

DEGRADATION PROCESSES OF HAIR IN AQUATIC AND SOIL CONDITIONS

Katarzyna Palacz-Ziolek¹, Monika Krzyzanowska¹, Rafal Ogorek² and Marcin Kadej³

¹University of Wrocław, Faculty of Biological Sciences, Department of Biology, Wrocław, Poland;

²University of Wrocław, Faculty of Biological Sciences, Department of Mycology and Genetics, Wrocław, Poland; ³University of Wrocław, Faculty of Biological Sciences, Department of Biology, Evolution and Conservation of Invertebrates, Wrocław, Poland

Background: Background: Hair is a biological substrate that can yield valuable insights in both archaeology and forensic science. While prior research has predominantly addressed post-mortem alterations, this study concentrates on hair forcibly removed during life (ante-mortem). The primary objective was to characterize patterns of hair degradation in aquatic and soil environments.

Material and methods: Approximately 20 hairs were collected from each of 109 volunteers by ante-mortem extraction, following approval from a bioethics committee. Samples were obtained from adult women and men and included a range of hair colours, namely blond, grey and dark. The collected hairs were then placed in two types of soils and two types of water to simulate different depositional environments. Over a six-month period, hair roots were systematically observed under a microscope and documented through photographic records. Based on these observations, a degradation scale was developed, with particular emphasis on morphological changes within the brush-like structure of the hair root.

Results: Findings indicate that in aquatic settings, progressive structural alterations of the root region may serve as a useful indicator for estimating the post-mortem interval (PMI). In contrast, degradation processes in soil are largely influenced by the activity of keratin-degrading (keratinolytic) and keratin-associated (keratinophilic) fungi. The growth and metabolic processes of these microorganisms were shown to be highly influenced by temperature, making it a key determinant of both the speed and degree of hair decomposition.

Conclusion: This study highlights distinct pathways and influencing factors of hair degradation across different depositional contexts. The proposed scale offers a potential tool for forensic applications, particularly in refining PMI estimation in water environments and understanding biologically mediated decomposition in soil.

Keywords: Post-mortem interval; Hair degradation scale; Brush-like hair root; Dermatophytes; Aquatic and soil environment.