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Influence of Vinyl acetate/ethylene Copolymer Powder on Secondary Efflorescence in Portland Cement-based Decorative Mortar

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Key words: Portland cement-based decorative mortar (PCDM); redispersible vinyl acetate/ ethylene copolymer powder (VAE); secondary efflorescence; alkalis leachability

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Test of alkalis leachability

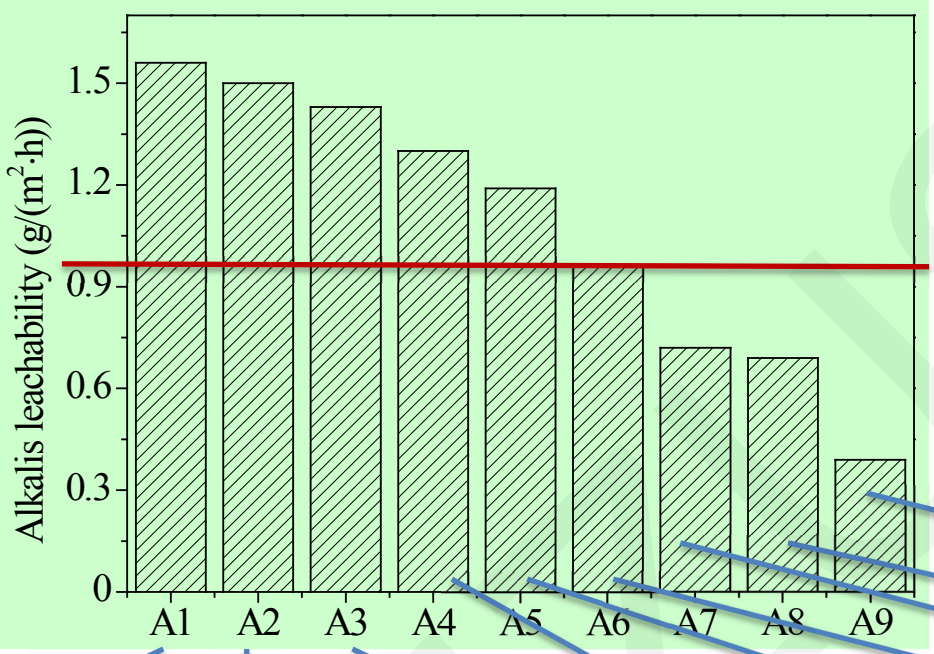
As shown in Fig.1, the upper surface of the cylinder specimen was exposed to de-ionized water (20 mL) with other surfaces sealed off. After immersion for 4 h, the water was completely collected and dried at (70±2)° C. Then the weight of the residue after being dried was used to calculate the alkalis leachability as follows (Ebrahim, 2012):

$$L_{a,s} = m/(A \cdot t)$$

$L_{a,s}$ is the alkalis leachability, g/(m^2·h);
m is the weight of the residue in water, g;
A is the immersion surface area of the specimens, m^2;
t is the immersion time, h.

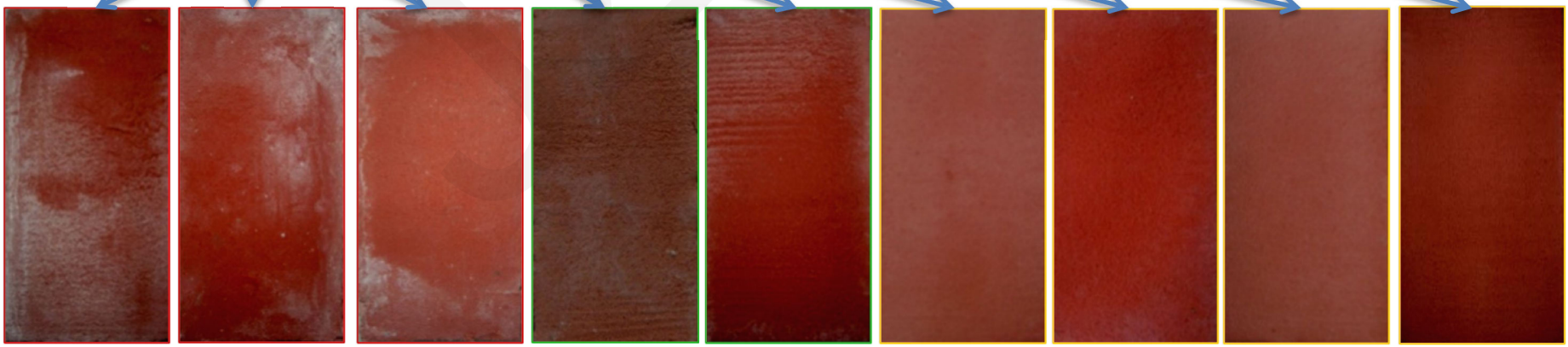


Relationship between secondary efflorescence and alkalis leachability



The alkalis leachability can be used to quantitatively evaluate the secondary efflorescence levels of PCDMs, with higher alkalis leachability value indicating a stronger secondary efflorescence trend.

With the alkalis leachability higher than 1 g/(m²·h), PCDMs will display visible secondary efflorescence.



Effect of VAE on secondary efflorescence

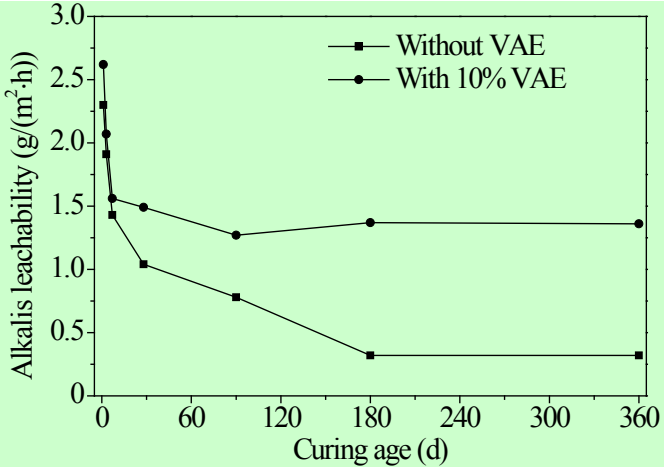


Fig. 5 The alkalis leachability of PCDMs

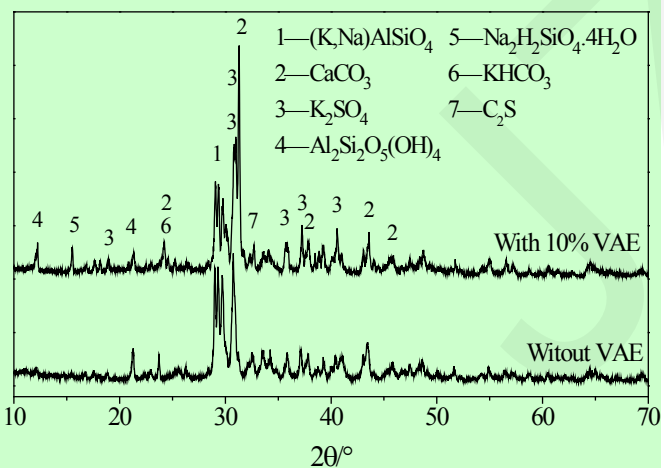


Fig. 6 XRD spectra of efflorescence substances

VAE promotes the secondary efflorescence of PCDM

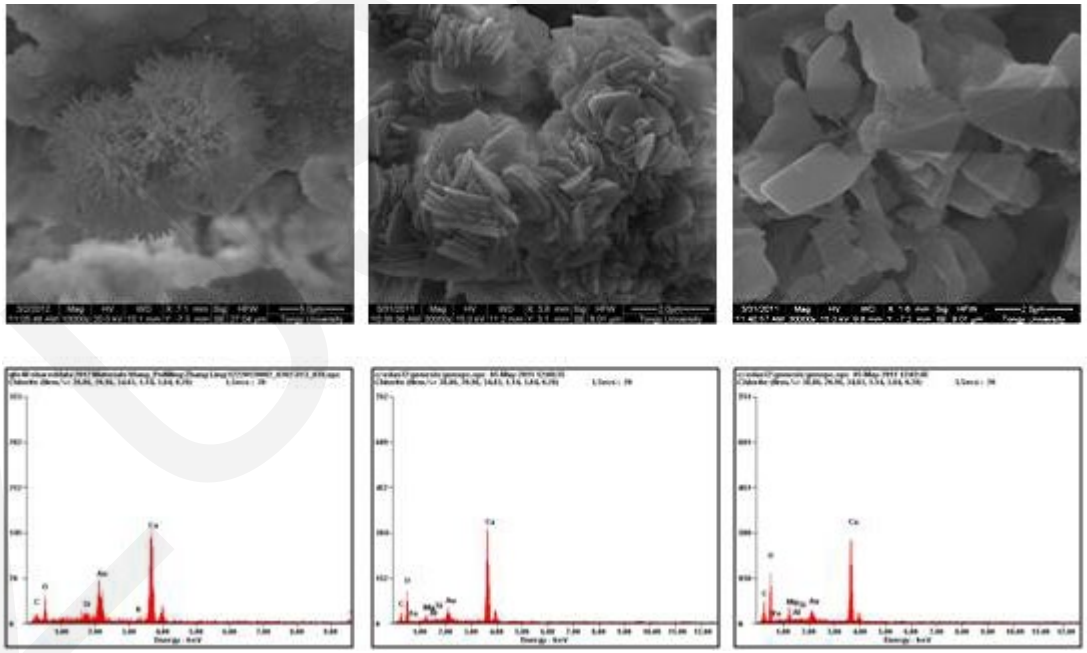
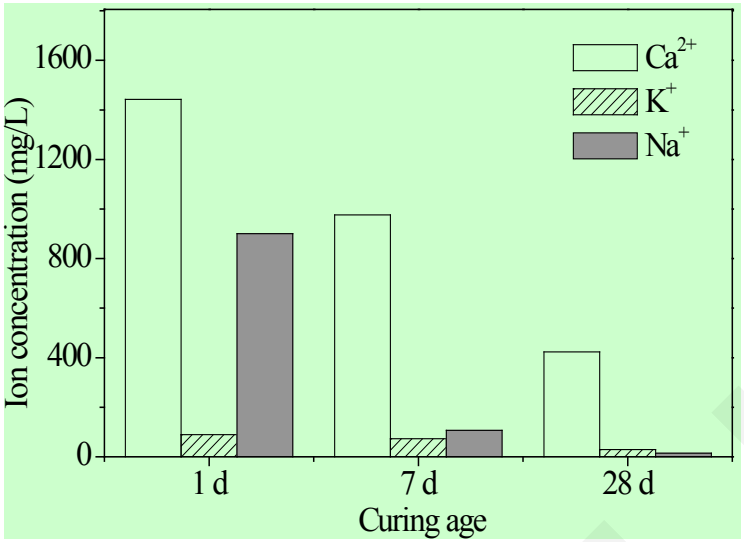


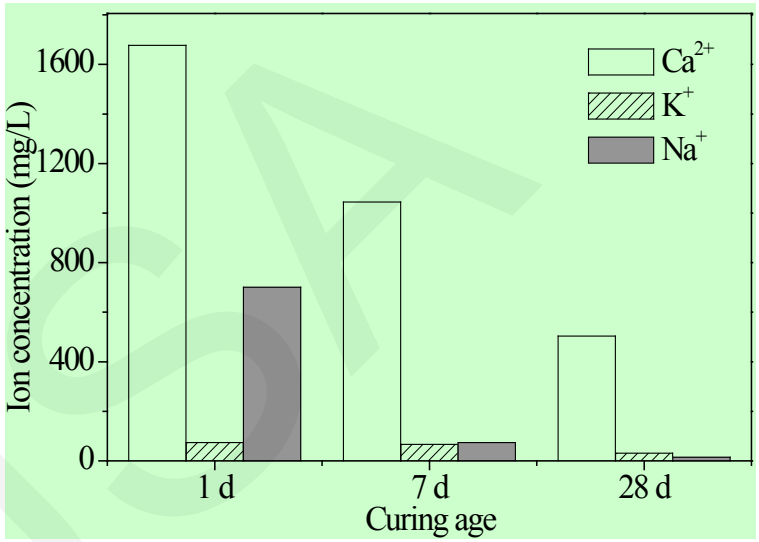
Fig. 8 Morphology and EDS analysis of secondary efflorescence particles

Alkalis ions including Ca^{2+}, K^+ and Na^+ are the main sources inducing secondary efflorescence for PCDM without or with VAE.

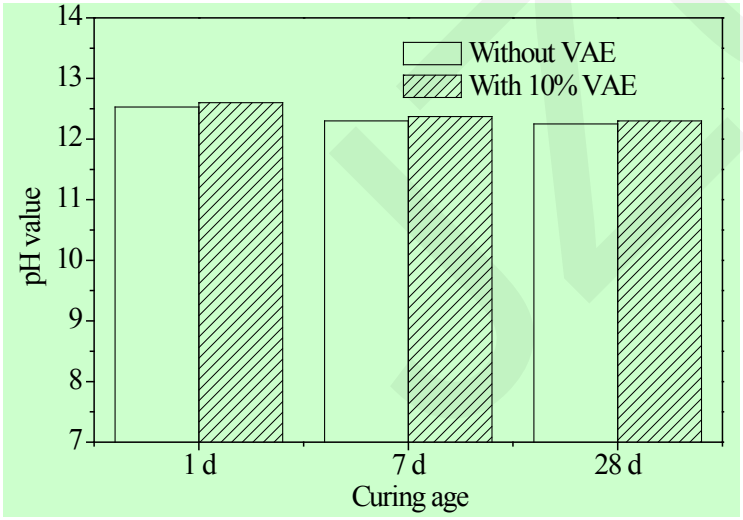
Content of soluble components inside PCDMs



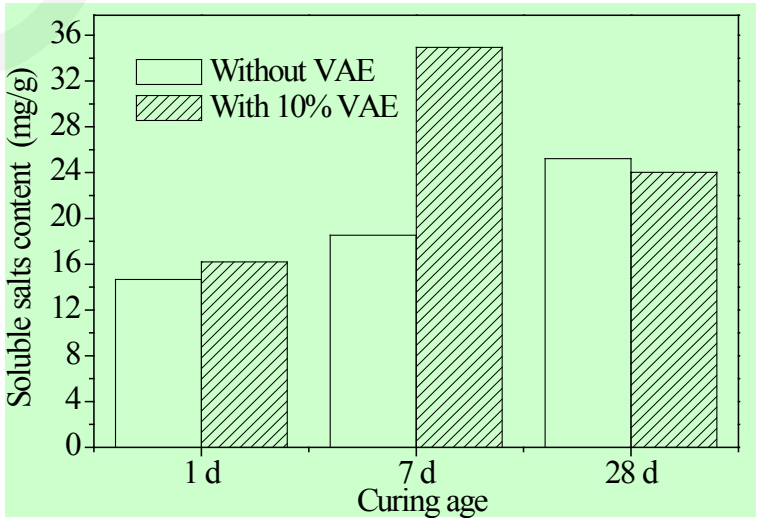
(a) Ions concentration in PCDM without VAE



(b) Ions concentration in PCDM with 10% VAE



(c) pH value



(d) content of soluble salts

☐ Results and conlusions

- The alkalis leachability can be used to quantitatively evaluate the secondary efflorescence levels of PCDMs, with higher alkalis leachability value indicating a stronger secondary efflorescence trend. With the alkalis leachability higher than 1 g/(m^2·h), PCDMs will display visible secondary efflorescence.
- Alkalis ions including Ca^{2+}, K^+ and Na^+ are the main sources inducing secondary efflorescence for PCDM without or with VAE.
- VAE increases the total contents of the Ca^{2+}, K^+ and Na^+ ions inside PCDM, promotes their mobility to the surface, improves the ability of pore water transmitting ions; and accordingly increases the alkalis leachability, and promotes the secondary efflorescence of PCDM.

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