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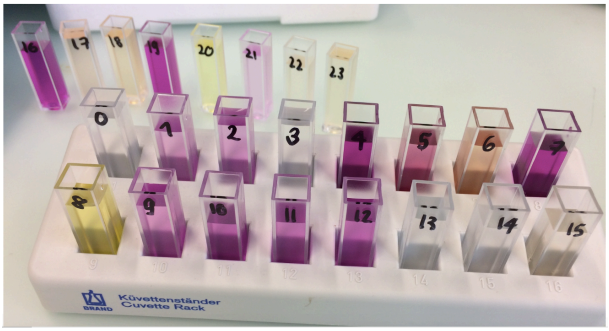
THE IMPACT OF WOOD ASH ON ACID FLY ASH LEACHING REGARDING HEAVY METAL RECOVERY AND CR(VI) REDUCTION

Wood ash is a very fine grained solid residue of wood incineration that arises at the flue gas cleaning system. It is often enriched in heavy metals and Cr(VI), depending on the amount of waste wood processed. In Switzerland, a total of 35'000t arise annually from the industrial combustion of wood. Wood ash is dumped on landfills, which may be problematic if the concentration of very mobile and toxic Cr(VI) and other environmentally harmful heavy metals like Cd, Pb, Cu and Zn are elevated. Especially wood ash arising from the combustion of waste wood (e.g. impregnated) yield heavy metal concentrations in the same range as MSWI fly ash, a similarly generated product from municipal solid waste incineration (MSWI). The FLUWA process, designed for leaching heavy metals from MSWI fly ash under acid and reducing conditions, represents a promising solution for treating wood ash prior to deposition in order to reduce Cr(VI) and deplete the ash in heavy metals. With the obligation for heavy metal recovery out of fly ash from 2021 onwards, the use of H_2O_2 might become mandatory, leading to oxidizing conditions during the FLUWA process, which is necessary for mobilizing the redox-sensitive elements Cu, Pb and Cd, but was assumed to suppress Cr(VI) reduction in wood ash.

In this study, the impacts of treating wood ash with the FLUWA process in terms of Cr(VI) reduction and heavy metal recovery is investigated. Wood and fly ash samples were collected at Energiezentrale Bern, an incineration plant where municipal solid waste and wood are combusted separately, but where the ashes are mixed at a ratio 2:1 in the FLUWA. For comparison, another wood ash sample from a biomass power plant was analyzed. Both water-extractable and total Cr(VI) were analyzed in wood ash samples and FLUWA-filter cakes. Together with a thorough chemical and mineralogical characterization, laboratory FLUWA simulations and on-site experiments were performed. The heavy metal recovery of wood ash FLUWA, where only wood ash is treated, was compared to fly ash FLUWA and the mixed FLUWA, as it is performed at Energiezentrale Bern. For better heavy metal recovery, H_2O_2 was used in second set of experiments.

The results show the strong need for Cr(VI) reduction prior to deposition of woodash, which showed average water-extractable Cr(VI) concentrations of 100 mg/kg (200x above threshold value!). Cr(VI) is successfully reduced during FLUWA at pH ≤ 5, even when H_2O_2 is used. During wood ash FLUWA, only Zn is mobilized and acid consumption was 3x higher than in the fly ash FLUWA. The addition of different dosages of H_2O_2 did not lead to significantly higher heavy metal recovery from wood ash due to the rapid H_2O_2 consumption by organic matter or metals in the metallic form.

As a conclusion, FLUWA represents a solution for treating wood ash, even under oxidizing conditions. A classification of all the Swiss wood ash types based on their chemical composition, especially TOC and heavy metal concentration is necessary to define the most efficient process for treating wood ash in the future. Since wood ash consumes a large amount of oxidizing agent, is suggested to either treat wood ash separately with the addition of a stronger oxidizing agent than H_2O_2 or to co-treat them with fly ash at a low ratio (≤ 2:1) and an increased H_2O_2 dosage for mobilizing Pb, Cu and Cd.



Cuvettes ready to measure with photospectrometric method. Notebthe different color than red-violet (e.g. Nr. 6 and Nr. 8 vs. Nr.9-12), the latter showing the expected red-violet color. Other colors are indications of Cr transitions reactions or interferences. Samples with Cr(VI) concentrations below detection limit remain colorless (e.g. Nr. 3)

Setup during on-site experiment: monitoring of pH, Eh, O2 during mixed (fly and wood ash) FLUWA with addition of H2O2

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