Abstract

Global food production is strongly dependent on the application of phosphate fertilizers, the production requires apatite – a primary phosphate rock. Apatite is a non-renewable source of phosphorus, depletion of which estimated within the next 50 – 300 years. Sewage sludge is an important secondary source of phosphorus through recycling. Thermochemical methods pose one of the ways of recycling phosphorus from this source. For this diploma thesis, the hydrothermal carbonization of stabilized sewage sludge was monitored in the environments of distilled water, sulfuric acid solution and sodium hydroxide solution. The transport of phosphorus and heavy metals between the solid and liquid product of this treatment depending on the environmental conditions was monitored.

In all cases, the weight of the sewage sludge was reduced and parts of the organic matter were destroyed. The highest efficiency was achieved under alkaline conditions, where the weight was reduced by 44 % and the resulting solid product contained approximately 25 % of organic matter.

After neutral hydrothermal treatment, 91 % of the phosphorus remained in solid form, in which the other monitored elements also accumulated. The greatest release of phosphorus into the liquid phase occurred under acidic conditions when 62 % of the phosphorus was dissolved. However, during this process, a significant dissolution of heavy metals (especially Cr, Ni and Zn) also occurred. In alkaline conditions, 41 % of phosphorus was dissolved, although the other monitored elements were in the solution in low concentrations. The final concentration of phosphorus in the alkaline hydrolyzate was 973,75 mg/l, in the acid hydrolyzate 1420,50 mg/l and 110,19 mg/l in the neutral hydrolyzate.

Keywords: phosphorus recovery, sewage sludge, thermochemical methods