Abstract

The growing demand for synthetic dyes and iridescence has risked the ecosystem by being toxic and carcinogenic. Meanwhile, structural colors do not require pigmented molecules, but use materials of different refractive indices to modulate light, as found in guanine crystals. Unfortunately, the study is only widely focused on eukaryotes, while the prokaryotic sources are potentially more sustainable for the ecosystem. With the latest development of microbial guanine crystal, the opportunity leads to developing the nutritional prediction of nitrogen concentration effect in guanine crystal synthesis using KBase's flux balance analysis (FBA), while also learning to characterize the optical properties of the product with a simulation on Nanohub. The flux balance analysis found that even with moderate biomass and guanine production flux in *Aeromonas salmonicida* subsp. *pectinolytica*, the small guanine consumption made it able to accumulate the product. However, *Shewanella oneidensis* MR-1 showed similarities with the negative control, *Escherichia coli* BW25113, with the absence of guanine excess, possibly because of the activity of the *guaD* gene. Besides, the *in silico* light simulation predicted that the reflected wavelengths contribute to the visible colors. However, due to the higher intensity of transmittance, it was estimated that the thin material allowed more light to pass to the back, so the color is more vibrant at the non-intense light side. Lastly, the hypothetical testing revealed that the only significant relationship in the study was the nitrogen concentrations and the guanine accumulation, while the guanine excess did not control the reflectance and transmittance scores.

Keywords: guanine crystal, biogenic crystal, biosynthesis, metabolic simulation, optical, bio-based