IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 1, October 2022
Impact Factor: 6.252

Self-Healing Technology for Microbial Concrete: A Review

Rashmi S. Majgaonkar
P.G. Student, Department of Civil Engineering
Pankaj Laddad College of Engineering and Management, Buldhana, Maharashtra, India

Abstract: *Concrete is the most common material, crack is the main problem that arises in a concrete structure. This causes corrosion in the steel reinforcement. The structure deteriorates with cracks, so due attention is needed to this problem. This work consists of various self-medication methods used by researchers to inhibit cracks and prevent further deterioration of the structure. This article discusses the different types of bacteria used to heal cracks. The maximum strength increased, and the width of the crack healed using these methods, also mentioned in the article.*

Keywords: Self-healing, microbial concrete, micro structure and CaCO3 precipitation

REFERENCES

[1]. Y. Ç. Erşan, E. Hernandez-Sanabria, N. Boon and N. de Belie, "Enhanced crack closure performance of microbial mortar through nitrate reduction," Cement and Concrete Composites, vol. 70, pp. 159-170, 2016.
[2]. S. Mondal and A. (Dey) Ghosh, "Review on microbial induced calcite precipitation mechanisms leading to bacterial selection for microbial concrete," Construction and Building Materials, vol. 225, pp. 67-75, 2019.
[3]. Á. González, A. Parraguez, L. Corvalán, N. Correa, J. Castro, C. Stuckrath and M. González, "Evaluation of Portland and Pozzolanic cement on the self-healing of mortars with calcium lactate and bacteria," Construction and Building Materials, vol. 257, p. 119558, 2020.
[4]. Y. Ç. Erşan, H. Verbruggen, I. De Graeve, W. Verstraete, N. De Belie and N. Boon, "Nitrate reducing CaCO3 precipitating bacteria survive in mortar and inhibit steel corrosion," Cement and Concrete Research, vol. 83, pp. 19-30, 2016.
[5]. P. V. Yatish Reddy, B. Ramesh and L. Prem Kumar, "Influence of bacteria in self healing of concrete - a review," Materials Today: Proceedings, vol. 33, pp. 4212-4218, 2020.
[6]. Z. He, A. Shen, Y. Guo, Z. Lyu, D. Li, X. Qin, M. Zhao and Z. Wang, "Cement-based materials modified with superabsorbent polymers: A review," Construction and Building Materials, vol. 225, pp. 569-590, 2019.
[7]. M. S. Jafarnia, M. KhodadadSaryazdi and S. M. Moshtaghioun, "Use of bacteria for repairing cracks and improving properties of concrete containing limestone powder and natural zeolite," Construction and Building Materials, vol. 242, p. 118059, 2020.
[8]. P. Jongvivatsakul, K. Janprasit, P. Nuaklong, W. Pungrasmi and S. Likitlersuang, "Investigation of the crack healing performance in mortar using microbially induced calcium carbonate precipitation (MICP) method," Construction and Building Materials, vol. 212, pp. 737-744, 2019.
[9]. V. Wiktor and H. M. Jonkers, "Quantification of crack-healing in novel bacteria-based self-healing concrete," Cement and Concrete Composites, vol. 33, pp. 763-770, 2011.
[10]. B. Tayebani and D. Mostofinejad, "Self-healing bacterial mortar with improved chloride permeability and electrical resistance," Construction and Building Materials, vol. 208, pp. 75-86, 2019.
[11]. G. F. Huseien, K. W. Shah and A. R. M. Sam, "Sustainability of nanomaterials based self-healing concrete: An all-inclusive insight," Journal of Building Engineering, vol. 23, pp. 155-171, 2019.
[12]. P. Kumar Jogi and T. V. S. Vara Lakshmi, "Self healing concrete based on different bacteria: A review," Materials Today: Proceedings, vol. 43, pp. 1246-1252, 2021.
[13]. M. Rauf, W. Khaliq, R. A. Khushnood and I. Ahmed, "Comparative performance of different bacteria immobilized in natural fibers for self-healing in concrete," Construction and Building Materials, vol. 258, p. 119578, 2020.

IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 1, October 2022
Impact Factor: 6.252

[14]. H. Singh and R. Gupta, "Cellulose fiber as bacteria-carrier in mortar: Self-healing quantification using UPV," Journal of Building Engineering, vol. 28, p. 101090, 2020.

[15]. J. Zhang, Y. Liu, T. Feng, M. Zhou, L. Zhao, A. Zhou and Z. Li, "Immobilizing bacteria in expanded perlite for the crack self-healing in concrete," Construction and Building Materials, vol. 148, pp. 610-617, 2017.

[16]. H. Singh and R. Gupta, "Influence of cellulose fiber addition on self-healing and water permeability of concrete," Case Studies in Construction Materials, vol. 12, p. e00324, 2020.

[17]. H. M. Jonkers, A. Thijssen, G. Muyzer, O. Copuroglu and E. Schlangen, "Application of bacteria as self-healing agent for the development of sustainable concrete," Ecological Engineering, vol. 36, pp. 230-235, 2010.

[18]. N. P. Kaur, S. Majhi, N. K. Dhami and A. Mukherjee, "Healing fine cracks in concrete with bacterial cement for an advanced non-destructive monitoring," Construction and Building Materials, vol. 242, p. 118151, 2020.

[19]. J. Y. Wang, D. Snoeck, S. Van Vlierberghe, W. Verstraete and N. De Belie, "Application of hydrogel encapsulated carbonate precipitating bacteria for approaching a realistic self-healing in concrete," Construction and Building Materials, vol. 68, pp. 110-119, 2014.

[20]. N. Chahal, R. Siddique and A. Rajor, "Influence of bacteria on the compressive strength, water absorption and rapid chloride permeability of concrete incorporating silica fume," Construction and Building Materials, vol. 37, pp. 645-651, 2012.

[21]. Y. Ç. Erşan, F. B. Da Silva, N. Boon, W. Verstraete and N. De Belie, "Screening of bacteria and concrete compatible protection materials," Construction and Building Materials, vol. 88, pp. 196-203, 2015.

[22]. W. De Muynck, K. Cox, N. D. Belie and W. Verstraete, "Bacterial carbonate precipitation as an alternative surface treatment for concrete," Construction and Building Materials, vol. 22, pp. 875-885, 2008.

[23]. W. Khaliq and M. B. Ehsan, "Crack healing in concrete using various bio influenced self-healing techniques," Construction and Building Materials, vol. 102, pp. 349-357, 2016.

[24]. M. Luo, C.-x. Qian and R.-y. Li, "Factors affecting crack repairing capacity of bacteria-based self-healing concrete," Construction and Building Materials, vol. 87, pp. 1-7, 2015.

[25]. E. Tziviloglou, V. Wiktor, H. M. Jonkers and E. Schlangen, "Bacteria-based self-healing concrete to increase liquid tightness of cracks," Construction and Building Materials, vol. 122, pp. 118-125, 2016.

[26]. A. F. Alshalif, J. M. Irwan, N. Othman, A. A. Al-Gheethi, S. Shamsudin and I. M. Nasser, "Optimisation of carbon dioxide sequestration into bio-foamed concrete bricks pores using Bacillus tequilensis," Journal of CO2 Utilization, vol. 44, p. 101412, 2021.

[27]. J. Xu, Y. Tang, X. Wang, Z. Wang and W. Yao, "Application of ureolysis-based microbial CaCO3 precipitation in self-healing of concrete and inhibition of reinforcement corrosion," Construction and Building Materials, vol. 265, p. 120364, 2020.

[28]. R. Andalib, M. Z. Abd Majid, M. W. Hussin, M. Ponraj, A. Keyvanfar, J. Mirza and H.-S. Lee, "Optimum concentration of Bacillus megaterium for strengthening structural concrete," Construction and Building Materials, vol. 118, pp. 180-193, 2016.

[29]. W. De Muynck, D. Debrouwer, N. De Belie and W. Verstraete, "Bacterial carbonate precipitation improves the durability of cementitious materials," Cement and Concrete Research, vol. 38, pp. 1005-1014, 2008.

[30]. R. Siddique, K. Singh, Kunal, M. Singh, V. Corinaldesi and A. Rajor, "Properties of bacterial rice husk ash concrete," Construction and Building Materials, vol. 121, pp. 112-119, 2016.

[31]. C. Qian, H. Chen, L. Ren and M. Luo, "Self-healing of early age cracks in cement-based materials by mineralization of carbonic anhydrase microorganism," Frontiers in Microbiology, vol. 6, p. 1225, 2015.

[32]. A. R. Suleiman, A. J. Nelson and M. L. Nehdi, "Visualization and quantification of crack self-healing in cement-based materials incorporating different minerals," Cement and Concrete Composites, vol. 103, pp. 49-58, 2019.

[33]. R. A. Khushnood, Z. A. Qureshi, N. Shaheen and S. Ali, "Bio-mineralized self-healing recycled aggregate concrete for sustainable infrastructure," Science of The Total Environment, vol. 703, p. 135007, 2020.

[34]. G. Lefever, D. Snoeck, D. G. Aggelis, N. De Belie, S. Van Vlierberghe and D. Van Hemelrijck, "Evaluation

of the Self-Healing Ability of Mortar Mixtures Containing Superabsorbent Polymers and Nanosilica," Materials, vol. 13, 2020.

[35]. G. Olivier, R. Combrinck, M. Kayondo and W. P. Boshoff, "Combined effect of nano-silica, super absorbent polymers, and synthetic fibres on plastic shrinkage cracking in concrete," Construction and Building Materials, vol. 192, pp. 85-98, 2018.

[36]. M. Kayondo, R. Combrinck and W. P. Boshoff, "State-of-the-art review on plastic cracking of concrete," Construction and Building Materials, vol. 225, pp. 886-899, 2019.

[37]. A. Danish, M. A. Mosaberpanah and M. UsamaSalim, "Past and present techniques of self-healing in cementitious materials: A critical review on efficiency of implemented treatments," Journal of Materials Research and Technology, vol. 9, pp. 6883-6899, 2020.