CHAPTER TWO

LITERATURE REVIEW

Coarse aggregate is the strength skeleton of plain concrete. It is the structural unit with the highest strength, the smallest volume shrinkage, the lowest cost and the best durability in concrete (Beshr et al., 2003). As a composite material, the compressive strength, elastic modulus and crack resistance of concrete will increase with the increase of coarse aggregate content (Stock et al., 1979). Verian et al. (2018) summarized the potential and challenges in the process of replacing natural aggregates with recycled concrete aggregates. Some researchers found that recycled concrete aggregates can reduce the performance of concrete, while some researchers found that recycled concrete aggregates can improve the performance of concrete. Yan et al. (2022) found that when calcined nano-attapulgite content is 6 wt% and recycled coarse aggregate (RCA) replacement rate is 30 wt% and 50 wt%, and the strength increases by 13.2% and 16.1% compared with that without calcined nano-attapulgite. Moreover, recycled coarse aggregate accounts for 60% of all crushed concrete (Ulsen et al., 2019). Therefore, it is necessary to improve the preparation process of foamed concrete by adding coarse aggregate. On the one hand, the application of coarse aggregate in foamed concrete is to add lightweight coarse aggregate. For example, Wang et al., (2021a), Wang et al. (2021b) found that with the increase of foamed concrete density, the compressive strength and energy absorption capacity of ceramsite foamed concrete are significantly improved. Ibrahim et al. (2020) prepared a new type of lightweight coarse aggregate with a particle size of 10–20 mm. They found that when 25% lightweight coarse aggregate is added, the strength of foamed concrete can be improved more effectively. Due to the high density of RCA, it will sink during mixing with foamed concrete slurry, which greatly increases the difficulty of sample preparation (Osman et al., 2022). Therefore, conventional coarse aggregate can also be added by changing the preparation process, such as two-stage pouring method. Wu et al. (2015) used RCA in the preparation of foamed concrete through the two-stage pouring method and produced recycled brick aggregate foamed concrete block with dry density of 1637 kg/m^3. The above methods can improve the performance of foamed concrete to a certain extent, but there are also some shortcomings. For example, although lightweight coarse aggregate can improve the performance of foamed concrete, it does not touch the demand of recycling construction waste; while the two-stage pouring method often encounters problems such as heavy weight and difficulty in pouring quality control. In view of this, in order to realize the resource utilization of recycled aggregate from construction waste and meet the requirements for the preparation of foamed concrete, in this paper, a new preparation scheme for foamed concrete is proposed based on the technology of throwing and filling aggregate concrete (Shen et al., 2010). Some scholars have carried out some research on riprap aggregate concrete. For example, Shen et al. (2014) found that the use of riprap aggregate concrete technology can improve the compressive strength of test pieces and reduce the cement content by 20% for C30~C80 concrete. Xu et al. (2020) found that when the distribution-filling rate was 15%, the compressive strength of distributing-filling coarse aggregate concrete was increased by 11.6%–27.0% compared with ordinary concrete. Therefore, the method of dumping and filling coarse aggregate is beneficial to the improvement of concrete performance.

As for the influence of different factors on the performance of foamed concrete, scholars have also carried out some research. For example, Xiao et al. (2022b) found that with the increase of the replacement rate of recycled concrete, the compressive strength of foamed concrete gradually decreased, and the decreasing trend became larger. Zhang S et al. (2022) found that with the increase of foam content, the water absorption of foamed concrete materials increased linearly and the compressive strength decreased linearly. Oren et al. (2020) found that with the increase of water-binder ratio, the porosity of foamed concrete increased, which led to the reduction of compressive strength of foamed concrete and the increase of water absorption. Favaretto et al. (2017) found that when construction waste was used as fine aggregate, the compressive strength of foamed concrete with particle size of 1.18–4.75 mm was higher than that of 0.6–1.18 mm, but smaller than that of 0.6 mm. Through the above analysis, it can be found that water binder ratio, foam content, recycled aggregate gradation and foam content will have a certain degree of impact on the performance of foamed concrete materials.

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