

**International Workshop on  
Environmental Aspects of Coal Ash Utilization**

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**Proposed Israeli Tests – Characterization and Compliance Tests, for  
Coal Ash**

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**Abstract**

*Introduction*

There is a variety of tests available for characterizing the leaching behavior of waste materials. These vary in test type, leaching aspects that are addressed, and the particular use for which the test is designed. Types of leaching tests include agitated extraction tests, serial batch tests, flow-through tests, flow-around tests, etc. These tests address different aspects of leaching, such as the physical mechanisms involved, chemical interactions between the waste and the leaching fluid, the kinetics of leaching, leaching as a function of time, Eh, pH, L/S (Liquid/Solid) ratio, etc. Some of the uses of leaching tests include regulatory purposes, scientific research, and environmental assessment [1].

Two tests are essential, the characterization test, which for coal ash, is mainly a leaching test at different pH's, and a compliance test which is the basis of acceptance for the different uses of the ash. While there can be only one characterization test, there may be different compliance tests according to the use of the ash.

The wide variety of tests used to assess environmental properties of materials has resulted in confusion which in turn has led to an evaluation of current practices and to an attempt of harmonizing the approaches across different fields.

*Harmonization of leaching/extraction tests*

In the framework of the Standards, Measurement and Testing Program (DGXII) of the European Community, a network for the Harmonisation of Leaching/Extraction tests [2, 3] has been established. The confusion, resulting from the wide variety of tests used to assess environmental properties of materials, has led to an evaluation of current practices and to an attempt of harmonising the approaches across different

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fields. One of the main concerns in relation to leaching test use and development is: there are too many leaching tests addressing largely the same question. One of the goals is: Development of cost efficient quality control systems through a hierarchy in testing.

We discuss the specific application of the characterization test (pH dependence test) and this compliance test (natural pH of the mixture of ash with water, liquid/solid ratio 10/1) to coal ashes, and why these tests are needed to accurately assess the release of contaminants into the environment.

*Advantages of characterization test (pH dependence test) [4]*

Identification of sensitivity of leaching to small pH changes

Provides information on pH conditions imposed by external influences and acid neutralization capacity information.

Recognition of factors controlling release

Basis for geochemical speciation modeling

Basis for comparison of international leaching tests

*Advantages of a compliance test which uses deionized water as the leachate (L/S = 10).*

It is closer to the real conditions than other tests, such as using acetic acid or a base.

The leaching data can be readily replicated in reasonable time and procedures.

It is the proposed method in the frame of European Waste Directive for determining the acceptance of a waste at each class of landfill, by fulfilling the criteria for the specific class.

It should be remembered that no test in the laboratory can duplicate the natural conditions.

*The proposed Israeli characterization for coal ash test*

It is a pH dependence test (pH stat) which is based on the European standard "Characterization of waste – Leaching behavior tests – Influence of pH on leaching with initial acid/base addition" CEN/TC 292, Version 1.3, March, 2003. The following are either small changes in the procedures or emphasize important points.

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There is no need to crush or grind the sample.

The sample will be of about 1.5 kg of dry ash.

The laboratory will be responsible for the preparation of representative test portions of 50 g samples (with a tolerance of 10%) with suitable sample splitters.

Since most of the ash samples have a high natural pH, or have components which can evaporate, care should be taken to have minimum contact with air to avoid carbonation or loss of a component during the preparation of the test samples

The dry residue of the test sample shall be determined on a separate test portion at  $105\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ .

The agitation device will be: end-over-end tumbler.

The first batch of tests will be carried out at a liquid to solid ratio (L/S) 10/1.

The temperature of the tests will be  $20\text{ }^{\circ}\text{C} \pm 5\text{ }^{\circ}\text{C}$ ; (the duration of the test is 48 hours).

The water used in the test shall have conductivity  $< 0.5\text{ mS/m}$ .

The first leaching test of this batch will be carried at the sample natural pH: 500 ml water/50 g sample. The temperature and pH will be measured once before and twice during (after 4h and after 24 h) and once again after agitation (after 28 h).

The other tests in this batch will be in the pH range 4 – 11 with 7 pH values including the natural pH (first duplicate).

The reagents will be according to CEN/TC 292 specifications

The preparation of the leachant shall be made according to CEN/TC 292

The following trace elements shall be determined in the eluant: Ag, As, B, Ba, Cd, Cr, Cu, Hg, Mn, Mo, Ni, Pb, Se, Th, U, V, Zn

There will be only one measurement of the pH between  $t_0+4\text{h}$  and  $t_0+48\text{h}$  at  $t_0+24\text{h}$ .

To test whether these small changes are critical, two coal ash samples will be sent to Dr. van der Sloot who will leach them according to the more elaborate test "PrEN 14997, pH dependence test".

The proposed Israeli compliance test

The test is based on the European standard test, EN 12457-2: Compliance test for leaching of granular waste materials and sludge. Part 2: One-stage batch test at a liquid to solid ratio of 10/1 for materials with a particle size below 4mm (with or

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without size reduction), prepared according to CEN TC/292 "Characterization of waste", January,2003.

There is no need to crush or grind the sample.

There minimum amount of solid required 100 gr.  $\pm$  5 gr. dry ashes.

The temperature of the test will be  $20^{\circ}\text{C} \pm 5^{\circ}\text{C}$ ; the duration of the test is 24 hours  $\pm$  0.5 hour.

The mass of the dry residue shall be determined at  $105^{\circ}\text{C} \pm 5^{\circ}\text{C}$ .

The agitation device will be, end-over-end tumbler (5 rpm -10 rpm) or roller-table including rotation of the bottle at about 10 rpm, for 24 hours  $\pm$  0.5 hour.

Most of the suspended solids will be settled after 15 min.  $\pm$  5 min.

Filtration will be through a filter with assize of  $0.45\ \mu\text{m}$ .

#### References

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