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## Study on flotation tailings of Kaolinite-type pyrite when used as cement admixture and concrete admixture

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### Abstract

In Southwest China, the pyrite resources are very rich and the proven reserves of pyrite ranks first in the country. In the past 50 years of mining and processing, hundreds of millions of tons of tailings have been produced. However, the tailings have not been used effectively as yet, causing adverse effects to the local ecological environment. Therefore, according to the characteristics of the tailings, this article has studied on the pozzolanic activity of the tailings when used as cement admixture and the optimal amount of the tailings when used as concrete admixture. The results show that, being calcined on appropriate temperature and ground to certain fineness, the tailings will be provided with high pozzolanic activity. The activity index is up to 120%, so the tailings can be used as fine cement admixture and high-performance concrete admixture. The concrete will be provided with the highest compressive strength and still have good workability when the tailings replace cement for 20% by weight. The treatment method which gives a new approach for the efficient utilization of the tailings features simple production process, low energy consumption, no secondary pollution and high consumption of the tailings.

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**Keywords:** Kaolinite-type pyrite; Flotation tailings; Activity index; Cement admixture; Concrete admixture

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### 1. Introduction

In Southwest China, there is a large number of sedimentary pyrite resources which has been found at the border region of Sichuan, Yunnan and Guizhou [1,2]. The explored reserves which accounts for 30% of the countrywide

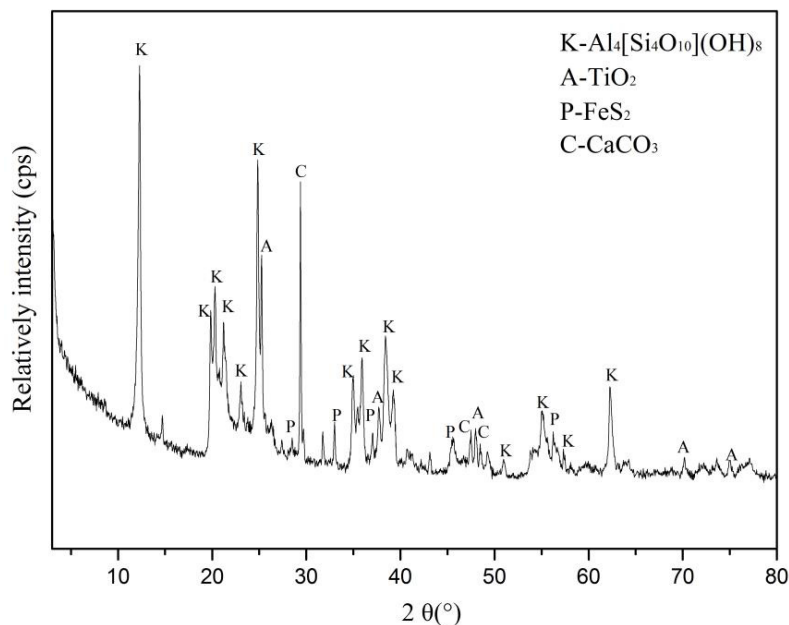
gross is no less than 6 billion tons. The pyrite occurs within the sedimentary kaolinite clay with the proportion that the pyrite is 25% to 30% and the kaolinite clay is 70% to 75%. After years of mining and processing, hundreds of millions of tons tailings which mainly consist of kaolinite have been produced. However, the tailings have not been used effectively as yet, occupying a lot of land and causing adverse effects to the local ecological environment. What's more, it's a waste of resources [3-7].

As research shows, kaolinite being calcined and ground will be provided with high pozzolanic activity and can be used as fine cement admixture and high-performance concrete admixture [8-12]. Due to the limited kaolin resources in China, using calcined kaolinite (metakaolin) as cement admixture and concrete admixture is costly and cannot get a certain resource support. However, the main mineral of the tailings is kaolinite. Both the iron oxide and the titanium oxide which contain in the tailings have tiny effects when the tailings are used as cement admixture and concrete admixture. Therefore, the tailings can be utilized directly without being purified and processed. Presently, the cement annual output of China is more than 2.4 billion tons which accounts for 60% of the world's total cement production. From all the foregoing, using the tailings as cement admixture and concrete admixture after calcined have got a huge market demand and can obtain both economic and environmental benefit.

## 2. Experiments

### 2.1 Raw materials

The cement used was Portland cement with the strength grade of 42.5 conforming to the Chinese National Standard GB175-1999. In all cement mortar experiments, the aggregates used were standard sands. In all concrete experiments, the coarse aggregates used were natural crushed stones with the size of 4.75-13.2mm and the fine aggregates used were natural river sands with fineness module of 2.5. By X-ray fluorescence analysis, the chemical compositions of the tailings used is shown in Table 1. Figs. 1 and 2 show the X-ray diffraction analysis of the primary tailings and the tailings calcined at 800°C for 0.5 hour and 1 hour, respectively.



**Fig. 1** XRD analysis of primary tailings.

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