

Diffusion kinetics of dyes out of hair fibre: link with fibre properties and impact on cosmetic performances

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The durability of hair coloration, particularly its vibrancy, is an increasingly fundamental concern for consumers¹. Indeed, hydrophilic oxidation dyes are progressively extracted from the hair fibre during shampooing, leading to noticeable fading over time. In this context, our study explores the kinetics of dye diffusion out of the hair fibre to understand the impact of its damage on this phenomenon. Thanks to an original experimental protocol, we quantified the kinetics of dye release from the fibre using UV-visible spectrophotometry. We first highlight that temperature plays a predominant role in this phenomenon, while the presence of surfactants does not impact it. Furthermore, our results demonstrate that dye diffusion out of the fibre follows Fick's law, allowing for the calculation of diffusion coefficients. These are consistent with existing literature² and increase significantly with fibre damage. In addition, some technical pathways to reduce this loss have been explored, identifying a promising solution. This study stands out by presenting the first measurements of dye diffusion out of the fibre and paves the way for a better understanding of dye desorption, thereby enabling the development of innovative formulations for more durable hair coloration.

References:

[1] Y. Zhou, L. Foltis, D. J. Moore and R. Rigoletto, J. Cosmet. Sci., 2009

[2] M.N. Chandrashekara, C. Ranganathaiah, Colloids and Surfaces B: Biointerfaces, 2009