APPLICATION OF CALCIUM OXIDE WASTE FOR THE SYNTHESIS OF HIGHER BASISITY CALCIUM SILICATEHYDRATES (CaO/SiO_2 =1.5)

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The application of industrial wastes is a very challenging process because their chemical composition, as well as their chemical and physical properties, depend on the industrial process [1]. Calcium-containing industrial wastes are a promising source for the synthesis of calcium silicate hydrates, as they enable not only the reuse of waste material but also a decrease in CO_2 emissions due to the calcination of calcium carbonate [2]. One of the industrial wastes that has potential as a source of calcium is calcium oxide waste from sugar production. It is estimated that the amount of this waste is 5-6 mass percent of the amount of sugar produced [3]. To our knowledge, there is no information in the scientific literature regarding the application of this waste for the production of calcium silicate hydrates or calcium silicates, which are widely used in environmentally friendly technologies. Therefore, this work aimed to evaluate the potential for reusing calcium oxide-rich waste from the sugar industry for the hydrothermal synthesis of higher-basicity calcium silicate hydrates.

For the synthesis of calcium silicate hydrates, a mixture of quartz sand (98.5 wt% SiO_2) and calcium oxide-rich waste (91.8 wt% CaO) from sugar production was used. Quartz sand and waste were mixed to obtain a mixture with a molar ratio of CaO/SiO_2 equal to 1.5. The dry primary mixture was mixed with distilled water to reach a water-to-solid ratio of 10.0:1.0. The hydrothermal synthesis was carried out under saturated steam pressure at 200 °C, with reaction durations ranging from 0 to 72 hours.

It was determined that quartz and calcium oxide fully reacted after 4 hours of hydrothermal synthesis at 200 °C, resulting in the formation of anhydrous calcium silicate pavlovskyite ($Ca_8Si_5O_{18}$). The increase in synthesis duration led to the formation of a mixture of calcium silicates and calcium silicate hydrates consisting of xonotlite, kilchoanite, scawtite, and/or pavlovskyite. It was determined that the thermal stability of the synthesis products was strongly affected by the phase composition.

The obtained results showed that calcium oxide waste from sugar production can be used as a calcium source for the synthesis of calcium silicate hydrates.

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