The Utilization of Soybean as a Catalyst Material in Enzyme-Mediated Calcite Precipitation (EMCP) for Crack Healing Concrete

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The effect of using soybean as a catalyst in the Enzyme-Mediated Calcite Precipitation (EMCP) method of crack healing concrete is discussed in this research. The existence of cracks in concrete reduces its quality, therefore, there is the need for repair efforts and one of these is through injection using the EMCP method. This technique employs the plant-derived urease enzyme to catalyze the reaction between calcium chloride (CaCl2) and urea (CH4N2O) towards precipitating calcium carbonate (CaCO3). Its effectiveness was, however, evaluated using a test tube experiment, and the optimum combination of urease, urea, and calcium chloride was selected and used as the preliminary data for the soybean added as a catalyst. Meanwhile, the concrete samples were prepared in the form of 5 cm x 10 cm cylindrical concrete and the crack was made through Universal Testing Machine (UTM) with a controlled area observed to be in the range of ± 0.2-0.3 mm. The injection solution was added to the concrete using the percolation method up to the period the height of the solution was 5 mm above the concrete surface and this was conducted several times with the effect on the concrete cracks evaluated through permeability tests which were used as one of the concrete quality parameters. Moreover, the permeability coefficient value was found to be inversely proportional to the quality and this means a smaller value of the coefficient produced better concrete quality and vice versa. The results showed the total calcite formed in the sample after the 4th injection was 18.3% of the total surface area of the concrete crack and was able to reduce the concrete permeability value by 95.43%. This, therefore, means the use of soybean in the EMCP method is considered feasible to repair concrete cracks.

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