentation. The cracking mechanism of sewage sludge over natural catalyst clinoptilolite was investigated by TGA, TG-FTIR and pyrolysis GC-MS. Influence of dose and pretreatment procedures of natural zeolite – as calcination and acidification on flash pyrolysis were also investigated.

References

1. E. Pütün, B.B. Uzun and A.E. Pütün. *Biomass Bioenergy*, 30 (2006) 592.
2. N. Miskolczi, L. Bartha and G. Deak. *Thermal degradation of polyethylene and polystyrene from the packaging industry over different catalysts into fuel-like feed stocks.* Thesis, 2005.