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Review

Current methods of graffiti removal: A review

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HIGHLIGHTS

- Survey of graffiti removal methods used on different structures.
- Advantages and limitations of current cleaning methods.
- Graffiti–substrate relation: efficacy of cleaning in relation to substrate characteristics.
- Traditional *versus* novel cleaning techniques.
- Bioremediation: a novel approach to graffiti removal.

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ABSTRACT

This paper reviews current knowledge and recent advances in methods of graffiti removal. Three approaches were considered: chemical, physical (including laser) and biological. Findings concerning the efficiency and effectiveness of the methods, including any damage to the substrate or other side effects, are described. Emphasis is placed on the limitations of the reported methods. Finally, current trends and improvements in graffiti removal methods towards the use of more efficient and less damaging treatments are addressed.

Contents

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1. Introduction

The term 'graffiti' is defined by the Oxford dictionary as 'writing or drawings scribbled, scratched, or sprayed illicitly on a wall or other surface in a public place' and by Webster's New World Dictionary as 'pictures or words painted or drawn on a wall, building, etc.'. The word is derived from the Italian *graffiare* (to scratch) and ultimately from the Greek γρφειν (to write). In most definitions, graffiti are considered the result of a criminal act usually involving the defacing of public (Fig. 1) and private property accessible to the public (Fig. 2).

Graffiti are an escalating problem, visible in most towns and cities worldwide. Around 3,500,000 protected monuments in European cities are affected by graffiti ([1], Fig. 3). In the preservation of public spaces and historic buildings, graffiti removal requires a huge financial outlay by local governments and agencies. According to a 2013 report by the department of public works, San Francisco city (U.S.) spends $20 million annually on graffiti removal [2]. In 2008, the municipal government of Morelia (Mexico) initiated a campaign to prevent and remove graffiti from the historic city center, which was designated as a World Heritage Site by UNESCO in 1991. The government is currently investing hundreds of thousands of pesos per year on methods designed to remove graffiti [3].

Fig. 1. Spray-painted graffiti on a concrete wall at the University of Milan (Italy). Photo: Fabrizio Iozzi.

Fig. 2. Graffiti at the bottom of the 18th century dockyard gate in Ferrol (Galicia, northern Spain). Photo: Santiago Pozo.

Undesired graffiti are not a negligible problem. Graffiti are associated with an increasing risk of damage to architectural heritage materials and also have negative social connotations as the affected neighborhoods or communities become stigmatized and labeled as poor socio-economic areas. Governments take different approaches to graffiti removal, often depending on their resources. In 2006, the European Parliament directed the European Commission to prevent and eliminate graffiti in European cities, as part of a program addressing other concerns about urban life (2006/2061(INI)). In the UK, in 2008, a conspiracy charge was used for the first time to convict graffiti artists. Nine people were convicted of causing criminal damage costing at least £1 million. In the US, to combat graffiti vandalism, the Philadelphia Anti-Graffiti Network (PAGN) was created in 1984 [4] and the Anti-Graffiti Task Force was created in New York City in 1995 [5]. New York City adopted a zero tolerance policy, which included prohibition of the sale of aerosol paint cans to people under 18 (NYC Title 10 § 10–117). Similar measures have also been taken in Chicago, where offenders are liable to be fined an amount of no less than US$500, and in Pittsburgh, where a man found to be responsible for graffiti on almost 200 buildings was sentenced to prison for 2.5 years [6].

In a 1995 publication, Weaver [7] encouraged owners and managers of historic masonry structures to remove graffiti as soon as they appear, although after first establishing the stone type, as well as its fragility, porosity and permeability, and testing cleaning methods in a discrete location to determine the most effective means of removing the graffiti without damaging the stone. More recently, Siano et al. [8] reported a similar approach involving preliminary analysis of small material samples taken from the artifact and the use of non-invasive, portable analytical devices. Siano et al. [8] measured LIPS (laser induced plasma spectroscopy) elemental depth profiles and Raman spectra (both *in situ*, using portable analytical devices) to assess the extent to which these diagnostic methods can integrate or replace invasive petrographic studies. Results on compositional features were obtained, providing prompt compositional answers and thereby avoiding the need for sampling.

Workshop trials help to clarify the limitations of the cleaning techniques and to provide a better understanding of their potential. Because of inappropriate cleaning methods and their effects on the lichen-covered 'Heel Stone' at Stonehenge (UK), graffiti were still visible in 2000, thirty years after the attacks were carried out, with 'ghosting' or remnant markings (Fig. 4) re-appearing prominently at certain times of year [9]. Daurelio [10] also complained that cleaning with chemical solvents produced some permanent visible damage to the Bisceglie dolmen (Bari, Italy). An even worse case occurred in 1992 in France when a local scouting association