

Supplementary Figures

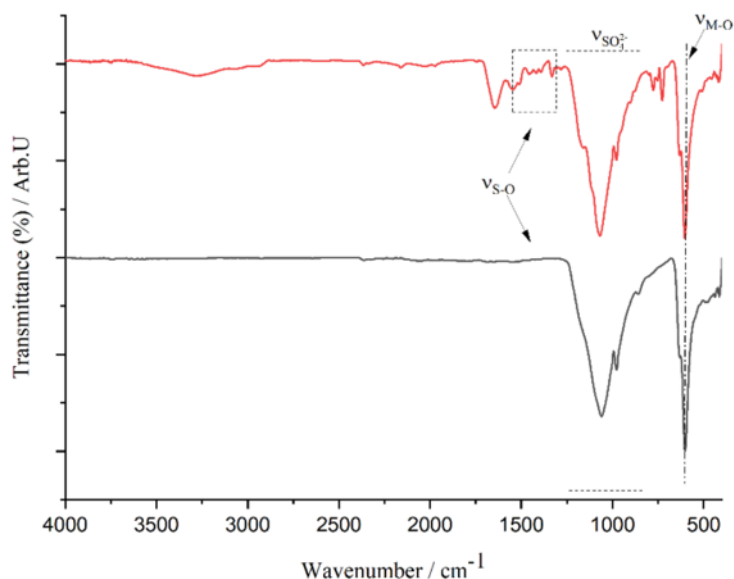


Fig. S1 Spectra of pigment P4 before and after burning, with P4 (red line) and P4 burnt (black line). This figure displays infrared spectra showing minimal structural changes after thermal treatment, except for the disappearance of inorganic sulfate S–O bands above 1100 cm^{-1} .

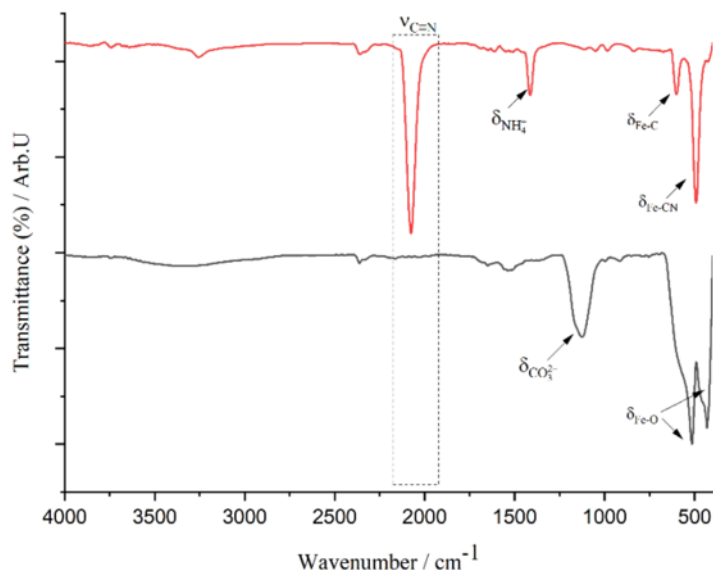


Fig. S2 Spectra of pigment P8 before and after burning, with P8 (red line) and P8 burnt (black line). This figure shows the infrared data for the pigment P8 where, after burning, the $\text{C}\equiv\text{N}$ band at 2071 cm^{-1} and NH_4^+ bending vibration disappear, while Fe–O bands occur at 516–432 cm^{-1} and a carbonate-related band appears at 1130 cm^{-1} .

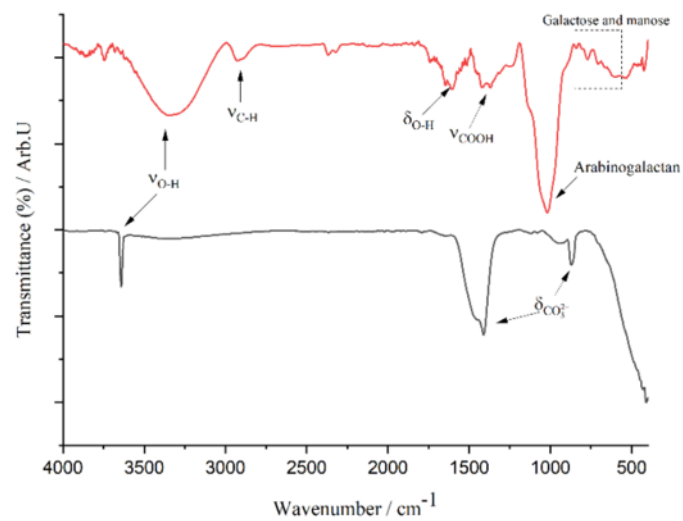


Fig. S3 Spectra of binder L7 before and after burning, with L7 (red line) and L7 burnt (black line). In the infrared spectra of the L7 binder, after heat treatment, the polysaccharide bands disappear, while a sharp O–H band occurs at 3638 cm^{-1} and carbonate-related bands appear at $1469\text{--}1408$ and 872 cm^{-1} .

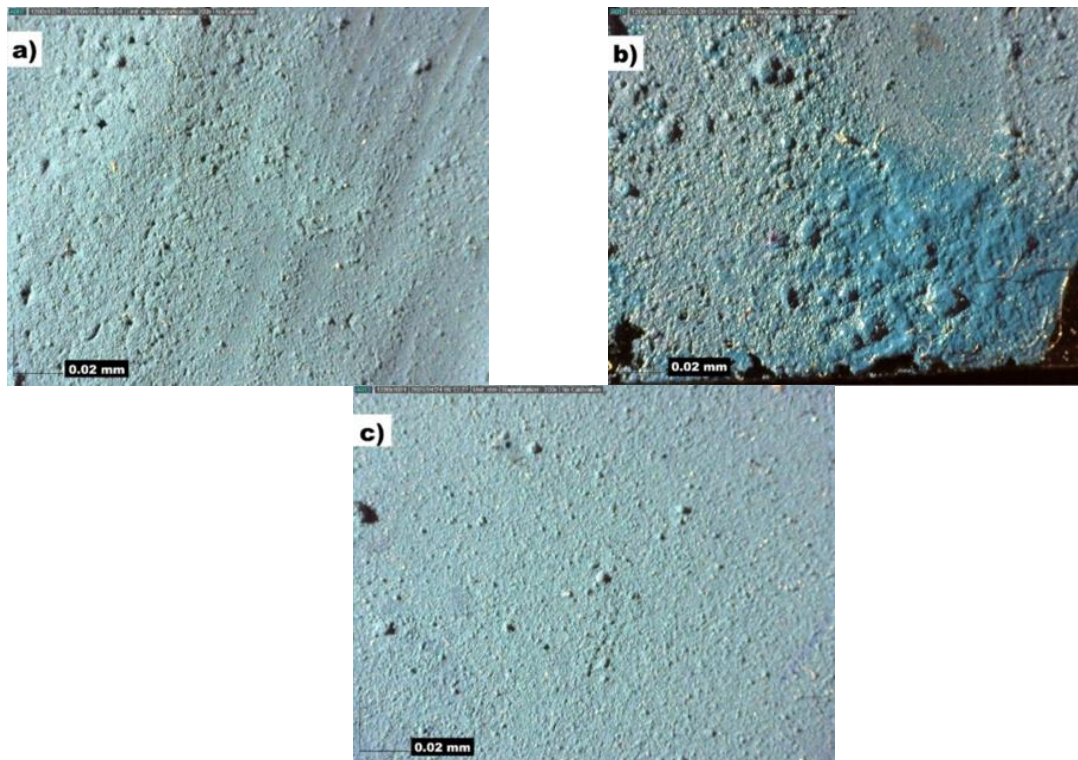


Fig. S4 Optical microscopy images of P4 mixed with (a) L3, (b) L5, and (c) L7 binders at $200\times$ magnification. This images reveals that all mixtures of P4 with the used binders show nonuniform particle distribution caused by binder migration toward the edges during drying.

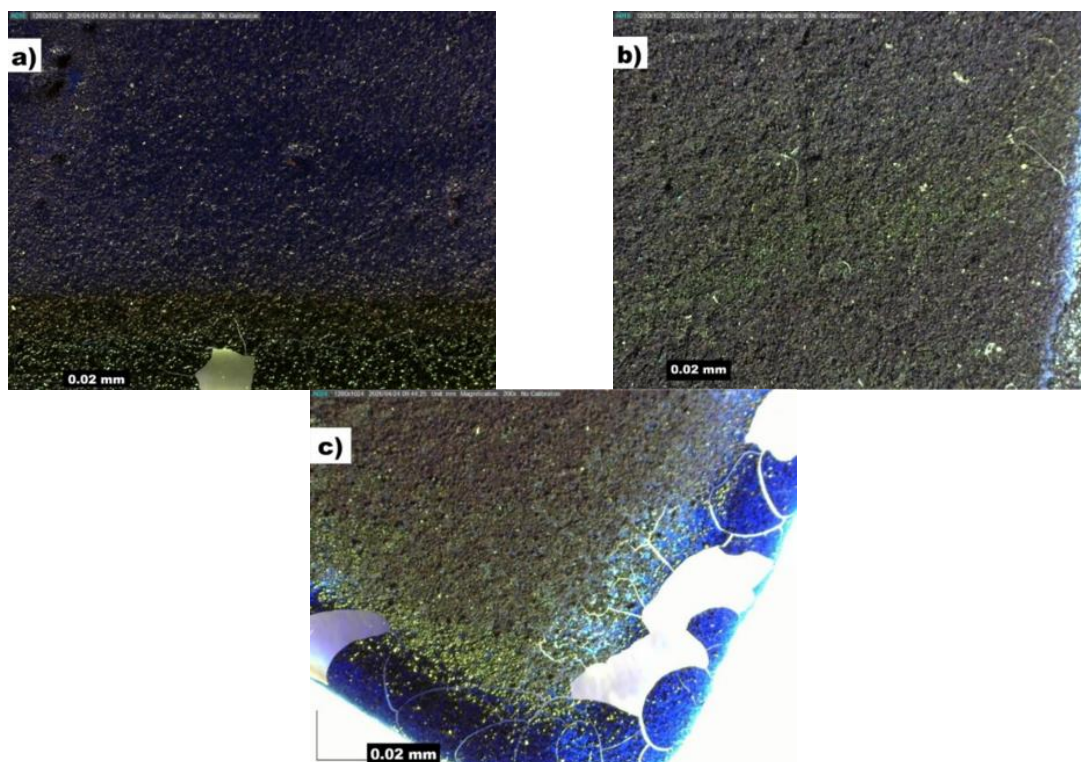


Fig. S5 Optical microscopy images of P8 with (a) L3, (b) L5, and (c) L7 binders at 200× magnification. All mixtures for P8 exhibit nonuniform particle distribution due to binder migration toward the edges during drying.

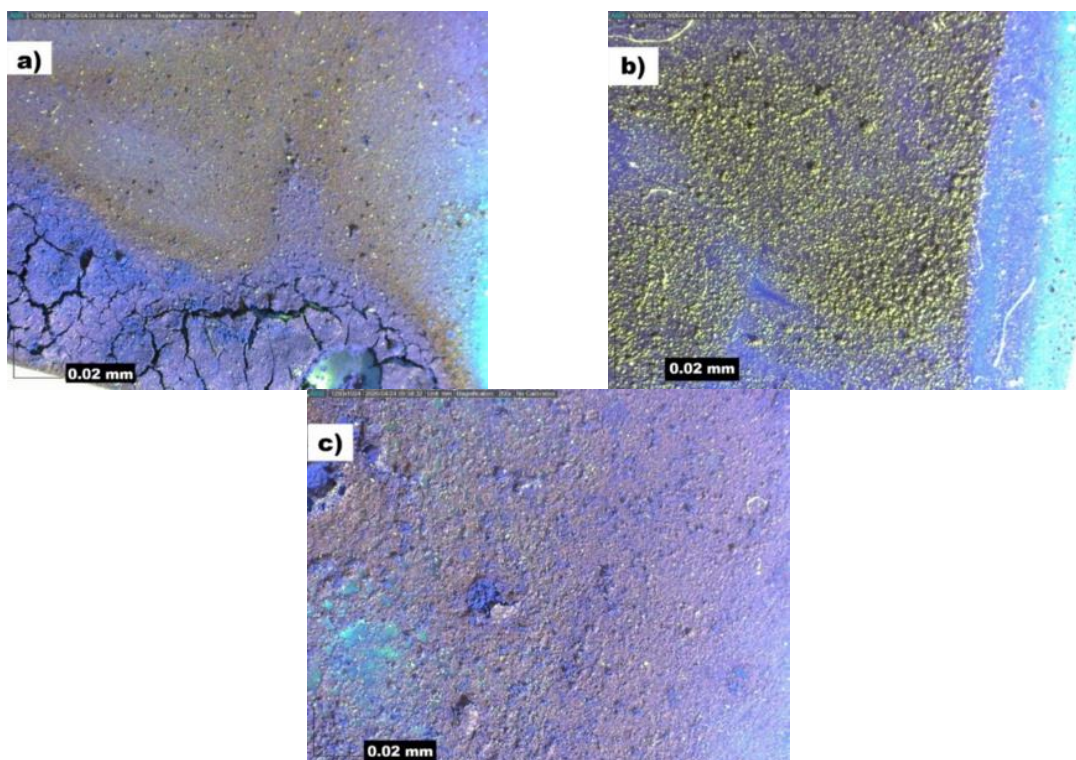


Fig. S6 Optical microscopy images of P9 with (a) L3, (b) L5, and (c) L7 binders at 200× magnification. The P9 mixtures show cracking with L3, binder migration toward the edges with L5, and nonuniform particle distribution with L7 after drying.

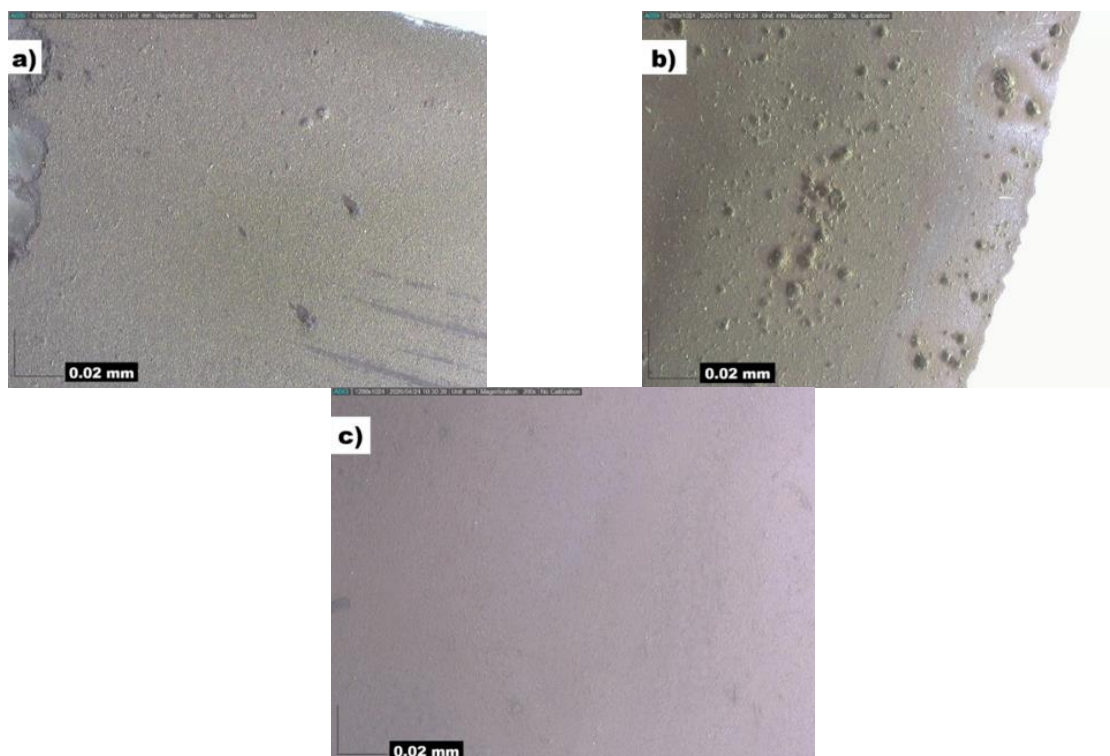


Fig. S7 Optical microscopy images of P10 with (a) L3, (b) L5, and (c) L7 binders at 200× magnification. The P10 mixtures with L3 and L5 show nonuniform particle distribution and pigment migration toward the surface, whereas L7 provides a more uniform distribution of pigment-binder particles after drying.