

Biodeterioration and Biodegradation of Historic Parks of UK by Algae

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Abstract : The present study aims to study the groups of algal genera that are responsible for the biodeterioration, biodegradation, and biological pollution of the structures and features of the two historic parks of the UK. Different sites of Campbell Park and Great Linford Manor Park in Milton Keynes are selected to study the morphological, aesthetic, and physical effects of the algal growth. Specimens and swabs were collected mechanically from selected sites. Algal specimens are preserved in Lugol's solution and labelled with standard information. Photomicrograph analysis of slides using taxonomic keys and visual observation identified algal species that are homogenously and non-homogenously mixed in the aerial, terrestrial, and aquatic habitats. A qualitative study revealed seven classes of Algae. Most of the algal genera isolated have proven records of potential biodegradation, discoloration, and biological pollution. Chlorophyceae was predominantly represented by eleven genera: Chlorella, Chlorococcum, Cladophora, Coenochloris, Cyndrocapsa, Microspora, Prasiola, Spirogyra, Trentepohlia, Ulothrix and Zygnema. Charophyceae is represented by four genera: Cosmarium, Klebsormidium, Mesotaenium, and Mougeotia. Xanthophyceae with two genera, Tribonema and Vaucheria. Bacillariophyceae (Diatoms) are represented by six genera: Acnanthes, Bacillaria, Fragilaria, Gomphonema, Synedra, and Tabellaria, Dinophyceae with a Dinoflagellate. Rhodophyceae included Bangia and Batrachospermum, Cyanophyceae with five genera, Chroococcus, Gloeocapsa, Scytonema, Stigonema and Oscillatoria. The quantitative analysis by statistical method revealed that Chlorophyceae was the predominant class, with eleven genera isolated from different sites of the two parks. Coenochloris of Chlorophyceae was isolated from thirteen sites during the study, followed by Gloeocapsa of Cyanophyceae, which is isolated from 12 sites. These two algae impart varying shades of green colour on the surfaces on which they form biofilms. Prasiola, Vaucheria, and Trentepohlia were isolated only from Great Linford Park. Trentepohlia imparted a significant orange colour to the walls and trees of the sites. The compounds present in algae that are responsible for discoloration are the green pigment chlorophyll, orange pigment β -carotene, and yellow pigment quinone. Mesotaenium, Dinoflagellate, Gomphonema, Fragilaria, Tabellaria and two unidentified genera were isolated from Campbell Park only. Largest number of algal genera (25) were isolated from the canal of Campbell Park followed by (21) from the canal at Great Linford Manor Park. The Algae were found to grow on surfaces of walls, wooden fencings, metal sculptures, and railings. The Algae are reported to induce surface erosion, natural weathering, and cracking, leading to technical and mechanical instability and extensive damage to building materials. The algal biofilms secrete different organic acids, which are responsible for biosolubilization and biodeterioration of the building materials. The aquatic algal blooms isolated during the study release toxins which are responsible for allergy, skin rashes, vomiting, diarrhea, fever, muscle spasms, and lung and throat infections. The study identifies the places and locations at the historic sites which need to be paid attention. It provides an insight to the conservation strategies to overcome the negative impacts of bio colonization by algae. Prevention measures by different treatments need to be regularly monitored.

Keywords : algae, biodegradation, historic gardens, UK

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