



Full length article

Advanced analyses of solid waste raw materials from cement plant using dual spectroscopy techniques towards co-processing

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HIGHLIGHTS

- The possibility of waste material co-processing within the cement plant.
- The use of LIBS and ICP-OES as an analyzing technique.
- Results suggest a new approach to be implemented for effective co-processing in cement.

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ABSTRACT

A tremendous amount of cement solid wastes from the cement plant still considered an environmental obstacle. The trend of co-processing widely accepted with the growing attention to the environment. On the spot and fast chemical analyses will provide tangible support to the decision maker to allow such an earlier mentioned material to go through co-processing and monitor the quality. In this study, modern chemical analysis methods were employed to assist the possibility of waste material co-processing within the cement plant. Real samples were collected from a cement plant in Egypt to validate and support the approach of co-processing. The samples were analyzed using two advanced techniques of Laser-induced breakdown spectroscopy (LIBS) and inductively coupled plasma optical emission spectrometry (ICP-OES). In this study, the results show that the composition of the collected samples contains the principal elements required for clinker and cement production. However, some heavy metals and other hazardous elements exist, but the concentration is below the accepted range of the specifications. In the present work, the ICP has used as a confirmation tool for the laser-induced breakdown simple analysis of cement raw materials. The results can suggest considering this approach implemented for effective co-processing in the cement plant. The combination of using LIBS analysis followed with ICP-OES offer very efficient approach suitable to provide enough information to decide on the cement solid waste materials to go through co-processing.

1. Introduction

The Egyptian cement market is known to be one of the biggest in the globe including twenty-one cement producers operate twenty-four plants. The cement industry is one of the most important economic drivers in Egypt's economy. Suez Cement Group of Companies (SCGC) is one of the oldest cement producers in Egypt. The company's five production facilities located in Suez, Kattameya, Torah, Helwan and El Minya. This study emphasis on the cement solid waste from Torah plant, solid waste here means the waste results during cement production only. The cement industry has enough chances to replace a portion of the virgin natural resources it uses with waste raw materials and by-products. These may be employed as raw materials, as

constituents of cement, depending on their properties. Alternative raw materials must meet the quality specifications in the same way as conventional raw materials [1]. However, the good practices should use as a procedure for co-processing standard. Calcium, silica, alumina, and iron must contain in the selected waste and by-products such as it can take part in raw materials in the kiln, replacing raw materials such as clay, shale, and limestone. These mentioned materials can be utilized with clinker to produce different types of cement. Fig. 1, illustrates examples of the feeding alternative raw materials [2–8].

1.1. Selection of co-processed raw materials

Water content or overall moisture content of alternative and

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