

## COASTAL VEGETATION DECLINE – ERASM\* PERSPECTIVE

A localised decline of vegetation along the Mediterranean coast was first reported in the early 1960's in the region of Tuscany (Italy). Further local instances of vegetation decline were subsequently noted in the South of France, Catalan coast (Spain) and Tunisia during the following decades. The decline is characterized by a discoloration of the leaves followed by the appearance of dead zones; which sometimes results in precocious falling of the affected leaves. Species impacted are pine trees and other evergreen trees (e.g. Eucalyptus) as well as deciduous species. Typically, the damaged vegetation is located near to urban zones and extends inland for a few hundred meters. Damage is often manifest after a long period of strong on-shore winds, as it occurs in autumn and winter, and has been associated with marine aerosols (sea spray).

Effluents from domestic and industrial wastewater treatment plants, as well as untreated discharges, reach the sea either via direct discharge or transport via rivers. Some of the trace organic materials present, particularly in untreated discharges, may then according to their physico-chemical characteristics become concentrated in the sea surface microlayer. Research has shown that wind and wave action can lead to transfer and further concentration of trace organic substances from seawater into the marine aerosol droplets.

The causative agent responsible for this coastal vegetation decline has been often attributed to surfactants present in the seawater. In the 1960's, detergent surfactants were, at least in part, poorly biodegradable and, due to the almost complete lack of any waste water treatment plants in certain regions, waste water containing surfactants was discharged directly to the rivers/sea. If they reach the sea; surfactants, together with other contaminants, can become concentrated in the sea surface microlayer and may be deposited on coastal vegetation through sea spray. This hypothesis has been proposed because of the spatial correlation found between MBAS (methylene blue active substance) concentrations in surface sea waters, sea sprays and deposits on the leaves of damaged coastal vegetation in some areas; mainly leeward of big industrial seaboard cities. Since MBAS is a non-specific analytical parameter for anionic surfactants, experimental findings of similar damage in plants exposed to high concentrations of particular anionic surfactants were considered supportive of this hypothesis. Damage is suggested to be due to the foliar penetration of sea salts being enhanced by the presence of surfactants [1]. Such MBAS measurements have probably overestimated the concentrations of anionic surfactants in the sea and on the leaves and, hence, their role in the coastal vegetation damage process.

The increasingly widespread findings of coastal vegetation decline in the vicinity of large conurbations are suggestive of a locally enhanced load of pollutants present in the coastal waters of such areas. The reduction of this burden and the prevention of problematic environmental concentrations of surfactants and other contaminants is directly achieved by the purification of urban and industrial waste waters in sewage treatment plants. This conclusion is strongly supported by the observation of an improvement in the health of the coastal vegetation since the installation of wastewater treatment plant facilities in the area of Barcelona [2]. Based on the very high removal of detergent surfactants achieved in sewage treatment plants and taking the EU requirements for urban waste water treatment into account [3], further improvements of the coastal vegetation in the affected areas can be expected.

[1] Gellini, Pantani, Bussotti, Racanelli 1981. Sulla degradazione della vegetazione litoranea nella Tenuta presidenziale di San Rossore. *Inquinamento* 23: 27-30

[2] J.M. Bayona, Environmental Chemistry Department, Jordi Girona, 18-26, 08034-Barcelona, Spain (pers. Comm.)

[3] Council Directive 91/271/EEC of 21 May 1991 concerning urban waste water treatment

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\* Environmental Risk Assessment of Surfactants, Management (ERASM): A research partnership of the detergent and surfactant industries in Europe