

1-3-3 石炭フライアッシュからの As, Se の溶出に対するカルシウム添加による溶出制御メカニズム

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Calcium Mechanism in Control Leaching of As and Se from Coal Fly Ash

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SUMMARY

Coal fly ash is a product of the combustion process in a coal-fired power plant. This process produces amounts of coal fly ash, which in fact contains As and Se. These trace elements could be leached out into the environment when contact with the rainfall after dumped into the landfill. Therefore, leaching of the trace elements in coal fly ash has to be controlled. This research provides information about what kind of calcium compound which effects to decreasing As and Se leaching concentration. Nine kinds of paper sludge ashes (PS ash 3, 4, 5, 6, 7, 8, 9, 10 and 11) have been tested into Fly Ash C (FA C). Based on ICP-AES measurement each paper sludge ash has the different effect in controlling these elements. In order to know the kind of calcium compound in paper sludge ashes which most affecting, thermal gravimetric (TG) and inductively coupled plasma (ICP-AES) have been used to determine percentage of CaO, CaCO₃ and Ca(OH)₂.

Keywords: Coal Fly Ash, Calcium, Arsenic, Selenium

[1] Introduction

Coal fly ash as a product of combustion process is contains trace elements which can be leached out after contact with rainfall then release to the water environment. As the coal burns, toxic pollutants such as arsenic (As) and selenium (Se) are transferred into the wastes [A. Baba, et al, 2010]. Arsenic (As) in water environmental divided into 2 types: reduce form in anaerobic condition called arsenite (As⁺³), oxidized form in aerobic condition called arsenate (As⁺⁵). Selenium (Se) dominant form selenite (Se⁴⁺) and selenate (Se⁶⁺) are released and transferred to fly ash through a physical in example volatilization during combustion process. If these element concentration in the water exceeds the environmental limit, it will be dangerous for the environment. Japanese government established an environmental quality standard to protect the environment. Related to the protection of human health, the permissible limit for As and Se is 0.1 mg/L and 10 mg/L. Then, related to environmental quality standard for water pollution the As and Se standard is 0.01 mg/L or less.

In purpose to prevent health hazard and living environment, leaching control of trace elements in coal fly ash necessary to do. F. Jiao (2011) said that calcium compound could control the leaching of trace element from coal fly ash.

[2] Experimental

a. Samples

Fly ash C (FA C) derived from a pulverized coal-fired power plant unit 2 electrostatic precipitators number 1. Each paper sludge ash was added into FA-C with the amount 10% of the total sample. Ca(OH)₂ 3% of total sample added into FA C to compare the effect of Ca concentration in each paper sludge ashes.

b. Leaching test

Leaching test for trace elements

Leaching test for this experiment based on the procedure of standard leaching test for fly ash (notification No.13 by the Environmental Agency of Japan). As and Se concentration in filtrate were measured by ICP-AES.

Ethylene Glycol Leaching Method

Determination CaO in paper sludge ash with the combination of TG and ethylene glycol have been developed. Because, the ethylene glycol dissolves not only CaO but also Ca(OH)₂. Therefore this method has to follow by TG analysis. The content of CaO in a paper sludge is calculated from the amount of calcium determined by the EG method and Ca(OH)₂ obtained by TG.

[3] Result and discussion

a. Effect of additive into trace element leaching concentration and leached pH value

Addition of paper sludge ash can increase the pH value of leached and decreasing leaching concentration of trace elements in FA C as shown